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Review of Information Technology Systems Development

December 16, 2002

REVIEW OF INFORMATION TECHNOLOGY SYSTEMS DEVELOPMENT

Commission Draft

This document is the commission draft of the JLARC report, Review of Information Technology Systems Development. The draft has been assembled for discussion and factual review. Do not quote, publish, or release any material contained in this document because it is subject to additional verification and editorial review.

Joint Legislative Audit and Review Commission

December 16, 2002

Report Summary

The Commonwealth of Virginia spends more than $900 million annually on information technology. A considerable amount of this expenditure is for the development and maintenance of major information systems. These systems, which can cost tens of millions of dollars, are used to provide better access to information, improve business processes, or provide more convenient services to citizens. Systems development in Virginia has been relatively decentralized, with most planning, design, and development occurring at the agency level. Most of the major systems development efforts have involved private sector assistance, although some systems have been built in-house by agencies.

In November 2000, the Joint Legislative Audit and Review Commission (JLARC) directed staff to conduct a review of information technology (IT) systems development and procurement by State agencies. The review was directed as a result of concerns about recent problems with the procurement and development of automated systems. There was also concern about the apparent waste of State funds on systems never completed or deployed. The focus of this study has been to address why agencies experience systems development and procurement problems, and what practices and requirements can be instituted to increase the rate of success.

The primary research activity for this study was a detailed review of 15 major information system projects in seven of the nine secretariats. The projects selected for review included projects that have been successfully completed in recent years, projects that are still ongoing, and projects that have been recently cancelled. The review included interviews with members of project management teams and agency executives. It also involved a review of documents associated with the projects, including planning documents, requests for proposals, workplans, and independent verification and validation reports. The research and analysis involved the identification of elements that are keys to successful systems development and embody concepts that are widely accepted in the information technology industry. The analysis of these projects consisted of an assessment of whether those elements were present.

The study found that the State's experience with the development of information systems has been mixed in recent years. Some major information technology projects have been well planned and managed and have substantially enhanced agency performance. However, some projects have been much less successful. In some cases, substantial amounts of State funds have been expended on projects that have been terminated or have met few of their goals. For the projects reviewed, the State has wasted at least $75 million on failed development efforts and has incurred an additional $28 million in cost overruns.

Three important steps contribute to the development and deployment of IT systems that further an agency's mission in a cost-effective manner. First, development of a business case prior to proceeding with a major project can ensure that a

proposed system is an appropriate means of addressing business needs. Second, appropriate involvement of executive leadership is necessary to ensure that needed resources are consistently available for the development and deployment of IT systems. Third, the systems development process itself must be properly managed. Based on the review, there are nine major elements that are critical to the management of IT systems projects. Despite the high cost of many systems projects, agencies generally fail to articulate an adequate business case for proposed new systems. The presence of effective leadership and the nine management elements has been mixed. Projects in which appropriate leadership and these management elements have been mostly present tend to be successful. Conversely, projects in which they are mostly absent are more likely to end in failure. Projects that involve multiple agencies present additional unique challenges.

The failure to develop an adequate business case, inappropriate leadership, the inconsistent presence of the nine project management elements, and the challenges associated with developing multi-agency systems suggest the need for a greater central role in systems development. This study shows that a number of agencies have the experience, capability, and knowledge to successfully develop major information systems, but that many other agencies do not. Unless the State plays a greater role in providing oversight and support, agencies without this capability and experience may continue to waste millions of tax dollars in the development of information systems that do not fully meet agency needs. With stronger central support, there can be substantial savings in the procurement of information systems through better project management, a higher project success rate, and a decreased need for agencies to hire outside consultants.

While the current Secretary of Technology has recently taken some positive steps that may improve the information systems development process, the existing organizational structures and processes need to be expanded. The State needs to establish an Information Technology Investment Board to set strategic priorities and a full-time Chief Information Officer to lead the development and planning of information systems. In addition, a more effective approval and oversight process needs to be established to ensure that the appropriate projects are being initiated and that the systems development process is adequate. Along with increased oversight, a new funding mechanism needs to be established to help pay for major statewide or general fund agency projects. The Department of Technology Planning also needs to develop stronger expertise in information systems development and provide increased support to agencies that need assistance with development. Finally, the strategic planning process needs to be improved to ensure that agency and statewide business needs are considered, and that technology projects which meet those needs are identified and appropriately prioritized.

Improving the systems development process will require more than the identification of problems and the establishment of the structures and process recommended in this report. Many of the problems identified in this review have been identified in previous reports by JLARC, the Auditor of Public Accounts, consultants retained by the State, and internal auditors within agencies. However, many of these problems continue to remain unaddressed. Significantly improving the sys-

tems development process will require the strong commitment of persons in responsible positions to make the proposed new process work.

Adequate Business Case Is Not Developed for Most Projects

Despite the large amount of funds invested in major information systems, State agencies do a poor job of developing the business case for such systems. The business case articulates the need for an information system as well as the appropriate means for solving an identified business need. The development of the business case is primarily intended to determine whether the development of a proposed system is justified based on its projected expense and benefits to the State. Most multi-million dollar projects have proceeded in Virginia without full development of the business case.

Executive Leadership Is Not Always Supportive of Project Success

The extent to which appropriate leadership is exercised can significantly affect the success or failure of an information systems project. Project leadership differs from management or oversight in that a leader supports but does not direct or oversee a project. A leader often has responsibility for addressing external factors that may facilitate or impede a project. In addition, a leader's role is to ensure financial and personnel resources are in place, and to lead the agency through the cultural changes that accompany major systems development projects. Some of the projects reviewed provide examples of how effective leadership can assist a project, while other projects indicate how ineffective leadership may hinder the success of a project.

Nine Elements Impact Project Success

A review of the State's recent experience with information systems development reveals that nine elements are critical to the success of major information systems projects. These elements relate to the various phases in a project's development, from the planning stage, through procurement, and finally project management and oversight. They include the following: (1) identification of functional needs and system requirements, (2) proven technical feasibility, (3) organizational and business process analysis, (4) adequate vendor and product evaluation and selection, (5) a strong legal contract, (6) effective project management, (7) involvement of end-users, (8) effective project oversight and control, and (9) reliable funding.

The first three elements involve the planning phase of a project. One of the first steps in the process is to identify the functional needs that should be addressed and the appropriate technology solutions to address them. Identification of system requirements involves identifying and specifying the functions that an IT solution must perform, along with the hardware and network infrastructure that will be required for the system to operate effectively. Another important element during the planning phase is assessing whether a proposed project has proven technical feasibility. Developing a project using unproven technology involves substantially greater risk of failure than a project that uses proven technology. A final key element during the planning phase is analyzing an agency's organizational structure and business processes. This involves examining whether there are organizational

or business process changes that need to be made for a project to succeed as well as identifying the degree and type of change required. Business process reengineering also needs to occur during development to minimize the need for customization or modification of the software product being implemented.

The next two elements involve the procurement phase of those projects in which private sector assistance is being sought. The proper evaluation and selection of vendors and products involves the use of a competitive and unbiased procurement process, a full evaluation of vendors and their proposals, and consideration of all options, including the options of not proceeding with procurement or of building a system in-house. Another critical element of the procurement process is a strong contract. Strong contracts clearly specify project deliverables, link payments to deliverables, and provide for phased or modular development.

The next three elements that are important to project success are effective project management, end-user participation, and oversight. These three elements are key factors during actual project development. Effective project management usually involves establishment of a strong project management structure that includes an experienced project management team. Strong project management also includes effective technical change control procedures and contract administration. Along with good project management, end-user participation is a key element for success. End-users are the business experts who can provide important feedback as systems are developed. Oversight is another important element during project development. Project oversight involves both internal executive level oversight and external oversight through oversight committees composed of State government officials, as well as independent review of projects that is generally provided by private sector consultants. The main goals of oversight are to keep projects within their scope, schedule, and budget and to identify and address major issues that may jeopardize a project's success.

The final element that is important to project success is adequate funding. Reliable funding enables a project team to invest the resources needed to develop a quality system. Based on this review, it appears that non-general fund agencies generally have greater access to reliable funding.

Project Success Has Been Mixed

A review of 15 major information systems projects indicates that the development record of the State has been mixed. Many projects have been completed successfully or appear to be on track for success. These projects have been led and managed by highly experienced and skilled State employees who have understood and addressed the elements that contribute to project success. For these successful projects, most of the nine elements identified for successful project management have been present. Conversely, the State has also had many projects that have failed entirely or have not met many of their intended goals. Those projects have generally lacked most of the critical elements for success, and also lacked individuals with the experience and knowledge necessary to lead and manage major information system projects. The exhibit on the following page shows the presence or absence of each of the elements for each of the projects.

Presence of Elements that Contribute to Project Success															
	✔ Present ✓ Partially Present ✗ Absent														
Agency	ABC	DMV	VCCS	TAX	DOE	DEQ	VDOT	DGS	DOC	DMAS	SBE	W&M	DOH	DOA/DHRM	VDOT
System	**MIPS**	**S2K**	**SIS**	**TPP**	**SOL**	**CEDS**	**ICAS**	**eVA**	**ICIS**	**MMIS**	**VVRS2**	**ARIA**	**VISION**	**IHRIS**	**IDMS**
Identification of Functional Needs and System Require-ments	✔	✔	✔	✔	✓	✓	✓	✓	✓	✗	✔	✓	✓	✗	✓
Proven Technical Feasibility	✔	✔	✔	✓	✗	✓	✓	✗	✗	✗	✔	✗	✓	✗	✗
Organizational and Business Process Analysis	✔	✓	✔	✔	N/A	✓	✓	✓	✓	✓	✗	✓	✓	✗	✗
Adequate Vendor and Product Selection	✔	✔	✔	✔	✔	✔	✓	✓	✗	✓	✓	✗	✗	✗	✗
Strong Legal Contract	✔	✔	✔	✔	✔	N/A	✓	✓	N/A	✗	N/A	✗	✓	N/A	✗
Effective Project Management	✔	✔	✓	✔	✔	✓	✗	✓	N/A	✓	✗	✗	✗	✓	✗
Involvement of End-Users	✔	✔	✔	✔	✔	✔	✔	✓	✔	✔	✓	✔	✗	✓	✓
Effective Project Oversight and Control	✔	✔	✔	✔	✓	✗	✗	✓	✓	✓	✗	✗	✗	✗	✗
Reliable Funding	✔	✔	✔	✔	✔	✓	✔	✓	✗	✔	✗	✓	✗	✗	✔

Of the 15 projects reviewed, five had most of the elements of success and have either been completed successfully or appear on track to meeting project goals. These five projects are: the Management of Inventory And Product Sales System at the Department of Alcoholic Beverage Control, the Student Information System at the Virginia Community College System, the Standards of Learning Technology Initiative at the Department of Education, the Tax Partnership Project at the Department of Taxation, and the Service 2000 project at the Department of Motor Vehicles.

In contrast, seven of the projects reviewed had more elements absent than fully present. These projects are: the Accurate and Reliable Information Access system at William and Mary, the Integrated Document Management System at the Virginia Department of Transportation, the Integrated Human Resource Information System at the Department of Accounts and Department of Human Resource Management, the Virginia Information System Integrated Online Network at the Department of Health, the Virginia Voter Registration System at the State Board of Elections, the Integrated Correctional Information System at the Department of Corrections, and the Medicaid Management Information System at the Department of Medical Assistance Services. Six of these projects did not achieve the major goals of the project and involved a substantial waste of State funds. The Medicaid Management Information System project is still ongoing and may eventually meet the project goals, although with significant cost and time overruns.

The three remaining projects had some of the success elements present and others absent. These projects include: the Department of Environmental Quality's Comprehensive Environmental Data System, the Department of General Services' Electronic Procurement System (eVA), and the Department of Transportation's Inventory Condition and Assessment System. Two of the projects have been completed and met some of their goals. The third project, eVA, is still ongoing.

Poor project management and oversight of project development has had significant financial consequences for the State. The total cost of the failed projects has been at least $75 million. This figure understates the full cost because it does not include agency personnel costs for some of the projects. In addition to the wasted dollars for failed efforts, the projects reviewed have had cost overruns totaling approximately $28 million.

Several of the identified elements appear to be especially crucial to the success of information system projects. The unsuccessful projects generally lacked the following elements: proven technical feasibility, adequate vendor and product evaluation and selection, a strong legal contract, effective project management, and effective project oversight and control. Conversely, these same elements were generally present in all of the successful projects.

Development of Statewide Enterprise Systems Presents Further Challenges

Development of statewide or inter-agency systems presents challenges in addition to the factors already discussed. These challenges, which were present with both the Integrated Human Resource Information System (IHRIS) and the elec-

tronic procurement system (eVA), include the lack of statewide technology standards, individual agency autonomy, lack of coordination between central and line agencies, and lack of funding for these systems. Without statewide standards, there is considerable variation among agencies in the types of systems implemented. This variation compounds the difficulty of implementing statewide systems. The absence of any mechanism for coordinating inter-agency projects, coupled with the autonomy of line agencies, further hinders the development of these projects. Additionally, financial resources to build statewide systems have not been adequate.

Oversight, Support, and Planning Have Been Minimal

The failure to develop an adequate business case for projects, inappropriate leadership, the frequent absence of many of the elements critical to successful project development, and the costs to the State associated with poor management of major IT projects indicate that there is a compelling need for a greater central role in the systems development process. However, the development of information technology projects has been highly decentralized in Virginia. Virtually all information systems development has occurred at the agency level. Projects have typically been initiated, planned, procured, and managed internally by the sponsoring agencies. There has been only limited central review of projects at their outset, and limited central oversight as they have proceeded. In addition, there has been minimal central support provided to agencies during project development. With limited project management standards and the lack of an overarching architecture for information technology in the State, the development processes used and the technologies chosen have varied substantially across agencies. This has produced many poorly managed projects and an ad hoc information technology architecture comprised of incompatible systems. Finally, the information technology development process has lacked an effective strategic planning mechanism to identify and prioritize systems needs on a statewide basis and to examine opportunities for collaboration among agencies.

Over the last six months, the Secretary of Technology and Department of Technology Planning have taken positive steps that may improve the approval and oversight process. However, even with these changes, the overall process for information systems development remains inadequate. There is currently no mechanism to align State policy priorities with systems development projects, or to ensure that sufficient funding is available for those projects that the State deems necessary. In addition, the approval process for projects continues to be limited by having a single individual, who does not represent all of the business interests of the State, solely responsible for the approval of all major projects. Also, the oversight of projects that is currently performed does not provide the level of ongoing monitoring and reliable reporting that needs to occur. Additionally, it remains critical for the State to provide greater ongoing support to agencies as they attempt to develop these complex and costly information systems. Finally, the State does not have a full-time Chief Information Officer.

Approval and Oversight Need to Be Strengthened

Given the importance of information technology to meeting the State's business objectives and the State's mixed success with systems development in re-

cent years, the process for central approval and oversight of systems development needs to be strengthened. The report recommends the creation of an Information Technology Investment Board that could be comprised of cabinet secretaries, legislators, and citizen representatives with technology experience. This report also recommends the establishment of a new full-time Chief Information Officer (CIO), project management specialist positions, and the increased use of oversight committees.

With these entities and positions, the report recommends the establishment of a new four-phase process to more effectively review, support, and oversee major information systems development. This process would involve approval of proposals to conduct project planning, followed by approval of requests to initiate project development. It would also involve approval of requests for proposals and contracts for more than $1 million. During development, it would involve ongoing oversight of projects and regular evaluation of whether projects should be cancelled. The Information Technology Investment Board, the CIO, the project management specialists, and the internal and external oversight committees would all be involved at various stages in this process. The figure on the following page shows the proposed new process.

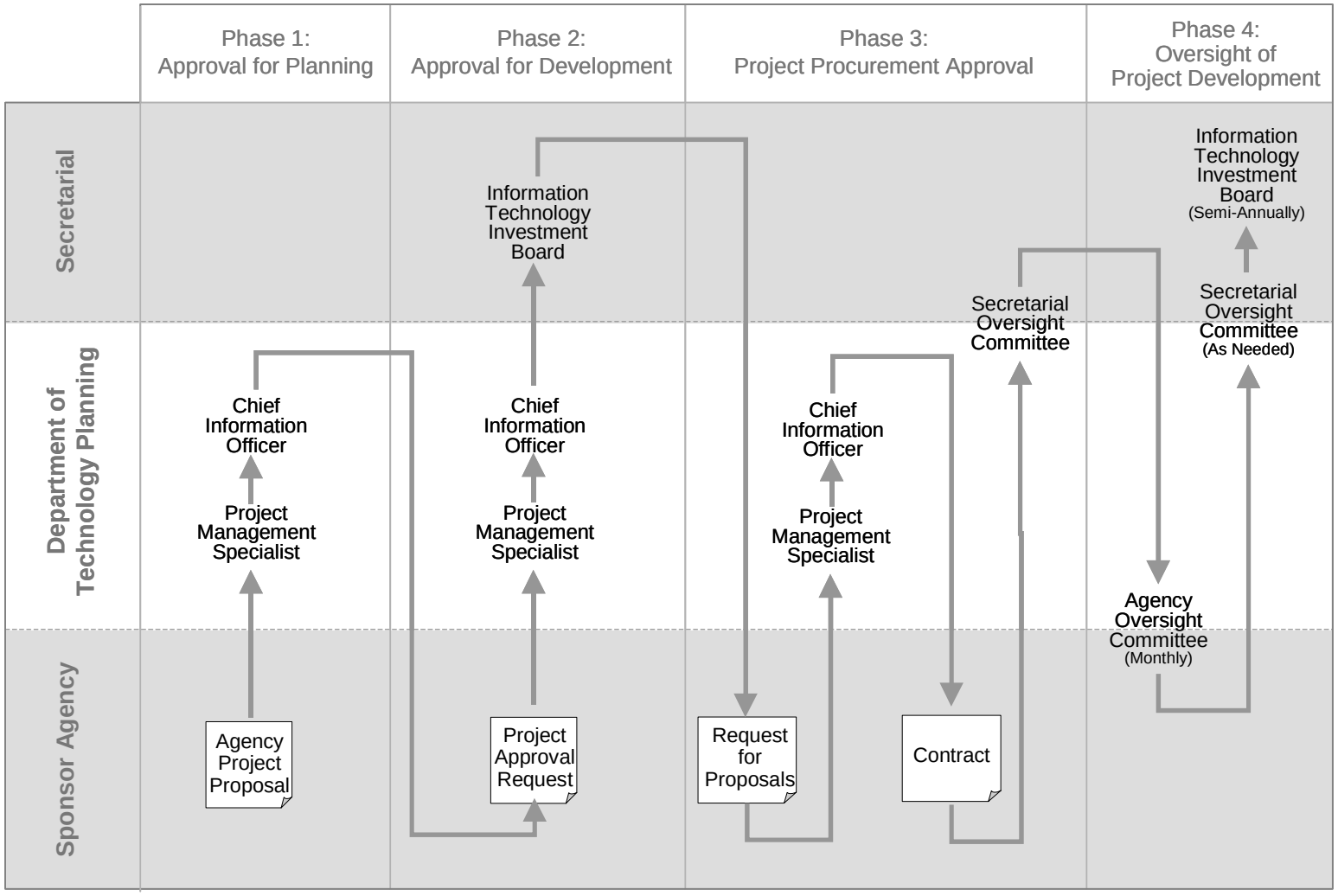
New Funding Structure Is Needed to Support Information Systems Development

In addition to a new approval and oversight process, a new funding structure needs to be established. While projects have been funded from a variety of sources, some projects have lacked sufficient funding, and this has ultimately contributed to their failure. In addition, some worthy projects have not been undertaken because of the lack of available funding. One of the limitations appears to be the biennial budget process, which does not provide guaranteed funding beyond two years. Additionally, the high cost of some major projects make them difficult to fund through direct appropriations or agency operating budgets.

Given current funding limitations, the General Assembly needs to explore alternative means of funding enterprise systems and major general fund agency projects. The most logical solution appears to be the adoption of a funding process involving the issuance of bonds or other debt instruments similar to that used to fund public buildings. This would help to provide a funding source for major projects that need to be undertaken.

Under this funding approach, the Information Technology Investment Board could be responsible for developing funding priorities and submitting funding recommendations to the General Assembly, which would have final budget approval authority. The report recommends that the General Assembly consider establishing a funding structure similar to the capital funding model for major IT projects.

Proposed Systems Approval and Oversight Process



Proposed Governance Structure Would Increase Support for Systems Development Process

Along with an effective process for approval and oversight of major information systems projects, the State needs to provide substantially more support to agencies in systems development than is currently provided. Given the enormous complexities of information systems development, it may not be practical or cost-effective for each agency in the State to retain a highly specialized IT staff with extensive experience in major information systems development. However, it is practical for the State to retain a core of highly experienced and qualified IT professionals who can provide needed support and guidance to agencies. The benefit to the State of providing this support would be substantial savings in the procurement of information systems through better managed projects, a higher project success rate, and a decreased need for agencies to hire outside consultants.

To provide increased support, this report recommends the creation of a project management office in the Department of Technology Planning. The Chief Information Officer, through this office, could direct the development of statewide or multi-agency enterprise projects. Project management specialists within this office could provide support to agencies by working in close partnership with them throughout the development process. In addition, the office could establish standards for the management of IT projects and could provide training to improve the skills of the State's IT project managers. The DTP should also serve as a planning and management resource to any agencies that are involved in information systems development. Finally, the proposed CIO position needs to work in coordination with the Secretary of Technology and the director of the Department of Information Technology to establish a State technology architecture and minimum requirements for future systems development projects.

This proposal would not require a major reorganization of the Department of Technology Planning or the establishment of a significant number of new positions. Instead, the existing division of technology management could become the office of project management, and some of the existing positions within the division could be refocused with different skill sets and competencies. Many other states and localities in Virginia use the structures and processes proposed in this report, including investment boards, capital funding, a statewide project management methodology, central project management support, and a full-time CIO.

Statewide Strategic Planning for Technology Investments Should Be Improved

Along with the need for increased oversight and support for systems development, statewide strategic planning for information systems development needs to be improved. An effective process needs to be established for identifying and prioritizing major information systems development needs and projects. This process needs to involve input at different levels. Agencies need to provide input regarding technology solutions to meet agency business needs. In addition, the Chief Information Officer, Secretary of Technology, and Information Technology Investment Board need to play a key role in identifying statewide priorities and opportunities for coor-

dination and integration of technology solutions among agencies and institutions. The report recommends that the Secretary of Technology should use the input provided from agencies and the CIO to develop a statewide strategic plan that is consistent with the strategic goals and policy priorities of the Governor and Secretary. The report further recommends that the Information Technology Investment Board be given final approval authority of the plan, because the board would represent all of the State's business areas and should therefore have the final decision regarding whether the plan meets the State's overall business goals and policy objectives.

JLARC Model Is Similar to Concepts Identified by Current Secretary

The current Secretary of Technology has identified many of the concepts recommended in this report as areas in which the State needs to take action to improve IT development. He has indicated that an IT investment board needs to be created, a capital funding process needs to be established, and the strategic planning process improved. While the Secretary has not yet provided much detail on many of these concepts, he appears to be moving in the right direction. The exhibit on the following page shows some of the similarities between the proposed JLARC recommendations and concepts proposed by the Secretary.

JLARC MODEL IS CONSISTENT WITH CONCEPTS PROPOSED BY SECRETARY

Proposed JLARC Model	*Secretary's Proposed Changes*
Strong independent CIO who directs the Department of Technology Planning	Enhanced CIO focus for the Secretary of Technology
Approval of all major projects by an Information Technology Investment Board consisting of cabinet secretaries and chaired by the Secretary of Technology	Approval of funding for enterprise projects by an investment board consisting of cabinet secretaries and chaired by the Secretary of Technology
Evaluation of all projects by the CIO and Investment Board based on alignment with strategic plan, benefits to the State, identified risks, funding requirements, and proven technical feasibility	Evaluation of enterprise projects for funding based on alignment with strategic business objectives, appropriate return on investment, solid business case, and proven technical feasibility
Approval of all requests for proposals and vendor contracts	Increased oversight of technology procurements
Secretarial Oversight Committees for all IT projects with an estimated cost of $1 million or more	Secretarial Oversight Committees for projects that involve procurements of $1 million or more
Capital planning and funding for enterprise and other major agency systems	Capital planning and funding for enterprise systems
Project management specialists within the Department of Technology Planning to provide oversight and support of all projects, and to manage development of enterprise systems projects	IT Services Director within Department of Information Technology to manage development of enterprise systems
Information Technology Investment Board consisting of cabinet secretaries to provide ongoing oversight of enterprise systems	Executive Oversight Committee consisting of deputy secretaries to provide oversight of enterprise systems
Technology standards for all information systems	Technology standards for enterprise systems
Formal project management methodology and formal project management training	Formal project management methodology

Source: JLARC staff analysis and Virginia Strategic Plan for Technology 2002-2006.

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I. Introduction

In November of 2000, the Joint Legislative Audit and Review Commission (JLARC) directed staff to conduct a review of information technology (IT) systems development and procurement by State agencies. The review was directed as a result of concerns about recent problems with the procurement and development of automated systems. There was also concern about the apparent waste of State funds on systems that were never deployed. The focus of this study is on why agencies experience systems development and procurement problems, and what practices and requirements can be instituted to increase the rate of success. The ultimate purpose of the review is to reduce the number of systems development failures in the future.

This study examines, through case studies, the State's recent experience with the development of major information systems and discusses the major elements that appear to contribute to project success and failures. In addition, this report examines the role of the agencies in the technology secretariat in systems development, and proposes changes in the current governance structure that would improve the process.

PURPOSES OF INFORMATION SYSTEMS PROJECTS

Major State information system projects appear to be developed to meet at least one of three major purposes. Some of the projects are developed in order to replace an aging or outdated system, otherwise known as a legacy system, often because the manufacturer no longer supports the product or because personnel with the necessary skills are increasingly scarce. Alternatively, the project may be designed to use technological advances, such as the Internet, to provide new services to citizens or to improve the efficiency of an agency's business processes. Finally, a system may be intended to increase access to existing information or to facilitate the sharing of information among offices within agencies or between agencies through the development of an integrated database or similar system.

The majority of systems development projects reviewed by JLARC staff were begun in order to increase access to existing information through integration of existing databases. For example, the Comprehensive Environmental Data System (CEDS) at the Department of Environmental Quality was a project that consolidated 140 agency databases into three. Similarly, the Virginia Information Systems Integrated Online Network (VISION) at the Department of Health was an effort to integrate information that was maintained in separate databases in each of the 35 health district offices.

Other projects have used Internet technology to provide improved services. The Standards of Learning (SOL) Technology Initiative at the Department of Education will allow students to take the SOL assessments on-line, for example. In addition, the electronic procurement project (eVA), which is being managed by the De-

partment of General Services, will provide all agencies in the State with the ability to conduct electronic purchasing.

Many of the projects achieve more than one major purpose simultaneously. The public-private partnership project at the Department of Taxation is a good example of using technological advances to provide new services, while also replacing a legacy system. The project is using a partnership with a private vendor to replace the department's legacy revenue accounting system, but has also introduced new services such as web-based income tax filing and electronic imaging of tax returns. In addition, several of the colleges and universities have undertaken projects to replace legacy student information systems with new systems that provide web-based enrollment services and other features to students.

HISTORY OF STATE TECHNOLOGY AGENCIES AND THE STATE ROLE IN SYSTEMS DEVELOPMENT

The organization of the information technology function in State government has changed substantially over the last 20 years. Similarly, the State-level role in systems development has evolved significantly over the same time period.

State Technology Agencies Have Been Evolving Over the Last 20 Years

Prior to 1984, there were three central technology agencies: the Department of Computer Services, the Department of Management Analysis and Systems Development, and the Department of Telecommunications. However, organizational studies initiated by the Governor raised concerns regarding fragmented data processing and data and voice communications services among these three State agencies. Acting upon these concerns, the General Assembly consolidated these three agencies in the newly created Department of Information Technology (DIT). The Department of Computer Services and the Department of Management Analysis and Systems Development were merged in 1984, and the Department of Telecommunications was merged with the other two agencies the following year.

The *Code of Virginia* directed DIT to control and oversee information services by planning, budgeting, acquiring, using, and disposing of data processing and telecommunications equipment and services. Then in December 1985, the Joint Legislative Audit and Review Commission directed a review of the management of information technology. JLARC staff and the Department of Planning and Budget conducted a joint executive and legislative review. The study concluded that the creation of DIT was a sound action, but concluded that there was a need for strong planning and control of IT resources at the State level. The report proposed the creation of an independent Council on Information Management (CIM), which was created in 1987. The primary purpose of CIM was to provide a technology planning process.

In 1997, JLARC retained the Gartner Group to review information technology in Virginia. Gartner concluded that CIM had not developed an effective technol-

ogy planning process at the State level. The Gartner report recommended that CIM be abolished and the Department of Information Technology be reorganized. In place of CIM, Gartner recommended the establishment of a chief information officer and the creation of a division within the office of the CIO responsible for developing policy, planning, and standards. In 1998, the office of the Secretary of Technology was established and the Department of Technology Planning (DTP) was created as the planning agency to replace CIM. DIT remains as the agency responsible for providing computer and telecommunications services to State agencies.

State-Level Role in Systems Development Has Evolved

In 1973, the Systems Development Branch was created as an organizational unit within the Division of Automated Data Processing, the precursor to the Department of Computer Services. The branch was created to provide greater centralized support for the development of interagency systems and for individual agencies that had occasional needs for systems-related services. Then in 1976, with the creation of the Department of Management Analysis and Systems Development, it became a division within the newly created agency. With the establishment of DIT in 1984, it became a division within that department. The division, which during the early 1980s had more than 100 employees, was responsible for developing a number of systems, including the Personnel Management Information System (PMIS) and the Virginia Voter Registration System (VVRS).

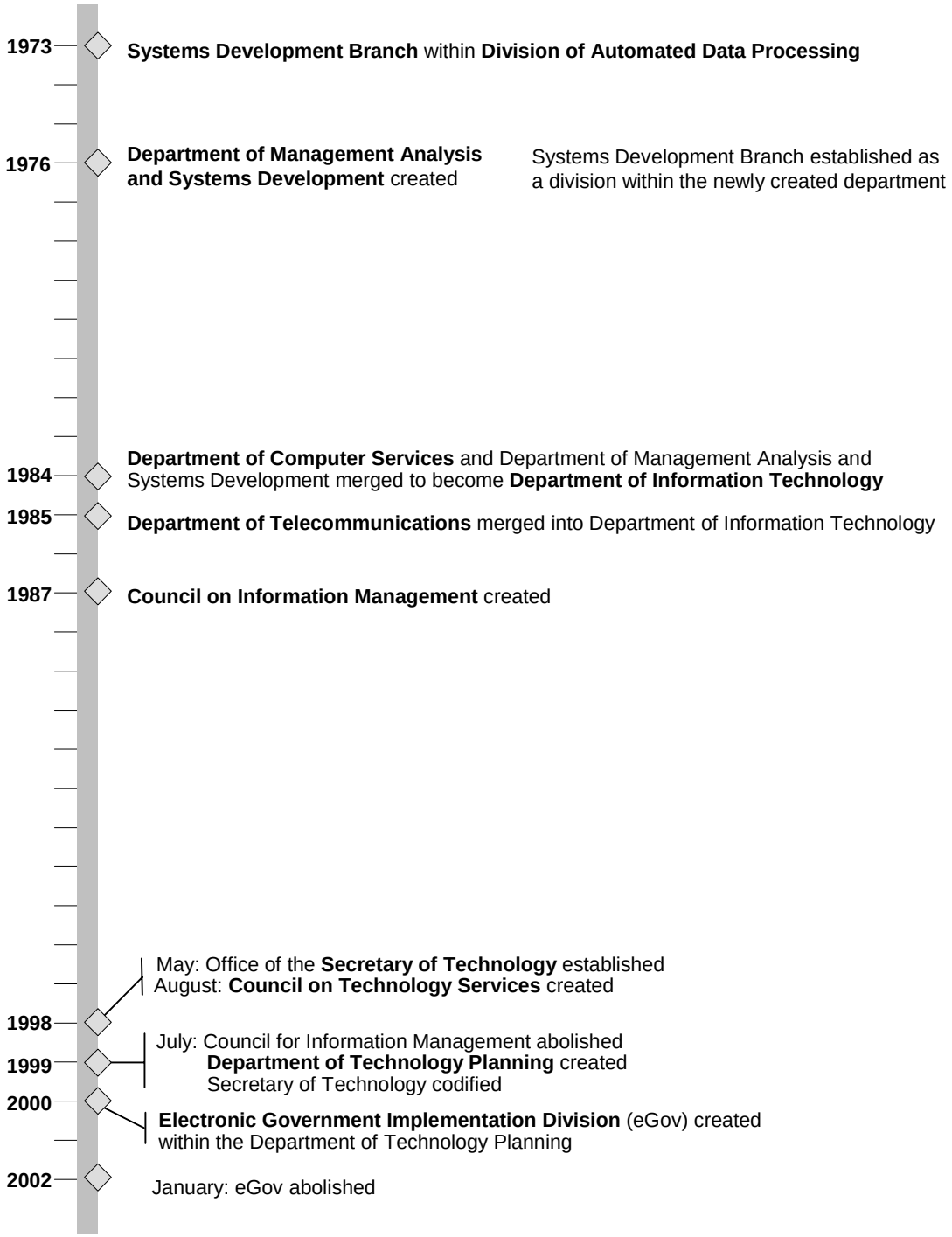
However, the JLARC review of information technology in 1997 found that the role and services provided by the Systems Development Division had declined over time. This was attributable to the decline in revenue for interagency projects, restrictions on the size of projects that could be developed by the division in order to promote greater use of private vendors, and the increased use of vendors and internal agency staff. With the growing move toward increased privatization, the Systems Development Division was effectively dismantled in the mid-1990s. Following the creation of DTP, the Virginia Electronic Government Implementation Division (eGov) division was also established and some systems development responsibilities were transferred to it. Subsequently, the eGov division was abolished in January 2002.

In 1998, with the realignment of DIT, the mission of the department became providing support for statewide enterprise solutions, supporting the Governor's office, and maintaining a few existing systems. DIT's role in information systems development has been limited over the last several years. Figure 1 provides a timeline of the evolution of the agencies that have provided central support for systems development over the last 30 years.

CURRENT ORGANIZATION OF STATEWIDE TECHNOLOGY AGENCIES

The organization and management of Virginia's IT resources is relatively decentralized, but the technology secretariat performs some roles and responsibilities centrally. Established under Executive Order in 1998, and codified by the 1999

Figure 1
Evolution of Central Support for Systems Development



Source: JLARC staff analysis.

General Assembly, the office of the Secretary of Technology was created to ensure the coordinated planning and effective development of State IT assets, and to establish a Chief Information Officer (CIO) as the focal point for technology development in the State. Currently, the technology secretariat is comprised of the Departments of Technology Planning and Information Technology, and their related boards and commissions, such as the Council on Technology Services (COTS). Figure 2 is an organizational chart that shows the agencies in the technology secretariat. In addition to the agencies of the technology secretariat, in 1997 the General Assembly created the Joint Commission on Technology and Science (JCOTS).

Secretary of Technology

The roles and responsibilities of the Secretary of Technology are codified in §2.2-225 of the *Code of Virginia*. The *Code* gives the Secretary responsibility for the two agencies within the technology secretariat, as well as several authorities and advisory boards such as the Innovative Technology Authority and Virginia Information Provider Network Authority. In addition to this responsibility, the *Code* gives the Secretary two other major areas of responsibility. The Secretary is required to function as the Chief Information Officer for the State, and is directed to lead economic development in the area of technology.

As the State CIO, the Secretary has responsibilities relating to planning, budgeting, acquiring, using, disposing, managing, and administering information technology (IT) in Virginia. Responsibilities set out in the *Code of Virginia* include:

- Direct and approve a comprehensive, statewide, four-year plan for the acquisition, management, and use of information technology which is integrated into the Commonwealth's strategic planning and performance budgeting processes;

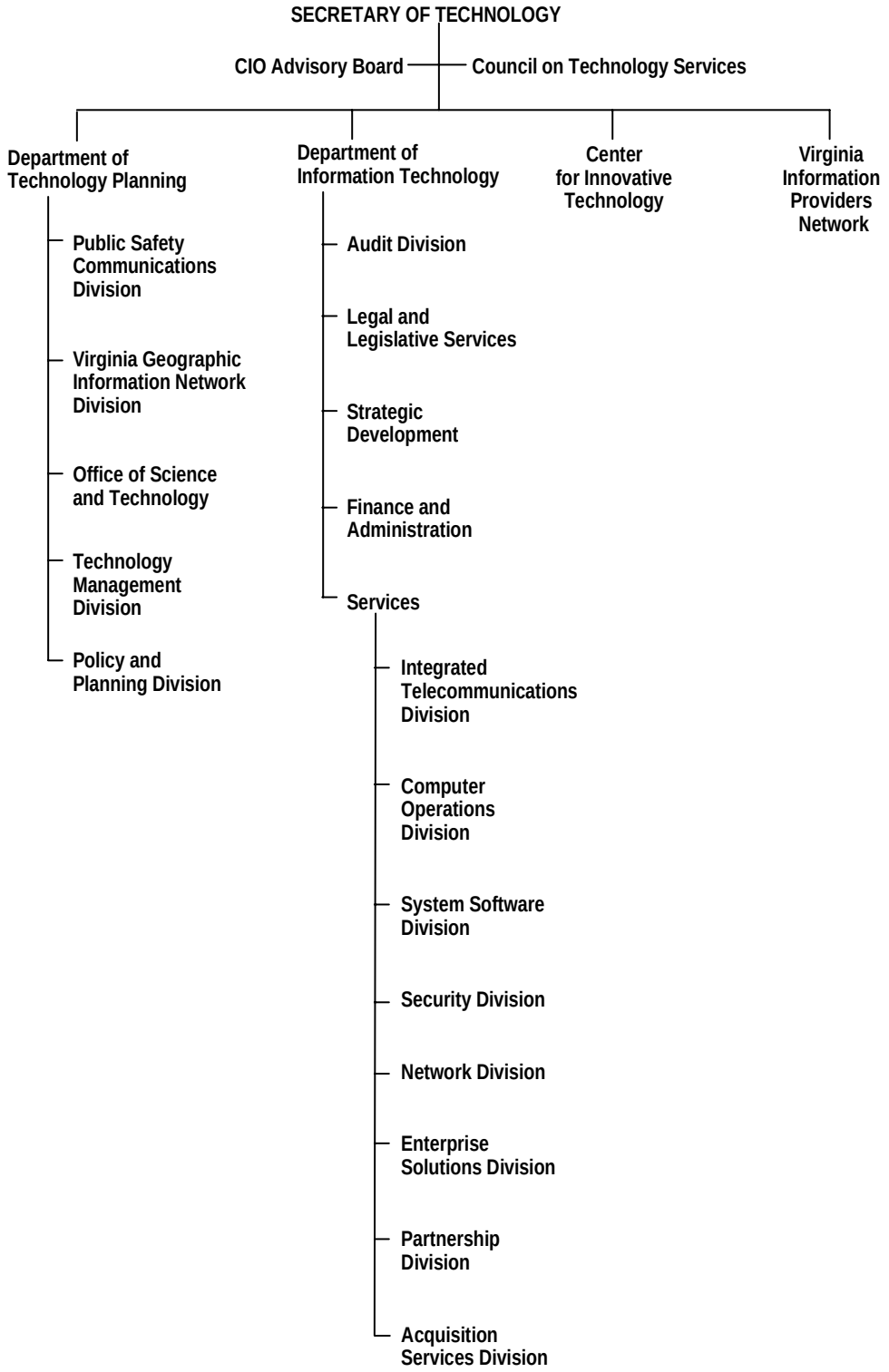
- Review and approve the information technology plans of all State agencies and institutions of higher education;

- Direct the formulation and promulgation of policies, standards, specifications, and guidelines for information technology in the Commonwealth;

- Review and prioritize budget requests for information technology from State agencies and institutions of higher education;

- Approve all technology procurements, agreements, or contracts for amounts in excess of one million dollars;

Figure 2
Current Organization of the Technology Secretariat



Source: JLARC staff analysis of data from the Department of Technology Planning and the Department of Information Technology.

- Develop, and periodically update, policies and procedures for the effective management of technology investments throughout their entire life-cycle, including, but not limited to, project definition, procurement, development, implementation, operation, performance evaluation, and enhancement or retirement;

- Periodically review the execution of projects estimated to cost one million dollars or more;

- Monitor trends and advances in fundamental technologies of interest and importance to the State; and

- Report annually to the Joint Commission on Technology and Science on the use and application of information technology by state agencies and institutions of higher education to increase economic efficiency, citizen convenience, and public access to State government and to assist the Commission in its effort to stimulate, encourage, and promote the development of technology in the Commonwealth and sound public policies related thereto.

Along with these responsibilities, the *Code* also gives the Secretary specific responsibilities in the area of economic development. These responsibilities include:

- Developing a stakeholder-driven technology strategy development process that results in a comprehensive and coordinated view of research and development goals for industry, academia, and government;

- Working with federal research and development agencies and program managers to maximize participation of State industries and universities in these programs;

- Directing the development of plans and programs for strengthening the technology resources of the State's high technology industry sectors; and

- Directing the development of plans and programs for improving access to capital for technology-based entrepreneurs.

Department of Technology Planning

The Department of Technology Planning (DTP) was formally established in 1999, as part of the codification of the Secretary of Technology, to serve as the information technology planning and policy development arm of the technology secretariat. Prior to the establishment of DTP, the Council on Information Management (CIM) served as the coordinative and policy-making authority for State technology projects. The mission and responsibilities of DTP differ from those of CIM, with DTP having increased planning, oversight, and regulatory authority. Furthermore, DTP has express authority, delegated by the Secretary, to review and approve all

proposed State agency information systems development procurements in excess of $100,000, but less than $1 million.

Created by §2.2-1700 of the *Code*, DTP has 16 staff with responsibility for: setting statewide information systems development standards, approval and oversight of information systems, and providing direct support to executive agencies in the planning and budgeting of information systems. Express responsibilities of the DTP include:

- Developing a comprehensive, statewide, four-year plan for the acquisition, management, and use of information technology;
- Planning and forecasting future needs for information technology;
- Developing and adopting policies, standards, and guidelines for managing information technology in the Commonwealth;
- Developing an approval process to ensure that all information technology procurements conform to the statewide information management plan and the information management plans of agencies and institutions of higher education;
- Assisting State agencies and institutions of higher education with the preparation of budget requests for information technology, and reviewing these requests for prioritization by the Secretary and the Department of Planning and Budget;
- Reviewing all State agency and institutions of higher education information management plans, and monitoring their implementation; and
- Developing and maintaining an inventory of information technology, including, but not limited to, personnel, facilities, equipment, goods, and contracts for services.

Department of Information Technology

The Department of Information Technology, which has 320 employees, is responsible for: (1) providing the State with data processing services through its data center, (2) managing the State's telecommunication contracts, and (3) maintaining some applications for customer agencies. DIT also assists agencies and local governments with designing, purchasing, and managing their information technology resources. During the 2002 General Assembly session, the agency was also given the authority to handle the procurement of all information technology equipment and services.

Council on Technology Services

The Council on Technology Services (COTS) was established at the same time as the technology secretariat in order to provide guidance and assistance to the Secretary of Technology in the development of statewide information technology policies. The Council, chaired by the Secretary of Technology, includes representatives from state agencies, institutions of higher education and local governments. COTS has interpreted its duties to include the following:

- Develop a framework for statewide information resource planning and decision-making;
- Develop statewide standards for all facets of information technology;
- Serve as a customer advisory/coordinating body to DIT as it seeks to address needs of many agencies concurrently;
- Participate in the development of a biennial IT Plan for State government;
- Assist DIT and DTP in exposing State agencies to new technologies and best management practices; and
- Assist in the development of other statewide programs, such as training, certification and IT workforce retention/recruitment.

Joint Commission on Technology and Science

The 1997 Virginia General Assembly created the Joint Commission on Technology and Science (JCOTS) as a permanent legislative commission. The commission is generally charged with studying all aspects of technology and science and promoting the development of technology and science in Virginia. The commission consists of seven delegates and five senators, and generally conducts studies through several advisory committees. Each year, the commission conducts studies of technology or science issues directed by the General Assembly, requested by government agencies or the public, or identified by the commission's own initiative.

OVERVIEW OF INFORMATION SYSTEMS DEVELOPMENT

The development of information systems in Virginia is relatively decentralized. There is no central process for development, and the statutory and regulatory requirements are minimal. Therefore, agencies have substantial latitude in the processes used to develop information systems. Generally, however, the information systems development process appears to have four major stages that are discussed in more detail within this section.

Most of the major systems development projects involve the procurement of private sector assistance for at least some portion of the project. State agencies have

used a variety of contractual arrangements to procure private sector goods and services. Some of these types of arrangements are also discussed in more detail within the following section.

Requirements for Information Systems Development

The development of automated information systems is guided by several sources, including the *Code of Virginia*, annual appropriations acts, executive orders of the Governor, and agency policies and procedures. The *Code* provides few direct guidelines for information systems development. The primary requirements in the *Code* are that the Department of Technology Planning review information technology procurements that exceed $100,000 and that the Secretary of Technology review and approve all information technology procurements of one million dollars or more. The *Code* also directs each agency to designate a chief information officer and for that officer to prepare an annual information technology strategic plan. The Secretary of Technology is then required to develop a four-year statewide information technology plan based on the individual agency plans. Additionally, the *Code* directs the Secretary of Technology and the agencies of the technology secretariat to establish policies and procedures covering all aspects of technology development within the State. However, few such policies or procedures regarding systems development have been developed since the establishment of the technology secretariat.

The most recently developed guidelines specifically governing the systems development process were promulgated by the Council on Information Management in 1991, and are still in effect. These are broad guidelines that have not been updated since that time. Additionally, some agencies have apparently developed their own agency-specific guidelines for project development.

Automation of various government services has been directed through several executive orders of the Governor. These executive orders have primarily related to particular systems development initiatives across State agencies but have not established specific policies and procedures for the development of information systems.

Information Systems Development Process

The systems development process usually involves a series of phases, often referred to as life-cycle stages. According to the literature on systems development, a project's life-cycle usually consists of between five and eight stages, beginning with the preliminary conceptual phase and concluding with a retrospective evaluation of the project. These stages can be grouped into four major phases: (1) planning, (2) procurement, (3) development and implementation, and (4) evaluation. The planning phase involves defining the functional need and the specific requirements, as well as analyzing business processes and the technical feasibility of the project. The next phase, the procurement phase, involves the evaluation and selection of a vendor as well as the development of a contractual arrangement. The third stage in the process is the development and implementation phase. This is the part of the proc-

ess in which the system is actually developed and is the period during which an agency must exercise effective project management and oversight. The new system is implemented and deployed at the end of this stage. The final stage is the evaluation phase during which the success or failure of a project is examined. Exhibit 1 describes each phase in more detail.

The term "project management" is used in both the systems development literature and DTP guidelines to refer to the series of activities that are performed over the entire course of a project. However, for the purposes of this review, the term project management refers only to those management-related activities that occur during the project development and implementation phase.

Models for Systems Development

While some systems are developed by agency staff, the vast majority of major systems development projects involve private sector assistance. In the past,

Exhibit 1

Project Life-Cycle Phases

Phase 1: Planning Agency planning activities prior to the initiation of a new project. These planning activities include identifying agency business needs, establishing or modifying business processes, defining the system requirements, assessing project feasibility, establishing the project scope, and performing cost/benefit or return-on-investment analysis. These activities define the parameters of the project and determine if it is worthwhile to pursue.

Phase 2: Procurement Activities performed to acquire information systems hardware, software, and consultant services. This phase includes the evaluation and selection of a vendor as well the development of the contractual arrangement with the vendor(s).

Phase 3: Development and Implementation Activities by the vendor or agency to develop and implement the information system. It may include the development of the project design as well as the actual development, customization, and implementation of software applications. Critical agency functions during this phase include day-to-day project management and ongoing project oversight.

Phase 4: Evaluation Activities include evaluation of the deliverables provided. This includes an assessment of actual benefits compared to anticipated benefits of the system. In the case of cancelled projects, this phase involves an evaluation of the reasons for project failure.

Source: JLARC staff analysis.

State agencies and institutions have used a variety of models for contracting with private sector vendors for information systems development assistance. The following is a list of some of the models that have been used:

Customized System – Contract for the development of a new information system designed to meet specific needs and business processes of a particular organization.

Commercial Off-the-Shelf System – Purchase of commercially available software which may involve varying degrees of customization.

Public-Private Benefits Funding Partnership – Agency and private vendor enter partnership agreement under which the vendor is paid to develop a project from revenues generated by the project.

Turnkey Approach – Development of information system is outsourced entirely with only minimal agency involvement in development.

Technology Transfer – Agency borrows and uses information system technology from another state that was federally funded to develop it.

Internal Development – Agency develops unique information system in-house.

FUNDING AND STAFFING FOR STATEWIDE INFORMATION SYSTEMS DEVELOPMENT

It is estimated that the State spends in excess of $1 billion annually in direct and indirect expenditures for information technology systems, with the majority of these expenditures concentrated among the institutions of higher education and a small group of large agencies. Funding for these system development initiatives is included within individual agency appropriations, and the Secretary of Technology has direct control over less than ten percent of these expenditures. A substantial portion of these expenditures are made by agencies which receive federal and special funds. Figure 3 on the following page shows the breakdown of direct IT expenditures in the State.

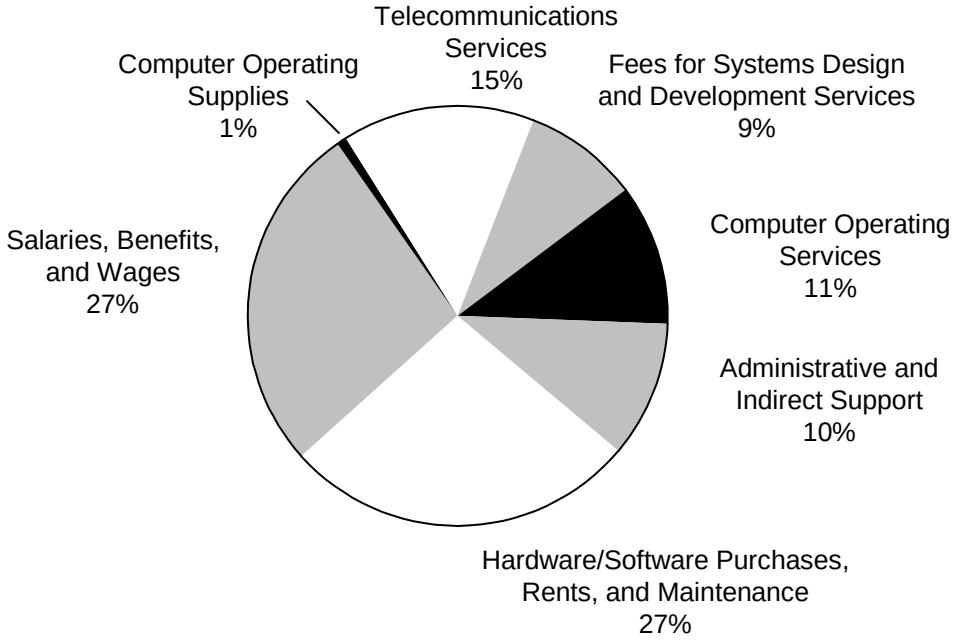
Along with the growth in overall expenditures for information technology, there has been substantial growth in State IT staff. Total information technology staffing now exceeds 3,800, and their salaries, wages, and benefits account for more than one-fourth of IT expenditures.

Statewide Expenditures for Information Systems Development

According to the Department of Technology Planning, the State's IT expenditures in FY 2002 were $931 million. However, this figure does not represent the total IT expenditures in the Commonwealth, because it does not include certain indirect costs such as IT training for staff, IT functions provided by personnel not in IT

Figure 3

State IT Expenditures by Major Category
FY 2002



Total = $931 million

Note: Administrative and indirect support costs, and a small portion of the salary and wage costs, are based on FY 2001 estimates.

Source: JLARC staff analysis of Department of Accounts data and Secretary of Technology estimates.

classifications, IT publications, and tuition reimbursement for IT personnel. The Secretary of Technology has not quantified these additional indirect IT expenditures. Information technology expenditures across the State are concentrated primarily among the institutions of higher education and a small group of large agencies. The institutions of higher education accounted for 42 percent of all direct IT expenditures statewide. Fifteen agencies, along with the institutions of higher education, accounted for nearly 90 percent of direct IT expenditures statewide. These agencies are listed in Table 1. The Department of Transportation (VDOT) had the highest IT expenditures of any agency or institution. The Department of Information Technology (DIT) is not included in the tables, because DIT expenditures are captured within other agency and institution expenditures.

Fourteen agencies had more than one million dollars in fees for systems design and development services in FY 2002. VDOT had the highest systems design and development expenditures at $22 million, which represented 26 percent of fees paid for systems design and development services statewide. The systems de-

Table 1

Breakdown of IT Expenditures Across Institutions of Higher Education and Major State Agencies (FY 2002)

Agency	Direct IT Expenditures	% Statewide IT Expenditures
Institutions of higher education	$ 352,131,863	42.5%
Department of Transportation	92,674,597	11.2%
Department of Social Services	59,057,432	7.1%
Department of Motor Vehicles	39,204,642	4.7%
Department of Medical Assistance Services	23,538,130	2.8%
Department of Health	22,117,661	2.7%
State Police	21,233,493	2.6%
State Lottery	19,512,624	2.4%
Department of Corrections	18,123,067	2.2%
State Corporation Commission	17,137,953	2.1%
Virginia Employment Commission	15,192,045	1.8%
DMHMRSAS	13,354,132	1.6%
Department of Taxation	12,745,089	1.5%
Department of Alcoholic Beverage Control	12,636,475	1.5%
Supreme Court	11,290,852	1.4%
Department of Environmental Quality	8,303,283	1.0%
Other	90,154,784	10.9%
Total	$ 828,408,121	100%

Source: JLARC staff analysis of Department of Accounts data, provided by the Department of Technology Planning.

sign and development expenditures at these 14 agencies represented 86.5 percent of the statewide total. Table 2 lists the agencies that paid more than $1 million in fees for systems design and development services.

Based on agencies that reported personnel data, the State spent at least $232 million in salaries, wages, and benefits for more than 3,600 full-time employees (FTEs) and 251 part-time hourly employees identified as information technology (IT) staff in FY 2002. These figures do not reflect the total IT workforce and salaries because several agencies, such as the Medical College of Virginia, Department of the

Table 2

Agencies that Paid More than One Million Dollars in Fees for Systems Design and Development Services (FY 2002)

Agency	Systems Design and Development Expenditures	% Statewide Systems Design and Development Expenditures
Department of Transportation	$ 21,772,783	26.2%
Department of Social Services	11,420,934	13.8%
Department of Medical Assistance Services	10,620,331	12.8%
Department of Motor Vehicles	4,816,474	5.8%
Department of Environmental Quality	4,598,651	5.5%
Department of Alcoholic Beverage Control	4,449,810	5.4%
State Police	4,163,678	5.0%
Virginia Employment Commission	1,896,885	2.3%
Department of Health	1,788,100	2.2%
State Board of Elections	1,518,101	1.8%
Department of Criminal Justice Services	1,242,721	1.5%
Virginia Retirement System	1,217,748	1.5%
Virginia Community College System	1,144,897	1.4%
State Corporation Commission	1,124,406	1.4%
Other	11,206,926	13.5%
Total	$ 82,982,444	100%

Source: JLARC staff analysis of Department of Accounts data, provided by the Department of Technology Planning.

State Lottery, the State Corporation Commission, the Virginia Retirement System, and the State Supreme Court do not report this data to the Department of Human Resources Management. Of the agencies that reported IT staff and salary data, VDOT spent the most on staff salaries and benefits, with more than $25 million in expenditures for 416.5 FTE employees. For those agencies that reported IT staff data, the mean number of IT employees was 53.8, although the median number was only 12.5. Table 3 lists the top ten agencies/institutions along with their total number of FTEs.

Table 3

Top Ten Agencies/Institutions with Highest IT Salaries, Wages, and Benefits Expenditures* (FY 2002)

Agency/Institution	Salary Expenditure	FTE Staff
Department of Transportation	$ 25,465,659	416.5
University of Virginia	25,123,365	390.0
Virginia Tech	23,363,968	397.5
Virginia Community College System	17,444,951	268.0
Virginia Commonwealth University	14,204,251	233.5
Department of Motor Vehicles	12,641,708	157.0
George Mason University	11,578,991	184.0
State Police	7,091,993	113.0
Department of Taxation	6,882,735	95.0
Old Dominion University	6,836,535	117.5

* Note: Does not include the Medical College of Virginia, State Corporation Commission or Virginia Retirement System.

Source: JLARC staff analysis of Department of Human Resources Management data, provided by Department of Technology Planning.

JLARC REVIEW AND REPORT ORGANIZATION

This JLARC review has involved a review of the information systems development process. JLARC directed staff to address the following issues:

- What causes have contributed to the recent system development failures in State agencies?
- Does the State have adequate systems development standards and procedures to guide agencies? Are those standards enforced?
- Do agencies have adequate staffing, funding, and expertise to support systems development activities?
- Does the State's central information technology organization support agency systems development efforts? Is there adequate technical assistance to and appropriate oversight of agencies? Is there accountability for systems development projects?
- Are there best practices in other states or the private sector that the State could adopt to improve the systems development process? Are there al-

ternative models for systems development that would reduce the State's risks when procuring or developing new systems?

This study has examined these issues through a variety of research activities.

Study Research Activities

A number of research activities were undertaken as part of this study to address the study issues. These activities included: structured interviews, case studies of agency technology projects, a survey of State agencies and of selected technology agencies in other states, a literature review, and attendance of meetings.

Structured Interviews. Interviews were one of the principal research methods for this study. Interviews were conducted with the previous and current Secretary of Technology, and the directors of the Departments of Information Technology and Technology Planning. In addition, interviews were also conducted with CIOs, project managers, project development team members and executives in a number of State agencies regarding their major IT project development experience. Interviews were also conducted with two local government CIOs about how their governments develop information systems. Finally, interviews were conducted with private sector vendors to obtain their perspective on systems development in Virginia.

Case Study Reviews. One of the primary methods used for this study was a review of 15 major information systems projects. Some of the projects selected have been completed, others were terminated, and still others are ongoing. This review has included interviews with members of project teams and other agency executives. The case study reviews also included a review of documents associated with the projects, including planning documents, requests for proposals, workplans, and independent verification and validation reports.

Survey of State Agencies. A survey was conducted of State agencies to obtain information on their IT organizational structure, their opinions on project management practices, and their views on the support provided by the technology secretariat. Agencies were also asked to provide information on their experience with the development of major information systems projects. In addition, agencies were asked to rate the effectiveness of the Secretary of Technology, DTP, and DIT.

Other States Review. JLARC staff conducted a review of other states to assess what processes they use for the development of and funding of major information system projects. Interviews were conducted with selected state CIOs and other technology officials.

Literature and Document Review. JLARC staff also conducted extensive literature and document reviews. A variety of technology periodicals and books were reviewed. In addition, JLARC staff reviewed other literature on IT project management, including guides and manuals.

JLARC staff reviewed a number of other documents, including prior IT studies conducted by State technology agencies. In addition, reports and studies

prepared on behalf of the State by private vendors were reviewed. JLARC staff also reviewed status reports on major IT systems development projects prepared by the agencies developing the systems and submitted to the State. Finally, JLARC staff reviewed the State agency IT strategic plans.

Attendance of Meetings. JLARC staff attended a number of meetings as part of the review, including the oversight committees established to monitor major IT development projects. Other meetings attended included the Council on Technology Services, the Joint Commission on Technology and Science, and the Governor's Commission on Efficiency and Effectiveness. JLARC staff also attended a national information technology conference.

Report Organization

This report is organized into three chapters and an appendix. Chapter I has provided an overview of the systems development process, expenditures on information technology, the organization of State technology agencies, prior studies on technology, and the JLARC review. Chapter II focuses on the elements that are central to successful IT project development and the presence or absence of these elements in recently developed projects. Chapter III discusses the State role in the support and oversight of systems development and proposes an improved structure and process for systems development. Finally, the Appendix contains case studies for each of the 15 information systems projects that were reviewed. The case studies include a narrative chronology of each project and a discussion of the presence or absence of the elements identified as critical to the success of IT projects.

II. Success of Systems Development Projects Has Been Mixed

The systems development process in Virginia State government is largely the responsibility of individual agencies. To complete this review of systems development, JLARC staff examined recent agency experiences with major projects. Based on that review, it appears the State's performance in the planning and execution of information systems projects has been mixed in recent years. Some major information technology (IT) projects have been well planned and managed and have substantially enhanced agency performance. There have also been some projects that have been much less successful. In some cases, substantial amounts of State funds have been expended on projects that have been terminated or have met few of their goals. The total cost of the unsuccessful projects reviewed as part of this study was at least $75 million, and an additional $28 million was spent on cost overruns in other projects. Exhibits 2 and 3 list the projects reviewed for this study along with their outcomes and development costs, and Figure 4 provides a timeline for the development of the projects reviewed.

Three important steps contribute to the development and deployment of IT systems that further an agency's mission in a cost-effective manner. First, development of a business case prior to proceeding with a major project can ensure that a proposed system is an appropriate means of addressing business needs.

Exhibit 2

Cancelled System Development Projects

ARIA	Accurate and Reliable Information Access The College of William and Mary Actual Cost $5.7 million
ICIS	Integrated Correctional Information System Department of Corrections Actual Cost $4.9 million
IDMS	Integrated Document Management System Department of Transportation Actual Cost $45.8 million
IHRIS	Integrated Human Resource Information System Departments of Accounts, and Human Resource Management Actual Cost $9.25 million
VVRS2	Virginia Voter Registration System State Board of Elections Actual Cost $2.9 million

Source: JLARC staff analysis of agency project documentation.

Exhibit 3

Completed and Ongoing System Development Projects

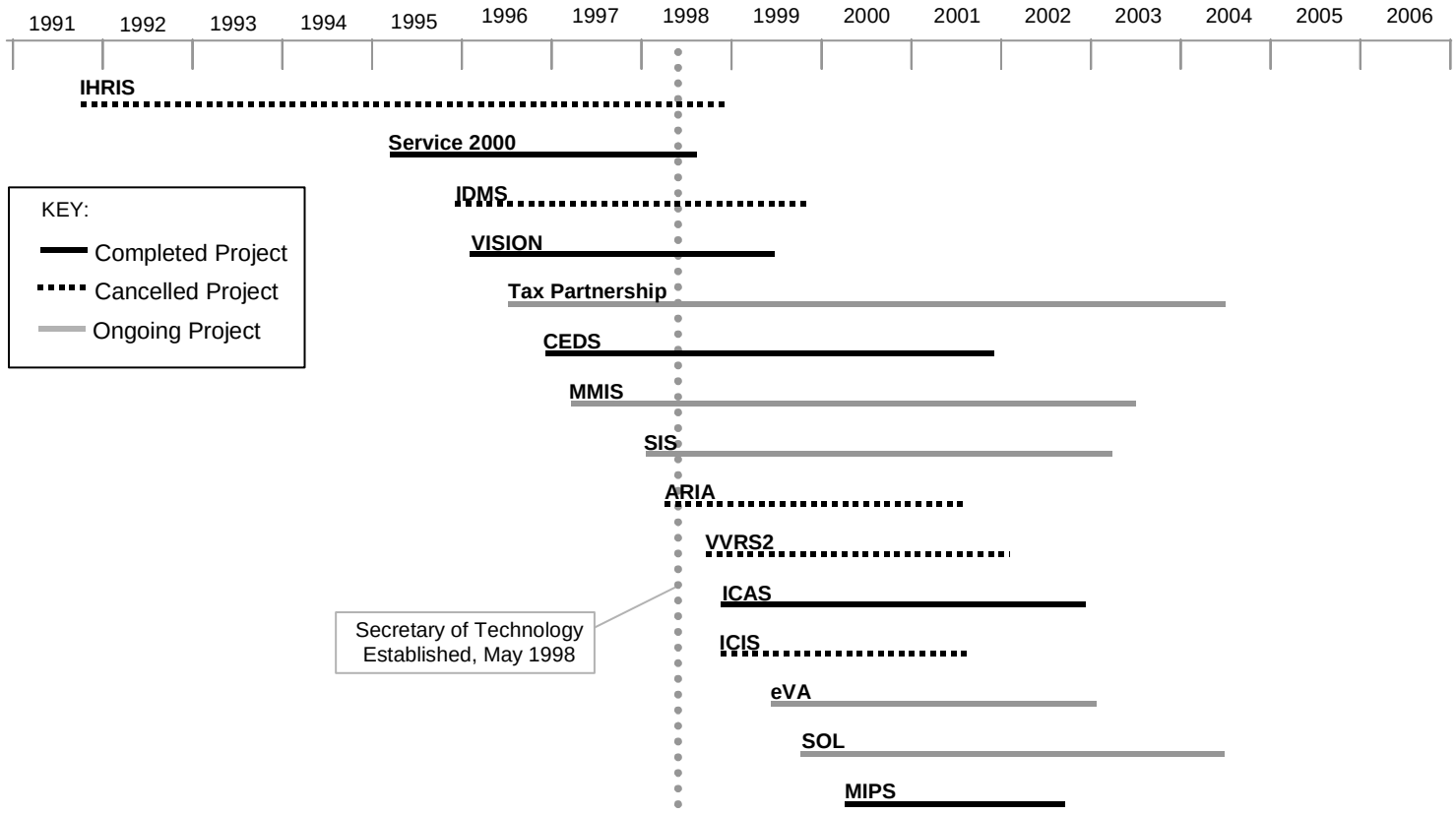
	Completed Projects
CEDS	Comprehensive Environmental Data System Department of Environmental Quality Actual Cost $13.3 million
ICAS	Inventory and Condition Assessment System Department of Transportation Actual Cost $21.4 million (Partially Completed)
MIPS	Management of Inventory and Product Sales Department of Alcoholic Beverage Control Actual Cost $18.3 million
S2K	Service 2000 Department of Motor Vehicles Actual Cost $25.6 million
VISION	Virginia Information System Integrated Online Network Department of Health Actual Cost $6.6 million (scheduled for replacement)
	Ongoing Projects
EVA	Electronic Procurement Department of General Services Projected Cost $22.8 million
MMIS	Medicaid Management Information System Department of Medical Assistance Services Projected Cost $60.6 million
SIS	Student Information System Virginia Community College System Projected Cost 18.5 million
SOL	Standards of Learning Technology Initiative Department of Education Projected Cost $317 million
TPP	Tax Partnership Project Department of Taxation Projected Cost $214 million

Source: JLARC staff analysis of agency project documentation.

Unfortunately, despite the high cost of many systems projects, State agencies generally fail to articulate a business case for the proposed systems.

Figure 4

Timeline for Development of Reviewed Projects



Source: JLARC staff analysis of agency technology projects.

Second, appropriate involvement of executive leadership is necessary to ensure that needed resources are consistently available for development and deployment of IT systems. Without the assignment of necessary staff and a reliable commitment of funding, systems development projects are unlikely to be successful. On the other hand, it is important for executive leadership to rely on professional project managers to complete the process without external interference.

Third, the systems development process itself must be properly managed. Based on the review of major projects undertaken in Virginia in recent years, there are nine major elements that are critical to the management of IT systems projects. These nine elements are listed and described in Exhibit 4. From planning, through development, to deployment, these key elements provide the framework for successful implementation. Projects in which most of these elements are present tend to be successful. Conversely, projects in which most of these elements are absent are more likely to end in failure. The problem is exacerbated when multiple agencies are involved in the development process. The recent experience of the State in developing statewide systems demonstrates the unique challenges faced in developing multi-agency enterprise systems.

SEVERAL FACTORS HAVE CONTRIBUTED TO MIXED PROJECT SUCCESS

The review of recent major information technology projects indicates that project success has been mixed. These mixed results appear to be the result of several factors. Agencies generally do not adequately develop the business case for projects despite their high costs. In addition, effective leadership has been a critical factor in the success of some projects, but inappropriate leadership has hindered the development of other projects.

Along with development of the business case and appropriate leadership, a third important factor has been the presence or absence of key elements important to the effective development of systems projects. The review revealed that there are nine elements that appear to be the keys to successful systems development. Only one-third of the projects reviewed have had most of the nine elements present and have either met their project goals or appear to be on track to do so. Conversely, almost half of the projects reviewed appear to have had more elements absent than fully present, and most of these projects were either cancelled or have not met their primary project goals.

In addition to these nine elements, development of large statewide or interagency projects present unique challenges that must be addressed. These challenges arise from the lack of statewide technology standards, individual agency autonomy, a lack of coordination between central and line agencies, and a lack of funding for these systems.

Exhibit 4

Nine Elements Identified as Critical to Project Success

Element	Description
Identification of Functional Needs and System Requirements	Agency functional needs are identified and prioritized, as are automated solutions to meet those needs. Specific functional and technical requirements are also defined.
Proven Technical Feasibility	Technical feasibility of solution is determined through prior successful implementation in a similar organization, or through demonstrated proof-of-concept.
Organizational and Business Process Analysis	Prior to system procurement, analysis is conducted of agency structure and business processes to improve the effectiveness of IT solution. Upon procurement, business process reengineering is performed to minimize software customization.
Adequate Vendor and Product Evaluation and Selection	Procurement process is competitive and unbiased, and background research on vendors and their products is conducted. "No-build" option is fully considered, as is the option to build the system in-house.
Strong Legal Contract	Contract minimizes financial exposure by specifying deliverables, linking payments to deliverables, and providing for modular development of the system.
Effective Project Management	Project is led by an experienced, full-time project management team. Team includes functional area leaders as well as professional IT staff. Systems development standards are utilized, and effective technical change control process and contract administration are established.
Involvement of End-Users	Agency staff who will actually use the system are extensively involved in planning and development of the system.
Effective Project Oversight and Control	Internal oversight structure is established, consisting of executive-level personnel within the agency, to address major issues that may affect a project's scope, schedule, or budget. External oversight structure is established to ensure agency has effective project management and oversight processes and to address major issues that arise. Also, independent review is provided to monitor the project and provide guidance.
Reliable Funding	Funding sources are identified and secured to allow for effective planning and development of system.

Adequate Business Case Is Not Developed for Most Projects

Despite the large amount of funds invested in major information systems, State agencies often do a poor job of developing the business case for such systems. The business case articulates the need for an information system as the appropriate means for solving an identified business need. The development of the business case, which is generally recognized by IT professionals as a critical first step in a major information systems project, is primarily intended to determine whether the development of a proposed system is justified based on its projected expense. Most multi-million dollar information system projects have proceeded in Virginia without full development of the business case.

Importance of the Business Case. Development of the business case is a critical early step in the development of information systems. It involves an analysis and articulation of a business problem as well as a proposed solution to meet the identified need. A key aspect of the business case is performing a cost-benefit analysis of a proposed project. This involves an analysis of both the costs that will be incurred by the development of a system as well as the benefits. This analysis serves as an important tool to assess whether to proceed with a project. The larger the dollar amount involved in the development of a project, the greater the importance of developing a business case, because the information generated could become critical in assessing how to allocate State funds among projects or other agency priorities.

Despite the importance of developing the business case for a project, agencies do not appear to adequately develop it for a number of reasons. One of the reasons appears to be a desire to avoid the associated expense. Another reason cited is that a cost-benefit analysis may be difficult to perform if the costs and benefits associated with a proposed project cannot be fully quantified. A final reason cited is that the need to develop a new information system is either mandatory, or thought to be plainly necessary, such that there is no need to prepare a business case.

Given the enormous cost of information systems and the amount spent by the State on their development, these reasons do not invalidate the need for a cost-benefit analysis. While a cost-benefit analysis does require some effort, the cost is low relative to the cost of proceeding with the development of an unnecessary system. According to a leading information technology trade publication, even in cases for which the cost-benefit analysis is lengthy and expensive, "wasting days, weeks, or even months is infinitely preferable to pushing forward with an ill-conceived or poorly structured plan that faces a high risk of failure down the line." Costs and benefits may be difficult to quantify in many cases but in virtually all cases can at least be roughly estimated. According to one State agency CIO, all costs and benefits can be quantified to some extent if agencies make the effort.

Absence of Adequate Business Case Analysis in Most of the Projects Reviewed. Most of the case study projects reviewed did not include an adequate business case analysis. In fact, four of the most costly projects reviewed did not have an adequate business case. These projects are discussed in more detail below.

The Department of Taxation partnership project to develop tax auditing, collection, filing, and processing systems, which is now estimated to cost in excess of $200 million, did not include an adequate business case presentation. In fact, the department conducted the analysis only after the Council on Information Management (CIM) requested it, two years into the project and within a month of signing the $139 million contract with the vendor. The cost-benefit analysis showed net benefits of $185 million over ten years. However, it does not appear to have included a thorough analysis of benefits or costs and was not a comprehensive analysis of all options available to the department. Moreover, the projected revenue analysis was based on increased revenue of $391 million resulting from vendor software that would assist the department in collecting delinquent taxes and identifying tax evaders. However, the department's analysis did not disclose that the software, which has been responsible for producing the additional revenue, would cost only $11.8 million – a small percentage of the full project cost.

The Integrated Correctional Information System (ICIS) project at the Department of Corrections is an example of a project in which no business case analysis was conducted. Although ICIS was estimated to cost more than $90 million, no formal business case was conducted to justify the investment. The failure to develop a business case has been cited as one of the reasons that the project did not receive funding beyond the planning phase, even though there clearly were identified needs.

The Virginia Department of Transportation's Integrated Document Management System (IDMS) project is another example of a multi-million dollar project in which there was no business case analysis. This project was assessed to be a lower priority project for the agency, yet the department proceeded to spend $46 million dollars on the system without conducting such an analysis.

The Electronic Public Procurement System (eVA) project at the Department of General Services (DGS) is another example of inadequate business case analysis. The analysis was not completed until three days before DGS signed the contract with the vendor. DGS did not conduct a cost-benefit analysis or any other estimation that adequately quantified the costs and benefits from eVA once the system was implemented. In addition, when the project was changed from an optional to a mandatory system, there does not appear to have been an analysis of the benefits in relation to the costs incurred by agencies that would be required to interface their own procurement systems with eVA. Finally, the assertion that eVA would save money through increased efficiency and lowered prices is not supported by any analysis in the business case.

Executive Leadership Is Not Always Supportive of Project Success

The extent to which appropriate leadership is exercised can significantly affect the success or failure of an information systems project. Project leadership differs from management or oversight in that a leader supports but does not direct or oversee a project. A leader often has responsibility for addressing external factors that may facilitate or impede a project. In addition, a leader's role is to ensure financial and personnel resources are in place, and to lead the agency through the cul-

tural changes that accompany major systems development projects. Some of the projects reviewed provide examples of how effective leadership can assist a project, while other projects indicate how ineffective leadership may hinder the success of a project.

A good example of appropriate leadership is the partnership project at the Department of Taxation. When the decision was made to replace the obsolete revenue accounting system, the agency was unable to secure funding for the project through general fund appropriations. Therefore, the Tax Commissioner began to explore other funding options, and the agency sought and received legislative authority to enter a partnership to conduct the project and thus use a benefits funding model to provide funding. This unprecedented approach was innovative and has led to a development effort that has been successful thus far. The Tax Commissioner also demonstrated leadership through the assignment of several senior staff with extensive experience to the project.

The eVA project at DGS illustrates how inappropriate executive leadership can have negative consequences for a project. While the commitment of the previous administration benefited the project in some respects, the involvement of the governor's office in the project hindered several planning activities in a manner that continues to negatively affect the project. The governor's office required that the first phase of the project be completed within nine months, and as a result, aspects of the project were adversely affected. This compressed development timeframe prevented the use of pilot projects, as recommended by the Council on Information Management. In addition, DGS staff reported that the aggressive schedule limited their ability to gather additional support for the project, from both State agencies and the vendor community, a step that had been recommended by the governor's task force on procurement. Moreover, the compressed timeframe for procurement appears to have led to misunderstandings between DGS and the vendor regarding at least one basic software requirement.

The project undertaken by the State Board of Elections to develop a new voter registration system also demonstrates the consequences of inappropriate executive leadership. The Secretary of Administration inappropriately empowered a local election official to act as project manager even though he was not qualified. The agency already had a designated project manager who reported to the project's oversight committee, but the local election official reported directly to the Secretary. This action diminished the State Board's role in the project, compromised the project management and oversight structures, and ultimately contributed to the failure of the project.

Presence of Nine Elements for Project Success Has Not Been Consistent in Projects Reviewed

Based on the review of major IT systems development projects in the State, the nine elements identified for project success have not been consistently present. Only five of the projects reviewed had most of the elements present. In contrast, seven of the projects had more of the nine elements absent than present.

With the remaining three projects, the presence of the elements was mixed. The nine elements are discussed in greater detail later in this chapter.

Some of the elements that appear present less often than others are planning elements, which include identification of the business needs and system requirements, proven technical feasibility, and organizational and business process analysis. Proven technical feasibility was absent in seven of the projects reviewed and only fully present in four of the projects. In addition, organizational and business process analysis was only fully present in three of the projects reviewed. Another element that was either absent or only partially present in most projects was effective project management. Finally, effective project oversight was absent in seven of the projects reviewed. Exhibit 5 provides a summary of the number of times each of the elements was present, partially present, or absent for each of the projects reviewed.

Many of the projects that have been failures lacked most of the elements important to success. In contrast, with the projects that have been successful, most of the elements have been present. The unsuccessful projects generally lacked the following elements: proven technical feasibility, adequate vendor and product evaluation and selection, a strong legal contract, effective project management, and effective project oversight and control. Conversely, these same elements were generally present in all of the successful projects. Exhibit 6 shows the presence or absence of each of the elements for each of the projects.

Successful projects include the Department of Motor Vehicles Service 2000 project and the ABC's Management of Inventory and Product Sales (MIPS) project. Both of these projects had virtually all of the elements critical to success and have met their goals. In addition, there are three large projects that are still ongoing but have most of the success elements fully present and appear on track to meeting project goals. These projects include the Standards of Learning (SOL) project at DOE, the partnership project at Tax, and the SIS project at the VCCS. All three of these projects have had virtually all of the success elements present and appear to be on track to success.

In contrast, seven of the projects that have been reviewed had more of the elements absent than fully present. These projects are: the ARIA project at William & Mary, the IDMS project at the Department of Transportation, the IHRIS project at the Department of Accounts and Department of Human Resource Management, the VVRS2 project at the State Board of Elections, the VISION project at the Department of Health, the ICIS project at the Department of Corrections, and the MMIS project at the Department of Medical Assistance Services. Six of these projects did not achieve the major goals of the project and involved the waste of a substantial amount of State funds. The MMIS project at the Department of Medical Assistance Services is still ongoing and may ultimately meet the project goals, but it is substantially over budget and behind schedule. The remaining three projects reviewed had some of the elements present and others absent.

Exhibit 5

Presence of Elements that Contribute to Project Success (for 15 Major IT Projects)

	Present ✔	**Partially Present** ✓	**Absent** ✗
Identification of Functional Needs and System Requirements	✔✔✔✔✔	✓✓✓✓✓✓✓✓	✗✗
Proven Technical Feasibility	✔✔✔✔	✓✓✓✓	✗✗✗✗✗✗✗
Organizational and Business Process Analysis	✔✔✔	✓✓✓✓✓✓✓✓	✗✗✗
Adequate Vendor and Product Evaluation and Selection	✔✔✔✔✔✔	✓✓✓✓	✗✗✗✗✗
Strong Legal Contract	✔✔✔✔✔	✓✓✓	✗✗✗
Effective Project Management	✔✔✔✔	✓✓✓✓✓	✗✗✗✗✗
Involvement of End-Users	✔✔✔✔✔✔✔✔✔✔	✓✓✓✓	✗
Effective Project Oversight and Control	✔✔✔✔	✓✓✓✓	✗✗✗✗✗✗✗
Reliable Funding	✔✔✔✔✔✔✔✔	✓✓✓	✗✗✗✗

Source: JLARC staff analysis of 15 major IT projects at State agencies

Poor project management and development has had significant financial consequences for the State. The total cost of the failed projects has been at least $75 million. This figure understates the full cost because it does not include agency personnel costs for some of the projects. In addition to the wasted dollars for failed efforts, the projects reviewed have had cost overruns totaling about $28 million.

Exhibit 6
Presence of Elements that Contribute to Project Success

	✔ Present				✓ Partially Present					✗ Absent					
Agency	ABC	DMV	VCCS	TAX	DOE	DEQ	VDOT	DGS	DOC	DMAS	SBE	W&M	DOH	DOA/DHRM	VDOT
System	**MIPS**	**S2K**	**SIS**	**TPP**	**SOL**	**CEDS**	**ICAS**	**EVA**	**ICIS**	**MMIS**	**VVRS2**	**ARIA**	**VISION**	**IHRIS**	**IDMS**
Identification of Functional Needs and System Requirements	✔	✔	✔	✔	✓	✓	✓	✓	✓	✗	✔	✓	✓	✗	✓
Proven Technical Feasibility	✔	✔	✔	✓	✗	✓	✓	✗	✗	✗	✔	✗	✓	✗	✗
Organizational and Business Process Analysis	✔	✓	✔	✔	N/A	✓	✓	✓	✓	✓	✗	✓	✓	✗	✗
Adequate Vendor and Product Selection	✔	✔	✔	✔	✔	✔	✓	✓	✗	✓	✓	✗	✗	✗	✗
Strong Legal Contract	✔	✔	✔	✔	✔	N/A	✓	✓	N/A	✗	N/A	✗	✓	N/A	✗
Effective Project Management	✔	✔	✓	✔	✔	✓	✗	✓	N/A	✓	✗	✗	✗	✓	✗
Involvement of End-Users	✔	✔	✔	✔	✔	✔	✔	✓	✔	✔	✓	✔	✗	✓	✓
Effective Project Oversight and Control	✔	✔	✔	✔	✓	✗	✗	✓	✓	✓	✗	✗	✗	✗	✗
Reliable Funding	✔	✔	✔	✔	✔	✓	✔	✓	✗	✔	✗	✓	✗	✗	✔

Some of the agencies with failed projects have learned from their experiences and appear to have substantially improved their project development process. For example, the Department of Health identified the weaknesses with the VISION project shortly after it was implemented and began to address the agency's systems development shortcomings. The department restructured its internal information systems division. In addition, it hired an experienced project manager and began efforts to develop a system that will meet the goals intended to be achieved through VISION. While still ongoing, it appears that this project will be successful.

Similarly, the College of William and Mary appears to have rebounded well from the ARIA project. The institution has now contracted with another vendor with a proven product to develop a student information system, and has designated a strong project manager to oversee project development. The project has not yet been completed but appears to be successful thus far.

Statewide Enterprise Systems Present Unique Challenges

Development of large, statewide or interagency systems presents unique challenges in addition to the nine elements already discussed. These challenges arise from the lack of statewide technology standards, individual agency autonomy, a lack of coordination between central and line agencies, and a lack of funding for these systems. Two statewide systems development projects that illustrate these challenges are the electronic procurement project (eVA) and the Integrated Human Resource Information System (IHRIS) project.

IHRIS and eVA Are Two Recent Statewide Systems Development Efforts. Two recent statewide enterprise projects that have been undertaken are the IHRIS and eVA projects. The IHRIS project, which began development in 1996, was intended to integrate the central payroll and personnel functions at the Department of Accounts (DOA) and Department of Personnel and Training (DPT), now the Department of Human Resources Management, respectively. In addition, the central agency proponents – DOA, DPT, the Department of Planning and Budget, and the Council on Information Management – also intended to have IHRIS replace the personnel and payroll systems that line agencies maintained to supplement the central systems. The eVA project, now in use at the Department of General Services (DGS), was initiated in order to provide an array of electronic purchasing tools for State agencies, gather data on state purchasing, and simplify purchasing requirements for vendors.

Three major issues had to be addressed in the development of both eVA and IHRIS. First, both projects faced the challenge of implementing very sophisticated and complex systems in a variety of technology environments without the benefit of State standards. Second, the central agencies managing each project had to consider the appropriate division of responsibility between central and line agencies. Finally, both projects had to obtain adequate funding for the life of the project.

The Absence of State Technology Standards Has Harmed Enterprise-Wide Systems Development. A significant obstacle to the development of

both IHRIS and eVA was the absence of State technology standards for hardware, software, or data exchange. Without the guidance of State technology standards, line agencies can develop their own systems using any hardware, software, or data standards they choose. This has led to substantial variation among agencies in the types of systems, including the hardware and software used. This variation compounds the difficulty of implementing statewide systems because the software maintained by the central agency must be compatible with the software and hardware at line agencies.

The absence of State technology standards hindered development of both IHRIS and eVA. During the IHRIS project, the steering committee found that the software would not function because each line agency was authorized to use any type of security and telecommunications software. The diversity of software types exceeded the ability of the IHRIS software, which was not designed for use in a highly unstandardized environment.

The development of eVA has been slowed by the lack of software and data standards. The eVA project has been required to accommodate a variety of software types at line agencies, and this has slowed usage of eVA. For each type of software, a different interface had to be developed that would connect the agency software to eVA, and this has required more than a year of ongoing effort by DGS, the vendor, and the line agencies to determine how to create the interfaces. As the project progressed, DGS and the larger State agencies were also forced to develop implicit State technology standards for data exchange. The line agencies had adopted a variety of data standards that were incompatible with each other, such as standard units of weight or measure, and the inability to share data prevented agencies from exchanging data with eVA even after the interfaces had made data exchange possible. The development of these data standards has increased the likelihood of eVA's success, and the development of additional technology standards would increase the State's ability to successfully implement enterprise-wide systems in the future.

Agency Autonomy and Lack of Coordination Between Central and Line Agencies Has Hindered Project Success. The absence of any mechanism for coordinating inter-agency projects, coupled with the autonomy of line agencies, has hindered the development of eVA and IHRIS. The inability to coordinate projects across agencies has resulted in an inadequate consideration of which functions should be provided centrally, and which were best provided at line agencies. During the IHRIS project, there is no indication that a single central system could satisfy the requirements of every line agency. Additionally, line agencies were resistant to the idea of a central system and reluctant to perform business process reengineering. In combination, systems development was hindered as a result of increased customization of the software.

The eVA project was initiated without adequate consideration of which purchasing tools should be provided by a central system in order to avoid duplication of effort and cost. Although eVA was intended to be an optional system, this approach was not successful and use of eVA has been mandated. However, line agencies have been reluctant to use the system because of their substantial investments in existing systems. Additionally, DGS asserts that eVA reduces the need for agen-

cies to maintain independent purchasing systems, yet agencies disagree with this assessment.

Finally, the absence of central coordination allowed both eVA and IHRIS to be initiated without a consideration of the costs that would be borne by line agencies. Budgets have been presented for both systems that have not included the total cost of either project, because only the costs for the central agencies were identified. This has proved harmful to both projects because line agencies have been unwilling to voluntarily commit their own resources to untested systems.

Funding for Enterprise Systems Has Been Inadequate. Another obstacle in developing statewide projects is the lack of sufficient funding. Projects of this scale are inherently expensive, but the General Assembly has not been inclined to provide full funding for them. This situation has been exacerbated by the failure to fully account for the total cost of statewide projects.

The IHRIS project was unable to obtain funding sufficient to provide hardware at the line agencies. In the final year of the project, the steering committee began to be concerned that full deployment of IHRIS would require an additional computer at each line agency, and that DOA and DHRM, formerly the Department of Personnel and Training, would be required to pay for their procurement and maintenance. According to the Director of the Department of Human Resource Management, who sought input from both the Comptroller and the Director of the Council on Information Management, another $30 million would have been required. Lack of funding for the project was one factor that contributed to the ultimate failure of the project.

Like IHRIS, the eVA project did not have an appropriation, but instead received a treasury loan, along with a directive from the General Assembly to first "explore other financing strategies during development." DGS requested a treasury loan of $3 million, which is being repaid by fees charged to State agencies and institutions of higher education. The treasury loan repayment was supposed to be the only charge to State agencies for eVA. In addition, the Secretary of Finance and DGS developed a reverse-funding model under which suppliers were to pay registration fees, plus a fee on each eVA transaction.

However, the reverse-funding model used for the eVA project has not worked as anticipated, although it appears that DGS presently has access to a sufficient amount of funding. One problem caused by the funding model has been the resistance by suppliers to the payment of transaction fees, which decreased support for the project among private sector entities, and has resulted in a $7.1 million charge to State agencies in the current fiscal year. In addition, the funding model assumed that the vendor would have an incentive to develop eVA in a timely manner, in order to collect additional revenue, but this has not occurred. Instead, DGS modified the contract to provide accelerated payments to the vendor in exchange for the completion of specific tasks.

NINE ELEMENTS IMPACT PROJECT SUCCESS

A review of the State's recent experience with information systems development reveals that nine elements are critical to the success of major information system projects. These elements relate to the various phases in a project's development, from the planning stage, through procurement and finally project management and oversight. They include the following: (1) identification of business needs and system requirements, (2) proven technical feasibility, (3) organizational and business process analysis, (4) adequate vendor and product evaluation and selection, (5) a strong legal contract, (6) effective project management, (7) involvement of end-users, (8) effective project oversight and control, and (9) reliable funding.

Each of the major projects reviewed as a part of this study were assessed based on the presence or absence of these major elements. The project case studies are included in Appendix A, and for each project there is an exhibit indicating the presence or absence of each of the elements. This section discusses each of these elements and provides examples of how the presence of these elements has contributed to the success of projects, or how their absence appears to have been a cause for project failure.

Some Projects Have Failed to Adequately Identify Functional Needs or Define System Requirements

Adequate identification of functional needs and definition of system requirements are key first steps in the development of a major information system project. The proper identification of functional needs is the process of identifying and prioritizing agency needs along with assessing whether there may be an effective technology solution to address the identified needs. The definition of system requirements is also a key aspect of the initial process. Requirements definition involves identifying and specifying the functions that an IT solution must perform along with the hardware and network infrastructure that will be required for the system to operate effectively. These planning elements have been present in many of the State projects reviewed but absent in others.

Identification of Agency Functional Needs and Appropriate Solutions to Meet Those Needs. The first step in the systems development process is the identification of agency functional needs and appropriate solutions to meet those needs. Proper identification of needs involves a fundamental assessment of business goals and system resources in an agency or a division within an agency. The process may originate with a strategic plan, and should be driven by leaders and end-users (those personnel that operate the system) within the agency and not information technology staff. Upon identification of functional needs, a general examination of the type of solutions available should be conducted to assess which ones are most appropriate to meet the identified needs. This process, when done effectively, can ensure that major system development efforts will be focused on critical needs, and that a project's scope will be proportionate to the agency needs being addressed.

Based on the projects reviewed, most agency projects appear to be initiated to address a significant functional need that has been identified. However, the extent to which the agency conducted a formalized process for the evaluation of functional needs has varied. A good example of a project that resulted from a structured analysis of the agency's functional needs was the Inventory and Condition Assessment System (ICAS) at the Department of Transportation (VDOT). VDOT conducted an extensive analysis of agency functional needs prior to beginning work on the development of ICAS. Beginning in 1995, VDOT undertook a comprehensive agency-wide needs analysis in order to identify the areas in which services could be improved or efficiencies realized. One of the recommendations of that study was the need to shift from a system in which maintenance was managed regionally by VDOT districts to a system of integrated asset management in which maintenance of the State's transportation network would be managed on a statewide basis. As a result of this identified need to integrate maintenance management, the ICAS project was initiated.

Another example of a project that emerged from a formal process for identification of agency needs was the Department of Taxation's (Tax) partnership project (TPP) to improve tax auditing, collection, filing, and processing. In early 1993, Tax retained a consultant to assist in the development of a strategic plan for the agency that identified agency needs that should be addressed. This process for identification of agency functional needs ultimately led to the TPP, which addresses those identified needs.

While agencies appear to be successful at identifying needs, they are sometimes less successful at identifying appropriate solutions to meet those needs. The Accurate, Reliable Information Access (ARIA) system at the College of William and Mary is an example of a project in which the solution did not appropriately address the institution's needs. William and Mary identified its most critical need to be a new student information system. However, the identified solution was an enterprise resource planning (ERP) system that would provide the institution with integrated student information, finance, and human resources systems. The institution selected as the vendor a company whose student information system had not yet been developed, even though that had been identified as the institution's highest priority need.

The Integrated Document Management System (IDMS) project at VDOT is another example of a project in which the identified solution may not have been proportionate to the need. VDOT had identified a document management system as a need, but it was a relatively low priority compared to other agency needs. However, VDOT ultimately contracted with a vendor and spent $46 million to build a customized system to meet this identified need when another vendor had proposed a basic integrated document system for substantially less cost.

Definition of System Requirements. Another important aspect of this element is the definition of system requirements, both functional and technical. After identifying the solutions to functional needs, systems requirements have to be developed. Definition of functional system requirements involves delineating all of the functions or tasks that an IT solution will need to perform to meet the needs of

the agency. Proper definition of the functional requirements of the system is critical to the success of an IT project.

Definition of technical system requirements involves determining the technical infrastructure that needs to be in place for the system to operate effectively. Technical system requirements may include such things as minimum processing speed of agency personal computers, minimum network bandwidth, minimum desktop operating system (for example, Windows 2000), minimum data storage capacity, and other computer hardware and software requirements.

The student information systems (SIS) project at the Virginia Community College System (VCCS) is a good example of a strong process to define the functional and technical system requirements before attempting to implement the system. The VCCS used workgroups composed of community college administrators from each of the functional areas – admissions and records, financial aid, student finance, and academic advising. These workgroups met on an ongoing basis for a period of six months to develop the functional requirements for the SIS. An infrastructure workgroup, which was assembled from IT staff both in the central office and at the colleges, met over the same time period to develop the technical requirements for the system.

The eVA project at the Department of General Services (DGS) is another good example of a thorough process for identifying system requirements. After reviewing available research on electronic procurement and contacting private and public sector entities, DGS formed a design team one year prior to issuing a request for proposals (RFP) to develop requirements. The design team consisted of representatives from the technology secretariat, three State agencies, three local governments, and three universities. Over a period of several months this team developed a set of preliminary requirements. DGS then presented these preliminary requirements at a statewide end-user forum to solicit additional input. After receiving comments, DGS held conferences with end-users and software companies to further refine the requirements.

In contrast, some projects have failed to adequately define requirements. The identification of system requirements was inadequate and adversely affected timely progress in development of the Medicaid Management Information System (MMIS) at the Department of Medical Assistance Services (DMAS). DMAS professional staff were assigned to teams to create Requirements Analysis Documents (RADs) for their functional areas. These RADs were then incorporated into the RFP and resulting contract for the system. However, according to DMAS project management staff, the teams were not provided with adequate direction and monitoring. As a result of the inadequate requirements definition process, considerable time was spent after project initiation on disputes between DMAS and the vendor (First Health) regarding contract deliverables and the project scope.

The Integrated Human Resources Information System (IHRIS) project is another example of a project in which there was inadequate definition of technical system requirements. Full consideration was never given to whether the hardware and software at line agencies would be compatible with the central IHRIS computer.

The failure to fully assess whether existing line agency hardware and software was compatible with IHRIS, or what products needed to be procured at line agencies, was one of the primary factors that contributed to the failure and abandonment of the project.

Some Projects Have Failed Because Technical Feasibility Was Not Established

Assessment of the technical feasibility of information systems development is a critical element for project success. Developing a project using unproven technology involves substantially greater risk of failure than a project that uses proven technology. Project failure rates and development costs naturally tend to be higher with newly developed systems than with systems that have been previously developed and implemented. Agencies should, therefore, strive to be technology leaders but not technology pioneers. If agencies decide to be pioneers in the development of a system, then they need to seek ways to shift much of the risk of project failure to software and implementation vendors.

While the use of proven technology is advisable, agencies sometimes take the risk of using unproven technology for a variety of reasons. Agencies may be tempted to enter into software development contracts with vendors that use unproven technology because of vendor promises that it can develop a package customized to their own business processes. In other instances, the prospect of being a pioneer in the field may seem worth the risk to political leaders, agency directors, or CIOs because of the exposure provided by being a technology leader.

One State agency CIO contends that State, instead of being pioneers in the development of systems, agencies should attempt to be "early adopters." Early adopters are not the first to implement new systems but are some of the first to implement systems after they have been successfully implemented by the pioneers. One benefit of this approach is that an agency can take advantage of emerging technology, but only after it is proven. Another benefit of being an early adopter is that the cost of purchasing a newly developed application may be less expensive at this early phase of product distribution than after the application is fully developed and widely available. The disadvantage of early adoption is that the technology may still have problem areas that need to be fixed.

There may be instances in which agencies may feel compelled to attempt development of systems without proven technical feasibility in order to meet federal or State mandates, or because of the unique mission of the agency. In these instances, agencies need to take steps to reduce the risk and financial exposure by ensuring that other critical success elements are present throughout the development process. Elements that may reduce the risk of project failure or financial loss include a strong project management structure, a legal contract that limits the State's financial risk, and effective project oversight.

Two good examples of projects in which agencies adequately assessed the technical feasibility of a project prior to implementation are the Department of Alco-

holic Beverage Control's (ABC) Management of Inventory and Product Sales (MIPS) project and the Department of Motor Vehicle's (DMV) Service 2000 project. Before initiating the MIPS project, ABC undertook a proof-of-concept demonstration and hired a consultant to review both the technical requirements of the system and the results of the demonstration. Thus, ABC had confirmation of the feasibility of the MIPS project before it was initiated.

The Service 2000 project at DMV is another good example in which project feasibility was fully examined prior to developing the project. A proof-of-concept pilot project was conducted to determine the feasibility of moving the system from the existing platform to a new Unix platform, and the Department of Information Technology confirmed the feasibility of the technical requirements during the initial planning phase. Additionally, a consultant was retained to review and evaluate the project plan and systems architecture documents in order to assess the overall feasibility of the project.

In other instances technical feasibility has not been adequately assessed prior to undertaking major systems developments efforts. The IDMS project at VDOT is an example of a project in which proven feasibility was not adequately assessed. The IDMS project involved a contract with a vendor to build an integrated document management system. However, this particular software solution had not been implemented previously. In fact, project documents refer to the opportunity for VDOT to be a "pioneer." In addition, the vendor did not have a proven track record of implementing complex information systems and was not required to demonstrate a proof of concept prior to VDOT entering the contract. The vendor was not able to successfully develop the system, and the project was abandoned after costs of $46 million to the State.

The MMIS system at DMAS is another instance of an agency attempting to be a pioneer, but not having properly protected itself against the associated risks. When DMAS began the project in 1998, a successful state MMIS had not been developed in more than ten years, and the most recent attempt in Virginia had failed. However, DMAS entered a contract on the basis that the selected vendor was in the process of successfully implementing an MMIS in Mississippi. Two years into the development, the vendor decided to abandon the Mississippi approach and develop an entirely new and unproven technology in Virginia. This pioneering effort, which is still ongoing, has resulted in a project that is over budget by approximately $15 million and delayed by several years.

Increased Use of Organizational and Business Process Analysis Contributes to Project Success

One element of a successful project development is an analysis of the organization and its business processes before a project begins. This analysis determines if changes are needed to the structure of the agency itself, or to the steps it takes to perform its daily activities. In addition, once a project is under development agencies can also benefit from properly balancing software customization with modifica-

tions to existing business processes. These activities appear to increase the likelihood of project success, and are present in some projects.

Organizational Analysis Can Identify Needed Changes Before the Project Begins. Some systems development projects require a significant degree of organizational change for the project to succeed. These organizational changes may involve an agency's internal structure, or its external relationships with other organizations. Internal changes may result in a realignment of responsibility between regional offices and an agency's central office, or between divisions within an agency. External changes may involve the reallocation of responsibilities between two agencies.

In some instances, the organizational change may reduce the need for new technology, while the inability to make needed changes may indicate that the project is not prudent. With some of the projects reviewed, organizational changes were made that contributed to the success of the project. In other instances, the lack of needed change prior to the initiation of a project has hindered its success.

A good example of a significant organizational change made prior to project initiation was the VCCS Student Information System project, in which VCCS integrated the 23 college databases into a single VCCS database. VCCS is presently developing a new student information system that will be used by each of the 23 community colleges. The creation of a single database prior to systems development simplified the scope of the project and reduced its cost. VCCS only has to modify the SIS software once instead of 23 times, and was able to obtain reduced prices from software vendors by simplifying software distribution to the individual colleges.

In contrast, the IHRIS project illustrates how a lack of attention to needed organizational changes can hinder a project's development. IHRIS was an attempt to integrate the State's payroll and personnel systems, including the elimination of all duplicative personnel and payroll systems at line agencies. The proposed elimination of line agency systems would have represented a move towards centralization of these activities. However, it appears that little consideration was given to which payroll and personnel functions should be performed centrally, and which by line agencies. Instead, IHRIS was customized to replicate existing line agency functions, which increased the cost and complexity of the project.

The Comprehensive Environmental Data System (CEDS) project at the Department of Environmental Quality (DEQ) provides another example of a project in which organizational changes were not addressed. The success of the CEDS project was somewhat limited because the agency did not fully integrate its Air, Water, and Waste Divisions before beginning the project. DEQ was created from four separate State agencies in 1993, four years before the project began, and the agency did not address the need for further organizational integration prior to initiating the project. By attempting to use technology to further integrate the air, water, and waste management programs instead of making an organizational change directly, DEQ was unable to develop a fully integrated information system. In other respects, however, the CEDS system has met many of its goals.

Business Process Analysis Can Increase Agency Efficiency and Aid Software Evaluation. Another important aspect of this element is conducting an analysis of existing business processes before a project begins. The result of any systems development project is the automation of individual business processes, which consist of the steps taken to perform an agency activity. A thorough examination of how business is conducted may identify areas of inefficiency such as overlapping procedures or unnecessary steps. If these inefficiencies can be corrected without the introduction of new technology, then the agency will realize the benefit immediately and at a lower cost. If new technology is needed to reduce inefficiency, then the business process analysis can be used to identify the degree and type of technological change required.

Furthermore, an understanding of how business is conducted can aid the evaluation of software, particularly commercial software which already includes commonly used business processes. This analysis will often be required during systems development in order to identify gaps between a desired process and an existing process, and an agency that performs this analysis before a project begins may reduce the possibility of automating an inefficient process. The CEDS project at DEQ and the MIPS project at ABC benefited from business process analysis, while the IDMS project at the Department of Transportation was impaired by its absence.

The analysis of business processes before the CEDS project began allowed DEQ to more precisely define the project's goals and requirements. DEQ began the project by analyzing existing business processes and used this information to develop general system requirements. DEQ retained a system development consultant, and then held two major end-user conferences at which attendees analyzed the processes and data that would be used in the new system.

The analysis conducted by ABC for the MIPS project provided a comprehensive evaluation of the role played by each business unit in the management and sale of alcoholic beverages across the State. ABC conducted an extensive business process analysis that outlined both the daily business workflow and reporting requirements of the existing automated systems. Furthermore, the analysis provided a detailed description of the existing computer systems that were in place to support the business operations.

In contrast, VDOT undertook the IDMS project before the agency had conducted any business process analysis. VDOT hired a vendor to create document management and retention policies, and subsequently design an integrated document management system. The use of a single contract to accomplish both tasks prevented VDOT from evaluating its new document management policies before deciding to proceed with a document management system, and prevented it from using the new policies as a basis for developing requirements for the new system.

Business Process Reengineering During Development Can Reduce Software Customization. Business process reengineering refers to the modification of an existing business process in order to improve, or reengineer, the process. An industry best practice is to perform reengineering instead of software customizations or other modifications. During systems development, agencies must carefully

examine existing processes to look for reengineering opportunities, because not doing so may result in increased cost, as well as the increased likelihood of project failure. For some projects, reengineering is not possible until new technology is provided, whether hardware or software, or both. This illustrates the iterative nature of reengineering, in which the development of a system reveals new reengineering opportunities or the need for changes to the system itself.

Business process reengineering is especially important when a project uses commercially available off-the-shelf software. An off-the-shelf product consists of those business processes that are typical enough among similar organizations for a vendor to automate them in a software package. However, vendors usually issue new versions of off-the-shelf software on a regular basis, and may require that these upgrades be installed as a condition of maintenance agreements. Agencies that perform extensive modifications to off-the-shelf software may have difficulty performing future upgrades, and may also incur higher long-term costs for programming and consulting staff. If an off-the-shelf product is used, software customization needs to be minimized. An industry best practice is to perform no more than a 20 percent modification of the software itself, and a need for further customization may suggest that additional reengineering needs to be performed to conform to the software application.

The SIS project at the VCCS is an example of an agency performing business process reengineering instead of software customization. At the project's inception, VCCS decided that the "installation of the vendor's software shall be without modifications" and that the business units would instead reengineer their business processes. After purchasing the software, the VCCS project management team created functional workgroups to analyze existing business processes and identify which would have to be reengineered to conform to the software. A system prototype was developed that satisfied a majority of the existing business processes at the colleges, and the colleges were then tasked with reengineering their own business processes during the deployment phase of the project.

In contrast, the business process reengineering process on the IHRIS project was undisciplined, and this contributed to the project's failure. The project had a formal structure to review requests for customization of the software by the line agencies, but this process was hindered by a lack of clear authority to refuse the requests of line agencies. As a result, there was significant customization of the software to conform to agency requests and little effort to modify agency business processes to conform to the software.

Some Projects Have Failed Due to Inadequate Vendor and Product Evaluation and Selection

The proper evaluation and selection of vendors and products is another critical element in determining the success of systems development projects that are not developed in-house. The vendor and product selection process begins with the development of a request for proposals (RFP), and ends with the award of a contract for the procurement of goods or services, or in some cases, cancellation of the RFP.

An inadequate selection process can lead to the use of incapable vendors or incompatible software products that do not meet the agency's business needs. A proper vendor and product selection process includes a competitive and unbiased proposal and evaluation process, adequate background research on competing vendors, and consideration of the full range of options, including not developing the system or developing it in-house.

Procurement Process Should Be Competitive and Unbiased. The procurement process should be competitive and unbiased in order to obtain the best possible hardware, software, and services, and to comply with State law. A competitive and unbiased procurement process provides the opportunity for as many qualified vendors as possible to submit proposals, and ensures that these vendors are considered. In addition, the process needs to allow for the full evaluation of the vendors and products by the procuring agency so that the agency can select the best product or vendor available.

The Public Procurement Act in the *Code of Virginia* provides rules for the procurement process to ensure that procurement is competitive and fair. The Act requires competitive negotiation or competitive sealed bidding for the purchase of goods and services. The Act does provide two instances in which the competitive process is not required to be used: (1) if there is only one practicably available vendor (a sole-source procurement), or (2) if urgent circumstances dictate the need to conduct the procurement on an emergency basis.

The projects reviewed appear to have generally followed the requirements of the Procurement Act in selecting and purchasing hardware, software, and services for major systems projects. The general process used has involved the issuance of a request for proposal (RFP) and the receipt and evaluation of proposals. Agencies appear to generally evaluate the proposals effectively using systematic criteria and committees established to evaluate the proposals.

However, based on the review of projects, there appear to be ways in which the competitive process may be jeopardized and the selection process weakened. Two ways include: (1) a vendor helps develop the system requirements for an RFP and then submits a proposal, or (2) an agency avoids the competitive procurement requirements based on the sole-source or emergency provisions.

In some instances, the process may be compromised if a vendor who participates in the development of system requirements then submits a proposal in response to the RFP. This situation may threaten the competitive process because such a vendor may have written the requirements to meet its strengths, giving the vendor an advantage over its competitors. Both the IDMS and IHRIS projects had vendors that had participated in the development of the system requirements for the RFP and then responded to their own requirements in the RFP. With the IDMS project, the vendor who participated in both phases was the vendor that was awarded the contract.

The exceptions to the Procurement Act may also jeopardize the competitive process. If an agency can establish that there is only one practicably available prod-

uct or vendor, or that there is urgent need for the procurement, it does not have to follow the competitive procurement process. Two of the projects reviewed included non-competitive procurements for the services of vendors. In both instances the vendor failed to meet the goals of the contracts. With the Virginia Information Systems Integrated Online Network (VISION) system at the Department of Health (DOH), the agency avoided the procurement process based on the existence of an emergency. The vendor chosen did not have the resources to perform the required work adequately, and the software development and documentation were poor.

Similarly, with the IDMS project, VDOT sought and received approval from the governor to avoid the competitive procurement process and enter into a $22 million sole-source contract for the development of the system. The sole source was requested because VDOT had already entered into a $22.4 million fixed price contract with that vendor for the design of the same project. VDOT ultimately paid the vendor $45.8 million which included contract payments as well as an agreed upon legal settlement.

Agencies Need to Perform a Full Evaluation of Vendors and Their Products. Another key aspect of this process is an adequate background evaluation of the vendors prior to making a vendor selection. Agencies can reduce the risk of project failure through careful analysis of each vendor's ability to deliver the requested goods and services. This may include an evaluation of the vendor's previous experience, financial stability, and staff resources.

The VCCS student information system project and the Tax partnership project are good examples of projects in which agencies performed the necessary background research on vendors before awarding a contract. For the student information system project, the VCCS determined there were two qualified responders to the RFP. Subsequently, VCCS scheduled a conference to allow project demonstrations of each system, in addition to contacting other colleges and universities that had recently implemented each of the systems. Additionally, VCCS evaluated the organizational culture of the vendors under consideration to determine which would be the most compatible with the VCCS.

The Department of Taxation (Tax) thoroughly researched vendors prior to awarding the contract for the tax auditing, collection, filing, and processing system. Two prospective vendors were brought on-site for a period of three months before submitting proposals for information system solutions. This process enabled the prospective vendors to become more familiar with the mission and organizational culture of Tax, and enabled Tax to become more familiar with each of the vendors. After proposals were submitted, Tax scheduled three-day exhibitions for each vendor's system proposal to provide further clarification to agency staff. Before awarding the contract, Tax sent multiple teams of agency staff to two California agencies that had recently implemented the vendor's tax systems to discuss their experience with the vendor.

In contrast, the College of William and Mary and VDOT did not perform adequate background research on prospective vendors for the ARIA and IDMS projects, respectively. William and Mary chose a foreign implementation partner that

had little experience working with American universities. The institution relied primarily on the written response to the request for proposal and failed to check the vendors' references. William and Mary eventually terminated its contract with the vendor after the project went over budget, and the institution became dissatisfied with the progress of development.

Similarly, VDOT did not perform adequate research on the vendor it selected for design and development of IDMS. It appears that the vendor did not have the level of success with previous projects as VDOT was led to believe, and the financial position of the company was not as strong as it should have been given the magnitude and complexity of the IDMS project. In fact, had a vendor with Woodside's financial condition bid on a highway construction project, it would have been disqualified because of VDOT's financial requirements. VDOT's internal audit division concluded that the department did not review the company's financial statements, other information system projects the company had developed, or references to confirm that the company was a viable candidate for selection.

Agencies Need to Be Prepared to Not Proceed. Another aspect of vendor and product selection is the determination of whether to actually proceed with the award of a contract. While an agency with funding for a system may feel compelled to move forward, there may not be an acceptable product available in the private market to meet the agency's goals. In such instances, agencies need to fully consider the options of either building the system in-house, or of not pursuing the project until the required technology has been developed. In some of the projects reviewed, agencies have properly considered the full range of options and not proceeded with procurement. In other instances, agencies have made questionable decisions to proceed.

The CEDS project at DEQ and the MIPS project at ABC are good examples of projects in which agencies decided to develop systems in-house after determining vendor responses were inadequate. DEQ contracted with a consulting firm to assist the agency with the definition of system requirements for the design of a system to integrate all of the department's environmental databases. After much of the initial design work was complete, DEQ was approached by a private vendor which offered its services to develop a system for DEQ. However, after reviewing the vendor's proposal, DEQ decided not to pursue the procurement of an undeveloped system and instead build the system in-house.

Prior to developing MIPS in-house, ABC considered retaining a vendor to build it. The agency issued an RFP but did not receive any responses that it deemed to be adequate. Subsequently, with the assistance of private sector contractors, ABC was able to successfully build the inventory management system in-house using agency personnel.

In contrast, the Integrated Correctional Information System (ICIS) project at the Department of Corrections (DOC) and the IDMS project at VDOT are examples of projects in which agencies proceeded with the procurement of systems when other options may have been advisable. The RFP for the ICIS project resulted in two qualified vendor responses to provide the agency with an enterprise resource

planning (ERP) system. However, neither software vendor offered an adequate solution for the key component of an ERP, an offender management system (OMS), which was the agency's highest priority need. One vendor proposed building an OMS module specifically for DOC. The other vendor proposed interfacing its standard ERP software package with an OMS product from another vendor. DOC leadership was familiar with this OMS product and knew it would not meet the needs of the agency. Thus, DOC was confronted with a choice between an undeveloped product and a product that was not deemed to be satisfactory. DOC selected the vendor that proposed to develop a new OMS. The vendor never completed the development of the system and recently announced that it has no plans to build an OMS. Given these choices, it appears that DOC should have delayed the project or considered trying to build it in-house.

With the IDMS project at VDOT, the agency received two qualified responses to its RFP and considered only one to be truly responsive to its requirements. This response was provided by a vendor that had not developed such a system before, and did not have a proven track record. Yet VDOT proceeded with procurement of the system.

Some Projects Have Lacked Strong Contracts

Another critical element for projects developed by vendors is a strong legal contract. Strong contracts generally specify deliverables, link payments to deliverables, and provide for modular development. Many of the projects reviewed have had strong legal contracts that contain all of the important elements, while others have not.

Contracts Need to Clearly Specify Deliverables. For projects that are developed with vendor assistance, one of the critical elements for project success is a contract that clearly specifies the requirements and deliverables that are to be provided by the vendor. Without clearly specified requirements and deliverables, there is a substantially greater risk that the vendor ultimately will not provide a completed product that is desired or needed. With clearly specified deliverables, there is less likelihood of misunderstanding between the parties and a much greater chance that the desired system will be provided without major changes to the contract. Moreover, with clearly specified deliverables, the State will be in a much stronger legal position to seek enforcement of the contract or to minimize financial liability if the vendor does not meet the requirements of the contract.

Agencies' success in clearly specifying deliverables has been varied. Two projects in which agencies have developed contracts with vendors that effectively specified the deliverables were the SIS project at the VCCS and the MIPS project at ABC. With the SIS project, each contract contained a scope of work document that specified in detail the work needed to be performed by the vendor. Likewise, the contract with ABC for the point-of-sale portion of the MIPS system specified in great detail the deliverables that were to be provided by the contract.

In some instances project deliverables have not been as well defined. One example was the contract between DMAS and the vendor for the MMIS system. Contract deliverables were not sufficiently specified, and this has led to numerous disputes regarding the scope of the work to be performed by the vendor.

Another contract that did not adequately specify requirements was the contract between VDOT and the vendor for the IDMS system. The fixed price contract stated that the vendor would provide resources for the procurement, development, and implementation phases, but did not specify what those services would be. In addition, the second major contract entered with the vendor did not clearly specify the deliverables to be provided.

Contracts Need to Link Payments to Deliverables. Another important element of a strong contract is to ensure that payments are linked to the provision of deliverables. Contracts that have this linkage improve the likelihood that the State will receive the deliverables and the product for which it contracted and minimize the risk to the State's investment. Conversely, failing to link payments to deliverables increases substantially the risk that the State will not receive the product for which it contracted.

Many of the projects that have been reviewed involved contracts in which payments were linked to deliverables. The VCCS contracts, the ABC contract, and the DMV contract for the Service 2000 project are all good examples of contracts that specifically linked payments to deliverables. Payment to the vendor was contingent upon the vendor providing, and the State accepting, specified deliverables.

Other projects reviewed have involved contracts in which payments were not properly linked to deliverables. In some instances, the failure to link acceptable deliverables to payment has resulted in failed projects in which substantial amounts of State funds have been wasted. One example of this was VDOT's contract for the development of IDMS. The first major contract was a fixed price contract, and payments to the vendor were scheduled to be made over five years without regard to the tasks to be completed by the vendor. A subsequent time and materials contract signed with the vendor was based merely on hours worked and was not tied to any required deliverables. VDOT's internal audit review team described the time and materials contract as the equivalent of the agency giving the vendor "an open checkbook." The lack of contracts that linked payments to deliverables contributed to the fact that VDOT paid the vendor $46 million without receiving a system with any of the functionality for which the agency had contracted. In addition, the vendor submitted a claim for $800,000, which VDOT ultimately paid.

Another contract in which payments were not tied to deliverables was the eVA electronic procurement project at DGS. The rationale for not doing so was that with a benefits funding model, the State thought that the vendor would have sufficient incentive to produce the deliverables because payments to the vendor would be tied to the successful implementation of the system. However, it was subsequently determined that without payments tied to deliverables, the vendor was providing only a minimal effort in meeting the requirements of the contract. As a result, the contract was modified to specifically tie payments to deliverables.

A third project in which deliverables were not tied to payments was the contract for implementation of the ARIA system at William and Mary. The contract with the implementation partner was a time and materials contract to implement the commercial software. William and Mary paid the vendor $3.8 million without receiving many of the deliverables in return.

Contracts Should Provide for Modular and Phased Development When Possible. Another important aspect of structuring a strong contract is to develop a modular or phased approach if possible. With such an approach, a major project is performed in defined increments. A contract for phased or modular development should provide the State with the right to terminate the contract after each major phase or module is completed. This approach can help to significantly minimize the State's risk in a large project and better ensure that the State obtains value from the project even if terminated before completion. With this approach, the State can receive usable pieces of the project as the project progresses. This gives the State more flexibility to terminate a project before completion because some value has been obtained. This approach also enables an agency to better assess the overall progress of a project by receiving modules or completed phases.

A good example of a project with a phased approach is the Inventory and Condition Assessment System (ICAS) project at VDOT. The contract was divided into three major phases, and VDOT had the option of ending the project after each phase. The first phase was to build the application and to collect asset condition data for three pilot counties. The second phase would have been to collect asset condition data for the entire State. The third phase would have been to manage the system on an ongoing basis. VDOT determined that, given concerns regarding the vendor's performance during the first phase and the anticipated cost of the second phase, it would terminate the contract after the first phase. With the phased structure of the contract, VDOT was able to successfully terminate the contract after the first phase and receive a product of value without paying a significant penalty.

In contrast, there have been major projects in which the contract did not provide for a modular or phased approach. While some of these projects may ultimately be successful, using this approach involves substantially more risk for the State. An example of such a project is the eVA project being led by DGS. While the project is being developed in phases, the contract does not provide for a phased approach wherein the State could evaluate the desirability of continued development. Although the State will never own the eVA system, a substantial amount of development effort and expense specific to this system has been incurred by DGS and several other State agencies. Therefore, if DGS were to terminate the contract before completion of the entire project, the State would not receive any functional value from its development effort. This presents a significant risk for the State.

Project Success Has Been Hindered by the Lack of Effective Project Management

A critical element for project success is the use of effective project management, including a strong project management structure and appropriate man-

agement tools. Many of the projects reviewed by JLARC staff demonstrate a consistent weakness in the area of project management, and few agencies appear to have adequately developed the core elements of this area. Project management involves the daily supervision of a project, and encompasses activities such as technical change management and contract administration. All project management activities are directed toward fulfilling necessary project tasks and ensuring that the project is successfully completed within established parameters.

Effective Project Management Teams with Experienced Project Managers Are Essential. The aspect of project management that appears to be most lacking is the use of an effective project management team led by an experienced project manager who is accountable for the success of the project. To effectively perform project management, it appears that successful major projects need at least one full-time project manager or a full-time project management team. The project manager or project management team should have experience with the implementation of information systems, as well as experience or training in project management.

Most large projects require two project managers – business and technical project managers. The business or functional project manager represents the business users, those staff that perform the agency's daily business operations, and ensures that the technology is developed to satisfy business needs of the agency. The technical project manager should generally represent an agency's information technology division and provide the technical perspective and expertise.

A best practice is to place the business project manager in charge of the project. Although a systems development project is often very complex technologically, the primary purpose is to automate existing business processes. As a result, an individual with thorough knowledge of an agency's business practices is in the best position to manage a project. On larger projects the business project manager may lead a project management team, including a technical project manager who reports to the business project manager. Successful large projects have also established project management structures to provide support for the project manager or project management team. This structure may include the use of project workteams with responsibility for specific tasks or subprojects.

Some of the projects reviewed have established strong project management teams. For the Tax partnership project, the individual selected by Tax to serve as the business project manager has extensive experience at the department, both in systems development and as director of a business division. The partnership project has both a business and a technical project manager, and these individuals are assigned to the project full-time. Tax also established an extensive project management structure below the level of the project managers. Project teams have been established to work on single projects and are led by team leaders. Team leaders report to a group leader who has responsibility for several project teams. The group leaders report to one of two project managers. The team and group leaders meet weekly to resolve issues that arise. The vendor for the project also has a similar structure.

For the Service 2000 project, DMV effectively used development teams to organize the project's tasks and to represent key business units in the agency. DMV established an executive project management team consisting of an executive project sponsor, the heads of the business and technology divisions, and the project director. DMV also created three development teams to represent the key business units affected by the project, and the managers of these teams reported to the project director. The technical manager was from the IT division and was responsible for the network design and hardware acquisition. The business manager was a representative of the customer service unit and was responsible for the identification of the business needs. Finally, the applications manager was responsible for software design.

Other projects have not had effective project management. VDOT's IDMS project had extraordinarily weak project management. The individual assigned to manage this $46 million dollar project had no project management experience or training, no prior experience in implementing information systems, and was assigned to the project part-time. Moreover, this individual had no other VDOT staff assigned to assist him.

The College of William and Mary's ARIA project also had weak project management. The project managers had minimal experience or training, and they were not assigned full-time. In addition, there was very high turnover – the project had four different project managers from the start of the project in February 2000 to its termination in November 2000. Finally, the first three project managers came from the information technology department and did not represent the business users. As a result, the project quickly exceeded its budget and did not adhere to the business goals of the institution. Other projects that have lacked strong project management include the VISION project at the Department of Health and the IHRIS project, as discussed in the case studies in the appendix.

Several Projects Were Developed Without Systems Development Standards. The absence of agency standards may hinder both project management and higher level oversight by not providing project personnel with clear statements of agency policy regarding systems development. Systems development standards provide a methodology and structure for agencies to use in the development of information systems. Written standards establish agency policy for areas such as project management structures, planning documents, oversight and review activities, and resource management. As such, these standards provide a framework to project managers. State agencies have been required by Council on Information Management guidelines since 1991 to "adopt written standards for the development, maintenance and enhancement of all information systems," but several agencies have not adopted written agency standards and do not use a published project management methodology.

To assist project management, agency standards should address both in-house projects and those that use vendors or temporary contract staff. Several agencies have stated that agency systems development standards are unnecessary if a vendor follows an established methodology. However, even with projects developed by vendors, agencies need to have an internal project manager who uses a

structured methodology for managing the vendor and the overall project. In the projects reviewed for this study, some of the agencies have had an established project management methodology while others have not.

The MIPS project at ABC is a good example of a project that benefited from the use of systems development standards. The use of a formal project management methodology by ABC aided the successful implementation of the MIPS project by facilitating the establishment of a clearly defined project management structure. The MIPS project used a systems development methodology that was consistent with the Project Management Institute guidelines. In addition, ABC ensured that the project management methodology complied with State requirements for large-scope projects.

In contrast, several agencies that had not adopted standards have either had failed projects or have struggled with aspects of systems development. These agencies include the State Board of Elections (SBE), DEQ, DOH, and William and Mary. With all of these projects, the absence of systems development standards appears to have contributed to inadequate project management structures.

Use of Planning Documents Needs to Be Improved. Another important aspect of effective project management is the use of planning documents that serve to organize and track project management and outline a plan for a project. The extent to which an agency needs to develop planning documents will vary depending on whether a project is being developed with a vendor or in-house. This plan generally needs to include a budget, a project schedule, a plan for the allocation of resources, and an assignment of project responsibilities. Planning documents may also include the development of the critical path for the project – the sequence of activities that must be completed on time for the entire project to be completed on schedule.

The State Board of Election's Virginia Voter Registration System (VVRS2) project lacked a project plan that outlined development tasks or a timeline for completion of the project. This resulted in an ad hoc software development process in which the cost, time schedule, and performance of tasks could not be effectively managed. Moreover, the lack of defined project roles and responsibilities led to a split development between two individuals both acting as project manager simultaneously.

The MMIS project at DMAS lacked a sufficient project plan. There was no schedule for the implementation of project tasks for the first two years of development. Without a set schedule and deadlines, the project progressed slowly, and it was difficult for the project management team to assess the impact of project delays on meeting the overall completion date.

Technical Change Control Process Is Key Aspect of Management. Another key aspect of project management is technical change control, which ensures that all technical changes to the project are in accordance with the project's goals and standards. A change control process helps to ensure that technical changes to software development or to hardware configuration are justified and do

not adversely impact a project. Without effective change control, technical changes can be made that jeopardize the success of the entire project. This is especially true with large, complex projects in which multiple programmers or technicians may be working simultaneously on software development or hardware configuration.

The MIPS project at ABC is a good example of change control. The agency established a formal change control board (CCB) comprised of end-user representatives and the project's business and technical managers. This board was responsible for evaluating all proposed changes to the system. Because the project was primarily a software development effort, the CCB was given the authority to approve changes to procedural and business requirements, provided that they did not impact the project's scope, schedule, or budget.

The IHRIS project at the Department of Personnel and Training (now the Department of Human Resources Management) is an example of the problems that may result from the lack of effective change control. The lack of an effective process resulted in a significant number of modifications to the software that may have been unnecessary. The change control process for IHRIS was conducted by the change management group, which was chaired by the project manager. In spite of this formal process, project staff state that there was insufficient authority to refuse changes requested by the lead site agencies. As a result, portions of the IHRIS software were highly customized, which lengthened the time required for development as well as the cost. In addition, had the project succeeded, the high degree of customization would have increased the cost of upgrading and maintaining the software.

Large Projects May Require Full-time Contract Administration. Another important element of effective project management is contract administration – the process by which an agency ensures that a vendor with whom the agency has contracted meets the terms and conditions of the contract. Large projects may require a full-time contract administrator to ensure that the deliverables provided by the vendor meet the requirements of the contract.

One of the strengths of the MIPS project at ABC has been the effective use of contract administration, which has improved project management. Effective contract administration allowed the project managers to document changes to the contract or statement of work documents, evaluate vendor performance based on defined measures, and verify that all deliverables met established criteria before payments were made.

In contrast, contract administration by DMAS on the MMIS project has been ineffective. During the early stages of the project, the contractor was allowed to repeatedly miss task deadlines and unilaterally change the agreed-upon technical approach of the project. Although these incidents may have represented a breach in the contract, DMAS did not elect to terminate the agreement or seek other available corrective actions. The lack of effective contract administration has contributed to a lengthy delay in the implementation of the system and a substantial increase in cost.

Projects Should Involve End-Users During Planning and Development

Another element that is critical to project success is the involvement of end-users – the individuals who will actually use the system. The first stage at which end-user input is important is during planning, because end-users are the experts regarding the business requirements for a proposed system. End-users also need to be involved during systems development, when decisions are made about business process reengineering and software modification.

Most Projects Include End-Users in Project Planning. State agencies generally do a good job of including end-users during the planning phase of systems development projects. The primary purpose of including end-users at this stage is to obtain their input in developing the requirements for a proposed system. For most of the projects reviewed, end-users have been invited to participate during the planning phase. The Standards of Learning (SOL) Technology Initiative at the Department of Education (DOE), the partnership project at Tax, the Service 2000 project at DMV, and the CEDS project at DEQ are all good examples of projects in which end-users were given extensive opportunities to participate in the planning phase.

Continued Involvement of End-users During Development Is Less Consistent. Although most agencies involve end-users during project planning, there is generally less involvement of end-users during the development phase. However, end-user involvement during this phase is equally important. Through continued involvement, they can provide valuable input and feedback on software as it is developed to ensure that it meets the agency's business requirements. End-user involvement throughout the process also increases acceptance and understanding of a system. Some agencies have effectively involved end-users during the development process, while others have not.

A major strength of the partnership project at the Department of Taxation has been the involvement of the end-users throughout the project. Prior to the development of the RFP, more than 100 employees were interviewed regarding issues facing the department and possible solutions. Upon award of the contract, end-users at the department were heavily involved in developing the blueprint design for the project. A formalized structure for end-user input was developed to ensure that input would be provided from end-users in each focus area. Then as the project has been developed, Tax employees have been working alongside the vendor's employees in the development of the system.

The CEDS and Service 2000 projects are good examples of how a systems development methodology can improve quality, as well as save time, by increasing end-user involvement during development. Both projects were developed using a Joint Application Design (JAD) methodology, in which end-users pair with programming staff on teams. With this approach, end-users are directly involved in development activities. The end-users were also able to provide training to other agency personnel because of the proficiency they developed during the JAD process.

Other projects have not adequately involved end-users during development. The eVA project at DGS is an example of how the lack of involvement of end-users can substantially decrease support for a project. DGS did not include end-users at other agencies in the decision to make a substantial change to the project (declaring the system to be mandatory instead of optional), and instead used the agency's rule-making authority. However, the absence of end-user involvement in this major statewide project, which relies for its success on the cooperation of State agencies, has led to significant resistance and a continued lack of user support for the project among State agencies and their suppliers.

The VVRS2 project at the State Board of Elections (SBE) is another project in which end-users were not adequately involved during development. The Appropriations Act language directed the formation of a study committee consisting of business user representatives, and an extensive survey of end-users was used to develop the technical and functional requirements. Although the project involved end-users in project planning, during systems development the end-user committee did not meet regularly, had limited authority to make recommendations, and provided minimal input.

Ineffective Project Oversight Has Caused Some Projects to Fail or Be Delayed

Effective project oversight is another element that is critical to the success or failure of major information systems projects. The main goal of project oversight is to keep projects within their intended scope, schedule, and budget. Project oversight is distinct from project management in that persons in oversight roles are not involved in the daily management of a project, but are periodically informed of project progress by the project management team, and also provide direction to the project management team when major issues arise. Project oversight may take the form of internal agency oversight, external State government oversight, and independent review. Some of the projects reviewed for this study have had effective oversight while others have not.

Effective Internal Oversight. Effective internal project oversight involves an internal committee generally comprised of executive level members of an agency. While the project management team deals with the daily administration of system development, an internal oversight committee is needed to oversee the project management team and address major issues or proposed changes that have the potential to impact a project's scope, schedule, or budget.

The MIPS project at ABC and the Service 2000 project at the DMV are good examples of projects that had effective internal oversight processes. The internal oversight structure for the MIPS project was the MIPS management committee. This committee consisted of the deputy commissioner (the project's executive sponsor), chief information officer, chief financial officer, and director of internal audit. The committee was responsible for providing general oversight and approving any changes to the project's scope, schedule, or budget. The committee distanced itself from the day-to-day management of the project by delegating minor changes that

had no major project impacts to the change control board, which consisted of end-users and the MIPS project and technical managers.

DMV used an oversight structure for its Service 2000 project similar to that of ABC's MIPS project. The executive steering committee, consisting of DMV executives, held regularly scheduled monthly meetings to receive updates on Service 2000 development progress from the project management team. The committee discussed issues related to the project's scope and provided guidance on those issues that impacted project funding or would require a change to the department's business processes.

Along with the projects that had effective internal oversight structures, several of the projects reviewed did not. The IDMS project at VDOT established an internal steering committee for the IDMS project, but this committee did not function effectively as an oversight body. The project manager was one of two co-chairs on the committee, and the other members of the committee do not appear to have taken an active role in the project and were absent from many of the committee meetings. Moreover, the committee was not involved in major decisions regarding the project, such as the decision to issue a $22 million sole-source contract for expansion of the project from three VDOT divisions to all 29 divisions.

Another project that did not have effective internal oversight was the MMIS project at DMAS. During the first two years of the project, there was no formal executive oversight committee or regular forum for the project management team to address major issues above the level of the project management team. According to current MMIS project management staff, when DMAS executive leadership did involve itself with disputes between the project management team and the vendor, the leadership offered little support to the team and acceded to many of the vendor's demands over the objections of the team. With the lack of an effective oversight structure, the vendor made a major change to the system architecture that significantly impacted the scope and schedule of the project without any input from DMAS.

Effective External Oversight. With major projects, it is also advisable to have an external oversight structure. Such a structure provides an additional layer of project supervision and guidance that is more removed from the project sponsor and those intimately involved in a project. This ongoing oversight can ensure that agencies have the basic elements in place for successful project development. This oversight structure also needs to address major issues that arise which could impact the project's scope, schedule, or budget and cannot be adequately addressed at the agency level.

Most of the projects reviewed have had some level of external oversight, but with mixed results. Both IHRIS and VVRS2 projects had external oversight committees that did little to prevent the projects from failing. By contrast, the external oversight structure for the ICIS project was more successful in guiding the project planning effort and preventing the initiation of a high-risk and costly systems development project. Over the last two years, the prior and current Secretaries of Technology have required that oversight committees be established for all projects of

$1 million or more. Given the recent establishment of this process, it is not clear the extent to which it has contributed to the success of most of the projects reviewed.

Effective Independent Review. A third aspect of project oversight is the effective use of independent review. Unlike internal or external project oversight, independent review provides objective analysis of the systems development effort, but the reviewer does not have authority to make decisions regarding project direction. This review, which is generally referred to as independent verification and validation, promotes the probability of project success by providing an objective assessment of a project.

Independent verification and validation may provide oversight and guidance on all phases of systems development. During the planning phase, independent verification and validation may be used to provide opinions on the adequacy of system requirements definition, the technical feasibility of automated solutions to agency business needs, and the rationale for investing in a new information system. During the procurement phase, independent verification and validation may be used to assess the adequacy of the RFP and vendor responses. While development is ongoing, independent verification and validation may review various aspects of the project, including the adequacy of project deliverables and the agency project management structures, any potential ongoing risks to a project, and whether a project is meeting its schedule and budget.

The ICAS project at VDOT and the Tax partnership project (TPP) are examples of the effective use of independent review. VDOT hired a consulting firm to perform technical quality assurance on project deliverables and produce a project evaluation report at the conclusion of the pilot development phase. These services were valuable to VDOT in administering the contract and deciding whether to proceed with the second phase of the contract.

The Department of Taxation has utilized independent verification and validation consultants throughout the TPP. The independent verification and validation effort includes a team of on-site reviewers who continually monitor the quality of contract deliverables and identify potential risks to project success. Regular reports are issued to the project management team and steering committee summarizing the work of the independent verification and validation consultants.

The ARIA project at William and Mary and the VVRS2 project at SBE are examples of projects that did not have independent verification and validation but could have benefited from it. William and Mary contracted with a consultant to provide quality assurance services, but the consultant apparently provided no evaluations or reports. Thus, the institution received no regular quality assurance updates to assist leadership in monitoring the project. As the project was falling behind schedule and going over budget, these reports could have been valuable to institution decision-makers.

The VVRS2 project could have benefited from effective independent verification and validation as well. Experienced independent verification and validation consultants likely would have identified the numerous problems with the manage-

ment structure for the project as well as the lack of a design document to guide software development. A former member of the State Board of Elections project team has stated that the project would have benefited greatly from outside review.

Lack of Reliable Funding Has Impeded Some Projects

Another critical element to the success of systems development projects is an adequate and stable funding source. Reliable funding enables a project team to invest in the resources needed to develop a quality project. Some of the projects reviewed have had adequate funding while others have not. Overall, sufficient funding has been available primarily to non-general fund agencies.

The Service 2000 project at DMV, the MIPS project at ABC, and the public-private partnership project at Tax are all projects with adequate funding. Both the Service 2000 and the MIPS systems were funded primarily though agency allocations but received sufficient funding to meet all of the project expenses.

The Tax partnership project has also benefited from reliable funding but has had a different funding model. Instead of allocations from the agency budget or General Assembly appropriations, the project has been funded from revenue reportedly generated from the first phase of the system, implemented as part of the overall partnership project. According to Tax officials, these early projects, which have improved collection and audit functions, are currently generating sufficient revenue to fund the remainder of the project. This type of funding is known as a "benefits funded" model.

In contrast, several of the projects reviewed have not had adequate funding, and this has adversely affected the projects. For example, the IHRIS project did not have sufficient funds appropriated to pay for the costs of implementing the system in line agencies. The funds allocated for the project were only for the development of the software and the central server. This significantly hampered line agency buy-in for the project, which contributed to the project's failure. Another example of a project that lacked adequate funding was the ICIS project at DOC, which was cancelled as a result of insufficient funding. The VVRS2 project, which relied on general fund appropriations, was terminated because of the lack of funding. Finally, the eVA project at DGS has been adversely affected because the original funding model did not function as intended, necessitating a contract modification and an additional assessment to line agencies.

CONCLUSION

The failure to develop an adequate business case, inappropriate leadership, the inconsistent presence of the nine project management elements, and the challenges associated with developing multi-agency enterprise systems have led to substantial State funds being expended on failed projects or projects that have not met many of their intended goals. The loss of at least $75 million on failed projects and an additional $28 million in cost overruns on other projects demonstrates the need for significant changes to the systems development process in the Commonwealth.

These changes would need to address inadequate planning, oversight, and support of agency systems development projects, as well as the lack of a reliable funding source for several agency and multi-agency projects. Chapter III of this report proposes changes to address these shortcomings.

Based on the review of recent major IT projects, there appears to be a need for more consistent project planning, including the identification and prioritization of system needs, articulation of the business case, assessment of the technical feasibility, and analysis of agency organizational and business processes. These planning activities need to be conducted to ensure that only worthwhile projects are undertaken, and that agencies are prepared to initiate projects. The State could address shortcomings in the planning process by developing a mechanism for prioritizing statewide systems needs and requiring that agencies complete the appropriate planning activities prior to project initiation.

The review of major IT projects also shows the need for enhanced oversight of agencies during the procurement of goods and services and during systems development. Several of the projects appear to have suffered from inadequate vendor and product evaluation as well as contracts that exposed the State to financial risk. In addition, agency project management and oversight have been ineffective in several of the projects. The State could address these shortcomings by enhancing its oversight processes and requiring approval for agencies to proceed with systems development efforts at critical stages in the projects.

The State could also improve the systems development process by offering additional support services to agencies throughout the process. Given that effective project management was absent or only partially present in a majority of the projects reviewed, there appears to be a need for improved project manager training and support services. Agencies could benefit from affordable and effective project manager training and the availability of experienced IT professionals to assist them throughout the systems development process. In addition, the establishment of a common statewide architecture for IT systems would assist in the development of multi-agency projects.

Finally, there appears to be the need for consistent, reliable funding for major systems development projects. Although a majority of the projects reviewed for this study had reliable funding, several of the projects did not have sufficient funding. Also, needed projects, such as the replacement of the Commonwealth Accounting and Reporting System, the Program Budgeting System, and the Personnel Management Information System, have not been initiated in part because of funding limitations. In order for these and other needed systems to be initiated and effectively developed, a reliable State funding mechanism for IT projects is needed.

III. Improving Virginia's Information Systems Development Process

Historically, the Commonwealth of Virginia has followed a relatively decentralized government model, granting individual agencies substantial autonomy. The State's experience with information systems development, however, suggests the need for a greater central role. This study shows that a number of agencies have the experience, capability, and knowledge to successfully develop major information systems, but that many other agencies do not. Unless the State plays a greater role in providing oversight and support, agencies without this capability and experience may continue to waste millions of tax dollars in the development of information systems that do not fully meet agency needs. Greater central support should produce substantial savings through better project management, a higher project success rate, and a decreased need for agencies to retain outside consultants. A greater central role is also needed to ensure that sufficient funding is available for major projects, and that an effective strategic planning process is used to identify State priorities.

While the current Secretary of Technology has recently taken several positive steps that may improve the information systems development process, the existing organizational structures and processes need to be strengthened. The State needs to establish an Information Technology Investment Board to set strategic priorities, and a full-time chief information officer to lead the development and planning of information systems. In addition, a more effective approval and oversight process needs to be established to ensure that the appropriate projects are being initiated and that the systems development process is adequate. Along with increased oversight, a new funding mechanism needs to be established to help pay for major statewide or general fund agency projects. The Department of Technology Planning also needs to develop stronger expertise in information systems development and provide increased support to agencies that need assistance with development. Finally, the strategic planning process needs to be improved to ensure that agency as well as statewide business needs are considered, and that technology projects which meet those needs are identified and appropriately prioritized.

The current Secretary of Technology has identified many of the concepts recommended in this report as areas in which the State needs to improve IT development. He has indicated that an IT investment board needs to be created, a capital funding process needs to be established, and the strategic planning process improved. While the Secretary has not yet provided much detail on many of these concepts, he appears to be moving in the right direction. Exhibit 7 shows some of the similarities between the proposed JLARC recommendations and concepts proposed by the Secretary.

Finally, improving the systems development process will require more than the identification of problems and the establishment of the structures and process

EXHIBIT 7
JLARC MODEL IS CONSISTENT WITH CONCEPTS PROPOSED BY SECRETARY

Proposed JLARC Model	*Secretary's Proposed Changes*
Strong independent CIO who directs the Department of Technology Planning	Enhanced CIO focus for the Secretary of Technology
Approval of all major projects by an Information Technology Investment Board consisting of cabinet secretaries and chaired by the Secretary of Technology	Approval of funding for enterprise projects by an investment board consisting of cabinet secretaries and chaired by the Secretary of Technology
Evaluation of all projects by the CIO and Investment Board based on alignment with strategic plan, benefits to the State, identified risks, funding requirements, and proven technical feasibility	Evaluation of enterprise projects for funding based on alignment with strategic business objectives, appropriate return on investment, solid business case, and proven technical feasibility
Approval of all requests for proposals and vendor contracts	Increased oversight of technology procurements
Secretarial Oversight Committees for all IT projects with an estimated cost of $1 million or more	Secretarial Oversight Committees for projects that involve procurements of $1 million or more
Capital planning and funding for enterprise and other major agency systems	Capital planning and funding for enterprise systems
Project management specialists within the Department of Technology Planning to provide oversight and support of all projects, and to manage development of enterprise systems projects	IT Services Director within Department of Information Technology to manage development of enterprise systems
Information Technology Investment Board consisting of cabinet secretaries to provide ongoing oversight of enterprise systems	Executive Oversight Committee consisting of deputy secretaries to provide oversight of enterprise systems
Technology standards for all information systems	Technology standards for enterprise systems
Formal project management methodology and formal project management training	Formal project management methodology

Source: JLARC staff analysis and Virginia Strategic Plan for Technology 2002-2006.

recommended in this report. Many of the problems identified in this review have been identified in previous reports by JLARC, the Auditor of Public Accounts, consultants retained by the State, and internal auditors within agencies. However, many of these problems continue to remain unaddressed. Significantly improving the systems development process will require the strong commitment of persons in responsible positions to make the proposed new process work.

OVERSIGHT, SUPPORT, AND PLANNING HAVE BEEN MINIMAL

The development of information technology projects has been a highly decentralized process in Virginia. Virtually all information systems development has occurred at the agency level. Projects have typically been initiated, planned, procured, and managed internally by the sponsoring agencies. There has been only limited central review of projects at their outset, or oversight as they have proceeded. In addition, there has been minimal central support provided to agencies during project development. With limited project management standards and the lack of an overarching architecture for information technology in the State, the development processes used and the technologies chosen have varied substantially across agencies. This has produced mixed success in development efforts and an ad hoc information technology architecture comprised of incompatible systems. Further, the information technology development process has lacked an effective strategic planning mechanism to identify and prioritize systems needs on a statewide basis and to examine opportunities for collaboration among agencies.

Over the last six months, the Secretary of Technology and Department of Technology Planning have taken several steps that may improve the approval and oversight process. However, even with these changes, the overall process for information systems development remains inadequate. There is currently no mechanism to align State policy priorities with systems development projects, or to ensure that sufficient funding is available for those projects that the State deems necessary. In addition, the approval process for projects continues to be limited by having a single individual who does not represent all of the business interests of the State solely responsible for the approval of all major projects. Also, the oversight of projects that is currently performed does not provide the level of ongoing monitoring and reliable reporting that needs to occur. It remains critical for the State to provide greater ongoing support to agencies as they attempt to develop these complex and high cost information systems.

Approval and Oversight Has Been Limited

Until recently, there has generally been little oversight of the development of information systems projects. There has been no review or approval process for projects before their initiation, and there has been little ongoing oversight of projects as they have been developed. In recent months, the approval process has been modified and these changes may offer some improvement. However, even with these improvements, there remain problems with the approval process that need to be addressed.

Procurement Approval Process Has Been Flawed. Under current law, the Secretary of Technology is required to review all technology procurements exceeding $100,000. The statute gives the Secretary the authority to delegate approval of procurements between $100,000 and $1 million to the Department of Technology Planning (DTP), but requires that the Secretary directly approve all information technology procurements of $1 million or more. This review process is referred to as the agency procurement request or APR process.

In the past, this review process has been flawed. The review has been a limited determination of whether a procurement request is consistent with an agency's strategic plan. There has been no evaluation of the overall project objectives, project plan, or technical feasibility. As a result of this limited review, virtually all APRs submitted have been approved. With a more effective approval process, some of the projects reviewed for this study that lacked adequate planning or proven technical feasibility could have been identified earlier in the process and the problems addressed prior to the expenditure of millions of dollars on failed efforts.

Another problem with the APR process is that procurements have been considered individually without any assessment of whether a procurement or series of procurements are part of a larger project. Therefore, in many instances the review has been limited to one or more components of a project but not the project as a whole.

The current Secretary of Technology took steps in April of this year to improve the APR review process. Now, when a procurement request in excess of $1 million is submitted, DTP is required to determine whether a procurement request is part of a larger IT project. In addition, the Secretary now requires a more extensive review before approving an APR request, including a consideration of such factors as the project management organization, conformance with the agency's information technology strategic plan, and defined business objectives and performance measures. This review is conducted by an oversight committee comprised of a representative from the proponent secretariat, the director of DTP, and a representative of the Department of Planning and Budget. Based on its review, the oversight committee is required to provide a recommendation to the Secretary of Technology as to whether to approve the procurement request, and the Secretary has final approval authority.

While these recent modifications may improve the process to some extent, there remain significant problems that need to be addressed through an improved approval process. With the current process there is no preliminary approval to proceed with planning, and the first review comes after the proponent agency has expended a significant amount of resources on planning activities. Instead, the approval comes after the planning is completed. In addition, there is no outside review or approval of the request for proposals in most instances, and there is often no outside review of the contract. Moreover, the decision whether to approve projects remains with one individual (the Secretary of Technology) who, by himself, does not fully represent the State's business interests. Finally, the current approval process does not address projects that are being built in-house with agency staff or contrac-

tors retained by agencies, unless the project has a single procurement in excess of $1 million.

Oversight During Project Development Has Been Limited. Along with the weak approval process, there has also been limited central oversight of project development in recent years. Until 2001, there was no process for the routine establishment of oversight committees to periodically review the progress of major systems projects. However, there were oversight committees established by the Appropriation Act to oversee the development of three major State projects prior to the establishment of the current oversight structure. The Integrated Correctional Information System (ICIS), the Integrated Human Resource Information System (IHRIS), and the Virginia Voter Registration System (VVRS2) projects all had oversight committees. With the ICIS project, the committee played an active role and may have helped the project by limiting the State's potential financial exposure. However, with IHRIS and VVRS2 the oversight committees were ineffective in addressing the major problems associated with the projects.

With the new oversight committee structure discussed previously, there is now more systematic oversight for projects of $1 million or more. According to guidelines established in April of this year, the oversight committee is responsible for conducting a periodic review of each project to consider such issues as the adequacy of the project plan and project management, and whether a project should be continued or terminated.

To supplement this oversight, DTP and the Secretary of Technology have recently instituted an automated project tracking system called the Commonwealth Major IT Project Status Report Dashboard (Dashboard) to monitor project progress and improve ongoing oversight of projects. The Dashboard is a database containing information on projects, and is intended to track active projects and alert DTP to changes in project scope, cost overruns, missed milestones, and failure to achieve performance measures. Those projects selected by DTP for inclusion on the Dashboard must provide certain project-specific information, including: cost estimates, business goals, project scope, and business measures of project success. Agency project managers are required to update the critical project elements included in the Dashboard monthly, in order for DTP to track the ongoing status of each project.

While these steps taken by DTP and the Secretary of Technology may improve oversight to some extent, the process still does not appear to provide the level of ongoing oversight and reliable reporting that needs to occur. According to one agency CIO who has participated in the current process, the oversight committee did not focus on a review of the project schedules, risk plans, or business philosophy, but instead focused on "preventing any critical failures that were going to be in the paper." Additionally, it appears that the oversight committees for some projects meet infrequently, which may limit the ability of the committees to conduct meaningful ongoing oversight.

In addition, while the Dashboard appears to be a positive step in improving ongoing monitoring and oversight of projects, its value may be limited because it relies on self-reporting by agency staff. The system depends on project managers be-

ing willing to report that a project for which they are responsible has encountered problems. According to the CIO for the state of Arizona, self-reporting by agencies is not necessarily reliable. Arizona recently experienced a situation in which the project team for a major project was submitting monthly reports that the project was proceeding smoothly and failed to report that a major problem had developed that threatened the success of the entire project. Virginia needs to have an oversight process that includes a reliable and objective reporting system so that significant issues can be identified and addressed by oversight committees as needed.

State Support for Systems Development Has Been Minimal

While DTP staff appear to provide occasional input to agencies, support provided to agencies in the development of major systems projects appears to be fairly limited. In addition, few standards or guidelines have been provided to agencies regarding project development. Moreover, there has been no State-level effort to provide training in project management, and there are minimal informational resources available to agencies regarding systems development. Finally, there has been little effort to develop a statewide technology architecture.

Minimal Support Provided at the Project Level. The Department of Technology Planning does not appear to have provided much direct staff support to agencies in the development of information systems. While DTP appears to occasionally provide input to agencies, its involvement with major projects appears to be fairly limited. As a result, agencies developing major projects have had to rely primarily on in-house staff or hire consultants with limited knowledge of the State's business needs to provide needed advice.

State Standards/Guidelines for Project Management Are Outdated and Agency Standards Are Inconsistent. Another area in which the office of the Secretary of Technology and DTP have failed to provide adequate support to agencies is in the development of policies and standards for management of information systems development. Although both the Secretary and DTP are statutorily required to develop such policies and standards, they have failed to adequately fulfill this role and, until October 2002, had not issued any formal standards since the creation of the technology secretariat in 1998. Instead, the office of the Secretary and DTP relied on the systems development guidelines issued by DTP's predecessor agency, the Council for Information Management (CIM), more than ten years ago. The CIM standards, issued in 1991, are broad guidelines for the management of large- and small-scope information systems and appear to be of limited practical value to agencies.

In addition to the lack of statewide systems development and project management standards, many agencies have not developed formal agency-specific standards for the management of information technology projects. Of those agencies that have developed standards, few have based their standards on the CIM guidelines. One of the guidelines promulgated by CIM in 1991 states that "the policy of the Commonwealth [is] that all state agencies must adopt written standards for the development, maintenance and enhancement of all information systems." However, according to the JLARC staff survey of agency information technology professionals,

more than two-thirds of responding agencies indicated that they had not developed agency-specific standards for project management. Furthermore, of the 31 percent of agencies indicating that they had established formal project management standards, fewer than half indicated that they had used the DTP guidelines in the formulation of their project management policies. Additionally, only 17 percent of the responding agencies indicated that the office of the Secretary of Technology and DTP had done a good or very good job in creating effective policies and procedures for the development and management of the State's technology investments. All six projects reviewed by JLARC staff that were cancelled or failed to meet most of the project goals did not have well-developed agency project management standards.

The lack of statewide project development standards appears to have contributed to the absence of several of the key elements for project success in many of the projects discussed in Chapter II. Two of the elements that have been particularly impacted by the lack of common statewide systems development guidelines are effective project management and effective project oversight and control.

Absence of Project Manager Requirements or Training. As indicated in Chapter II, effective project management has been identified as a critical factor in developing major information systems. In managing the development of a major information systems project, the project manager is required to perform a variety of different organizational and administrative responsibilities. However, the State has not developed any minimum requirements for information systems project managers, and the technology secretariat has done little to support the development of strong project managers within agencies. Based on responses to the JLARC staff survey of State information technology professionals, there are currently more than 600 individuals across State government that have had responsibility for managing large systems development projects. However, almost one-third of these individuals did not receive any formal training prior to assuming project management responsibility. Furthermore, fewer than 17 percent of the responding agencies indicated that the agency had any formal requirements for project management training, and only two percent required that project managers have official project management certification from organizations such as the Project Management Institute or American Management Association.

Absence of Information Technology Clearinghouse Regarding State Experiences and Vendors. Another area in which there has been insufficient support is in providing information about the experiences of other State agencies in the development of information systems and the use of specific vendors. There does not appear to be any effort to collect information on other State agency experiences or vendors that have conducted business with the State. One agency CIO, who would like to have access to information about other agencies' development experiences, stated that it is easier to gain information from the private sector regarding their experiences in developing information systems than to gain information from other State agencies.

Lack of Access to Specialized Legal Advice. There also does not appear to be an adequate structure in place to ensure that agencies are receiving the legal advice they need when negotiating a contract for a major systems procurement. It

appears that agencies often do not have access to an attorney with IT expertise. Several agency CIOs indicated that despite the specialized nature of IT procurement, they generally receive their legal advice from an attorney in the office of the attorney general who is a generalist representing the agency on all issues, though agencies responding to the JLARC survey did generally express satisfaction with the legal support that they received. Moreover, a majority of the time agencies do not seek legal advice from the office of the attorney general. Fewer than half of the agencies responding to the survey indicated that they had used the office of attorney general during the IT procurement process for major information systems.

DTP Has Failed to Establish a Statewide Technology Architecture. Another area in which the Secretary and DTP have not provided adequate support is in the development of a common technology architecture and set of related systems standards. The purpose of developing a statewide architecture is to establish a logically consistent set of standards, principles, designs, and practices to guide the development of an information system. Areas in which the State lacks common standards include: network security, operating platforms, databases, and software applications. The current lack of a technology architecture limits the ability of the central technology agencies to provide support in systems development and hinders the State's ability to develop statewide or interagency enterprise systems.

Statewide Planning for Information Systems Development Has Been Inadequate

Currently, the State invests more than $900 million annually on information technology, yet spending on information technology goods and services is highly decentralized. Also, there does not appear to be any significant prioritization or coordination of these investments across State government. While the *Code of Virginia* mandates that the Secretary of Technology direct and approve a "comprehensive, statewide, four-year plan for the acquisition, management, and use of information technology," the State's strategic plan for technology does not establish clear guidelines for the prioritization of projects across agencies.

The current Secretary of Technology and DTP have recently taken several positive steps towards addressing deficiencies in the planning process through the establishment of a new strategic planning process and the Commonwealth Technology Portfolio. Through the IT strategic planning process, agencies are required to view information technology projects as investments within a strategic investment portfolio that supports the agency's mission. When fully implemented, the Commonwealth Technology Portfolio will allow agencies to share information about current and planned IT investments in order to make investment decisions that best support core business activities. This process is still under development, and it is too early to determine the extent to which it will improve overall planning.

The State has also lacked a formal structure for evaluating the need for statewide or other interagency systems from a statewide perspective. As a result, there appears to be a number of outdated statewide systems and no schedule or process for evaluating their replacement. Moreover, the enterprise systems that have undergone development (eVA and IHRIS) could have benefited from a process that

addressed the initial questions of the need for the systems, how the systems would be funded, and how responsibility for the development of the systems would be allocated among agencies involved.

The State also appears to have lacked an effective process for assessing opportunities for coordination and collaboration among agencies in the development of information systems. Most projects appear to have been developed in isolation without any consideration of whether there are opportunities to conduct shared development of systems, leverage buying power through joint purchases, or avoid duplicative development efforts.

APPROVAL AND OVERSIGHT NEED TO BE STRENGTHENED

Given the importance of information technology to meeting the State's business objectives and the State's mixed success with systems development in recent years, the process for central approval and oversight of systems development needs to be strengthened. A key element of the proposed process would be the creation of an Information Technology Investment Board that could be comprised of cabinet secretaries, legislators, and citizen representatives. Other States have established such boards to review and approve major IT systems projects. Along with an investment board, a new full-time CIO position and project management specialist positions would be established. Finally, the oversight committee structure that is currently in place would be strengthened.

With these entities and positions, a new four-phase process could be established to more effectively review, support, and oversee major information systems development. This process would involve approval of proposals to conduct project planning, followed by approval of requests to initiate project development. It would also involve approval of the key procurement documents as well as ongoing oversight of projects throughout the development process. The Information Technology Investment Board, the CIO and project management specialists, and internal and external oversight committees would all be involved at various stages in this process. The creation of these new entities and process would not require a significant number of new staff or additional funding but instead refocusing of existing positions and resources.

Information Technology Investment Board Should Be Established

Given the amount and importance of the State's investment in information systems, a strong board with accountability for systems development needs to be established. Such a board would help to improve the central approval and oversight of major IT projects, provide a structure for prioritizing projects for investment, and provide greater accountability for IT development. Moreover, it appears that several states and at least one locality within Virginia have already established similar boards to mange information technology investments.

While there are multiple options that could be considered regarding the composition of the Information Technology Investment Board, one model to consider would be the establishment of a board comprised of each cabinet secretary, at least

three legislators from the General Assembly, at least four other representatives appointed by the Governor, the State Treasurer, and the State's Auditor of Public Accounts. Including each cabinet secretary would increase the immediate success and long-term viability of the board. The secretaries represent all business areas of Virginia government, and together with other members of the investment board, can consider proposed systems development projects on a statewide enterprise level. Additionally, because cabinet secretaries provide overarching policy direction to the executive agencies, this group could establish funding priorities for systems development that are in accordance with the overall policy direction of the State. Furthermore, involving the cabinet secretaries in the board would provide a higher level of accountability and visibility for major information systems projects. As the head of the technology secretariat and as the official responsible for setting information technology policy in the State, the Secretary of Technology could serve as the chair of the investment board.

In addition to the nine cabinet secretaries, the board could include at least three General Assembly members. Given the role that the General Assembly plays in appropriating funds for systems development projects, through either the existing or proposed funding mechanisms, it is important that the investment board involve legislators in the project approval and funding process. Legislative participation on the board would improve the General Assembly's understanding and knowledge of proposed systems development projects and further enable the General Assembly to make informed decisions about the appropriation of funds to these projects. One of three members selected to serve on the board should be the chair of the Joint Commission on Technology and Science.

Finally, additional members with extensive IT expertise could be selected by the Governor to serve on the board. These members could be selected from the private sector or from universities or other institutions. Including members with expertise in information systems development would strengthen the board. Involvement of these technology professionals could provide substantive expertise in assessing the feasibility and advisability of proposed information systems development projects during the approval process. Additionally, these representatives could assist in the identification of areas in which the State could take advantage of technology trends in developing information systems.

At least nine states, including Georgia, North Carolina, and Texas have such investment boards. Most of the boards include some citizen members with direct experience in technology. Three of the boards also include legislators. The North Carolina board, which has 23 members, includes six cabinet secretaries or agency directors appointed by the governor, four private citizens appointed by the General Assembly, the State chief information officer, and representatives from higher education.

In Virginia, Fairfax County has a board that is comprised of 15 citizen members with responsibility for reviewing technology projects and endorsing the annual technology spending plan. The county also has a steering committee comprised of county executives with responsibility for approving the county's annual IT investment plan.

Recommendation (1). **The Governor and the Secretary of Technology should present to the General Assembly for its consideration a plan for the creation of an Information Technology Investment Board with the authority to approve or reject any proposed information systems project with an estimated cost in excess of one million dollars, or other projects of statewide significance, and to terminate any such project after approval. Such a board could be composed of each of the cabinet secretaries; at least three members of the General Assembly, including the Chair of the Joint Commission on Technology and Science; at least four citizen members with technology expertise appointed by the Governor; the State Treasurer; and the State's Auditor of Public Accounts.**

Independent Chief Information Officer Position and Project Management Specialist Positions Need to Be Established

One of the factors that limits the State's current role in information systems development is that the State does not currently have a full-time Chief Information Officer (CIO) position that is effectively insulated from the political process and can focus exclusively on the role of developing needed information technology for the State. JLARC first recommended the creation of a State chief information officer in its 1997 review of information technology. The *Code of Virginia* currently provides that the Secretary of Technology shall serve as the State's CIO. However, the office of the Secretary of Technology also has other major statutory duties including the promotion of technology-based economic development. Moreover, the position of secretary is a political position and may be removed from office by the Governor at will. While the secretary should continue to play a key role in developing the State's information technology policies and strategic plan, as well as in economic development, the role of State CIO should be transferred to a separate position.

A full-time CIO with responsibility for the planning and development of information systems needs to be established in order to have a single individual ultimately accountable for information technology projects who can provide professional leadership and continuity across administrations in the area of systems development. This position would lead the project approval and oversight process as well as direct the central support provided for systems development. The CIO would also play a key role in statewide IT strategic planning. The critical nature of this role in the systems development process makes it essential that the State recruit a highly qualified individual with substantial experience in information systems development to fill this position. In order to attract qualified candidates, a competitive compensation package will need to be developed. Given the increased role proposed for the Department of Technology Planning in the systems development process (discussed in more detail later in this Chapter), the CIO could serve as the director of the Department of Technology Planning. The Director of the Department of Information Technology would continue to manage the State's IT infrastructure, functioning as a chief technology officer.

The CIO position needs to be protected from external influence so that decisions are based on technological and business needs rather than external considera-

tions. To insulate the proposed CIO position from external influences and to retain the type of qualified candidate needed, the General Assembly may want to consider establishing a contractual employment model for the CIO similar to the model used by the Virginia Retirement System to employ a chief investment officer. Under this model, the CIO could be employed under a special contract with the board and report directly to it. The contract could include specific performance measures, and the board could be given the authority to remove the CIO for failure to meet the terms of the contract. The contract could be for a set term such as three years, which would not be concurrent with the term of the Governor.

Along with the establishment of a new CIO position, the General Assembly also needs to establish several project management specialist positions. The project management specialists would report to the CIO and provide assistance in the approval and oversight process, as well as in providing ongoing support to agencies. Like the CIO, these project management specialists would need to be well qualified, with extensive experience in information systems development. The structure at DTP could be similar to that used by the Departments of Planning and Budget (DPB), and General Services (DGS), in which individual staff are assigned responsibility to oversee and support groups of agencies. This structure allows the staff at DPB and DGS to provide oversight and support by combining their subject area expertise with a long-term understanding of the business needs at their assigned agencies. The establishment of these new positions would not require the creation of a significant number of new positions but would merely involve refocusing some of the current positions at the Department of Technology Planning and establishing different skill sets and competencies for those positions.

Recommendation (2). **The General Assembly may wish to consider amending the *Code of Virginia* to focus the responsibilities of the Secretary of Technology on statewide planning, policy development, and promoting technology-based economic development, and eliminate the position's responsibility as Chief Information Officer.**

Recommendation (3). **The General Assembly may wish to consider amending the *Code of Virginia* to provide for the creation of a State Chief Information Officer and project management specialist positions with responsibility for oversight, support, and planning of information systems development across all agencies. The General Assembly may further wish to require that the Chief Information Officer be employed by the proposed Information Technology Investment Board under a special contract for a set term that is not concurrent with the term of the Governor.**

Strengthened Project Oversight Committees Should Be Required

A final element of the approval and oversight function would be the continued use of internal and external oversight committees. For major projects, agencies should be required to establish ongoing internal oversight committees with responsibility for addressing major issues that arise during the course of a project, including any issues that affect the scope, schedule, or budget of a project. The internal

oversight committees would need to be comprised of executive leaders within the agency. For statewide projects there should be an oversight committee of representatives from key agencies instead of a single-agency committee.

In addition, major projects need to continue to have external oversight committees. These committees should continue to include the agency project sponsor or agency director and the secretary of the sponsoring agency or their designee. The committee should also include the State CIO, the director of the Department of Information Technology, where appropriate, and a representative from the Department of Planning and Budget. The external oversight committees would be less involved in project development than the internal oversight committees, and would instead ensure that an adequate project management structure was in place and address major issues that could not be effectively resolved at the agency level.

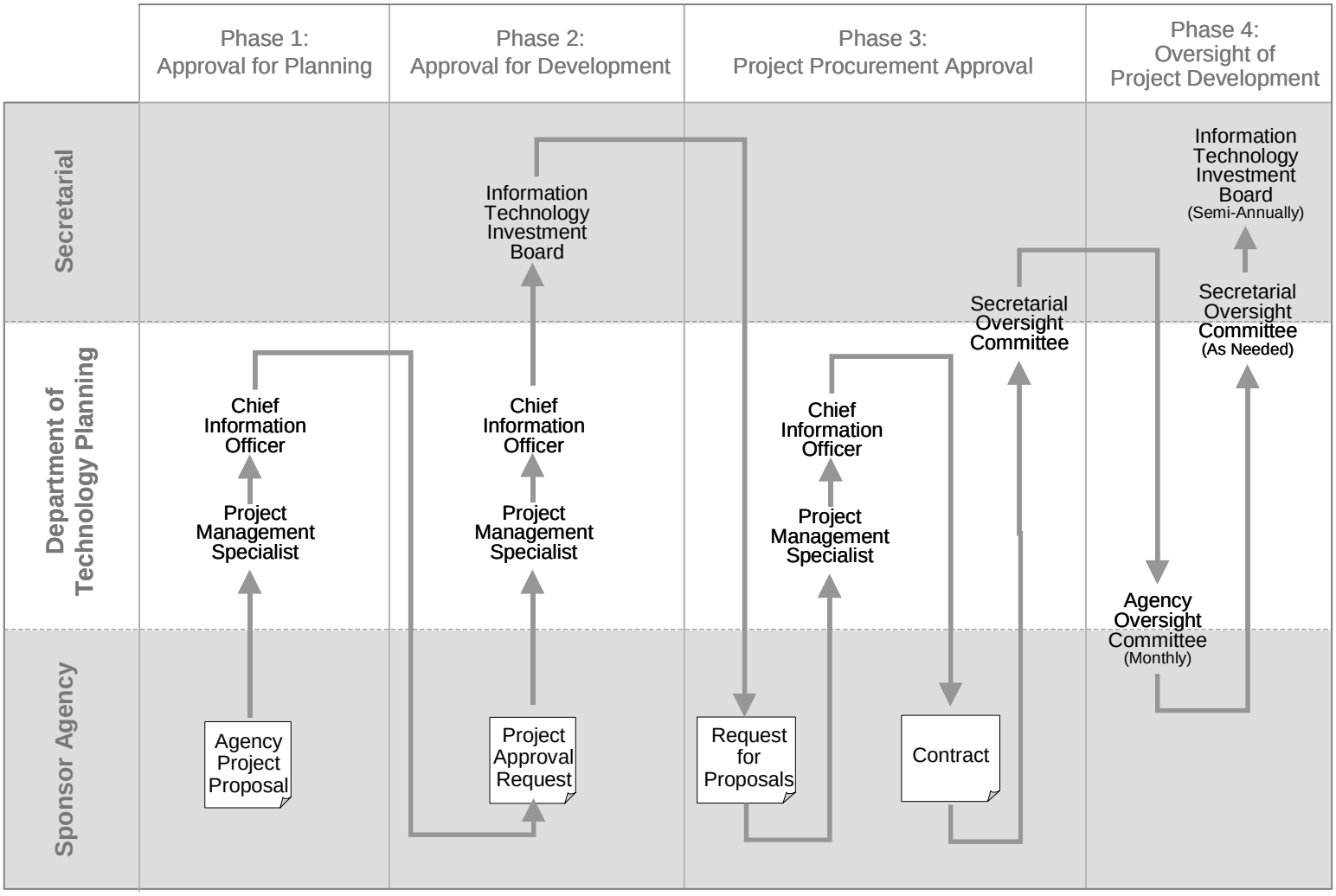
Recommendation (4). **The General Assembly may wish to consider amending the *Code of Virginia* to require agencies to establish internal oversight committees comprised of agency executives and external oversight committees comprised of the Chief Information Officer, a representative from the proponent secretariat, and a representative of the Department of Planning and Budget, which shall be required to provide ongoing oversight of information systems projects that are estimated to cost in excess of one million dollars.**

New Approval and Oversight Process Could Be Established

With the establishment of the Information Technology Investment Board, the CIO, and the project management specialist positions the State could strengthen the current approval and oversight process by providing increased assurance that only appropriate projects are pursued, and that all projects have the structures in place to ensure their success. The remainder of this section discusses a proposed solution to improve the approval and oversight process. The proposed process would include four major phases: project planning approval, project development approval, procurement approval, and ongoing oversight. These phases are illustrated in Figure 5. This process would be used only for major projects with a projected cost in excess of $1 million, or other projects of statewide significance.

With this proposed process, the newly created project management specialist positions would be the key liaisons between the approval authorities and the agencies. One way to organize the project management specialists would be by secretariat, with a specialist responsible for all major projects in one or more secretariats under their responsibility. The project management specialists could also provide assistance to agencies within their assigned secretariat throughout the project planning and systems development phases.

Figure 5: Proposed Systems Approval and Oversight Process



Source: JLARC staff analysis of systems development process.

Project Planning Approval. The first phase would involve approval to proceed with planning for a major project. Because project planning may require a significant expenditure of time and money, agencies could be required to submit project proposals for approval before proceeding with detailed planning. The planning proposal could first be submitted to the project management specialist responsible for projects in that agency. Such a proposal would need to outline the business need for the project; the proposed technology solution, if known; and an explanation of how the project would support the agency's business objectives and the State's IT plan. The project management specialist could review the proposal and recommend to the CIO whether to approve the project for further planning. The CIO would then make the final decision whether to approve or reject the proposal.

Project Development Approval. The second phase of the process would be formal project approval. After an agency completed the necessary planning for a project, it could then be required to obtain approval to proceed with procurement or development of the project. As with the project planning proposal, an agency could first submit the project approval request to the project management specialist. Among the information that would need to be provided would be a detailed business case (including cost-benefit analysis); a business process analysis, if applicable; system requirements, if known; a proposed development plan and project management structure; and proposed resource/funding plan. This information would then be substantively reviewed at three levels. The first two levels of review would be by the project management specialist and CIO. The CIO could then be responsible for making a recommendation to the Information Technology Investment Board regarding whether a project should proceed to development. The investment board could conduct the final level of review, thereby ensuring that all projects conform to the State's strategic plan.

The reviews conducted at all three levels would be based on established criteria. These criteria might include statutory or other requirements mandating the proposed project; the degree to which the project is consistent with the State's architecture and overall strategic plan; the technical feasibility of the project; benefits to the State of the project, including customer service improvements; risks associated with the project; continued funding requirements; and past performance by the agency on other projects.

Projects requesting capital or other special IT funding for development would then proceed to a separate funding approval process at this point. The new proposed funding mechanisms for major IT projects will be discussed in detail later in this chapter.

Procurement Approval. Following authorization to proceed with development and acquisition, a third approval process could be required for projects that involve a procurement for hardware, software, services, or a combination of these in excess of one million dollars. With projects that involved major procurements, approvals could be required for the RFP or invitation to bid (ITB) as well as the final contract. The RFP or ITB could be prepared by the sponsor agency, which would then submit it to the appropriate project management specialist for approval. The project management specialist would then make a recommendation to the CIO who

would have final authority to approve the RFP or ITB prior to its release. The sponsoring agency would then have responsibility to evaluate the proposals and negotiate the contract. Subsequently, the external oversight committee would be required to approve the final contract prior to execution.

Project Oversight. The final stage in this approval and oversight process would be the ongoing oversight by the internal and external oversight committees. Regular oversight would be conducted by the internal oversight committee. This committee's primary responsibility would be to authorize or reject any changes in a project's scope, schedule, or budget. In addition, the internal oversight committee would be responsible for addressing any other issues that could not be addressed effectively at the project management level.

External oversight committees could also perform ongoing oversight. The extent of this oversight would vary depending on the capability and maturity of the agency developing the system. This oversight would typically be less active than the oversight provided by the internal oversight committee. It would generally be limited to ensuring that the project had an adequate project management structure in place and addressing major issues that impacted the scope, schedule, or budget of the project as well as other issues that could not be addressed at the internal oversight level. Requirements could be established that certain major project changes such as proposed modifications to the contract would trigger external oversight. This oversight would also involve continuing consideration of whether a project should be cancelled. The external oversight committee would have the ability to refer a major issue, such as possible termination of a project, to the Information Technology Investment Board for further consideration.

The project management specialist assigned to each project would also play a key role in this oversight process by performing ongoing monitoring of each project. This individual would attend all internal and external oversight committee meetings but could also regularly monitor the progress of projects through other means, such as on-site observation of the project and discussions with the project management team. The project management specialist could also be responsible for completing the regular Dashboard reports on projects instead of relying on agencies to self-report. These reports could be made available to the external oversight committee, the Investment Board, and to the general public. The project management specialist could periodically report to the board on the status of each project. Finally, the project management specialist would be responsible for raising to the external oversight committee issues that needed to be addressed at that level or the level of the Investment Board.

Process for Enterprise Projects Would Need to Be Modified. The approval and oversight process for statewide enterprise projects would be somewhat different given the CIO's direct role in planning and management of these projects (discussed in detail later in this chapter). The initial review to proceed with planning would need to be approved by the Investment Board instead of the CIO because of the CIO's direct involvement in developing statewide project proposals. The project proposals would need to be reviewed by the board. Requests for proposals would not be reviewed at a higher level, but contracts in excess of a million dollars could be

required to be reviewed and approved by the board. Finally, internal oversight would need to be structured differently. The internal oversight function could be performed by a committee comprised of representatives from key agencies involved in the enterprise project. The investment board could then provide the external oversight for such projects.

Other States Approve and Oversee Major Projects. Other states have developed approval and oversight processes for major IT projects that usually involve a central investment board. The states of Arizona, Georgia, Indiana, Iowa, North Carolina, Texas, and Washington all have policy boards that must approve major IT projects. Several states also provide ongoing monitoring or oversight of systems development. For example, the state of Washington investment board requires agencies to report periodically on major systems projects and reviews whether projects are on schedule and within budget. In Texas, a legislative committee comprised of six legislators conducts ongoing oversight of major systems projects.

Process Would Not Apply to Minor Projects. While projects with an estimated cost in excess of $100,000 but less than $1 million may need some degree of review and oversight, the full process described above would not necessarily need to be applied to them. The appropriate project management specialist should review these projects for approval, and the chief information officer may be the appropriate party to provide final approval for the development of these projects and determine if additional oversight is needed.

With Proposed Process, Information Systems Development Would Be Strengthened

The proposed approval and oversight process would serve several important purposes. The additional requirements for approval and oversight should help to reduce the risks associated with systems development substantially and reduce the number of systems that are undertaken but which lack a strong business case. The proposed process would also increase the visibility of systems development by assigning accountability to an independent Chief Information Officer and an Information Technology Investment Board. This type of accountability for systems development is lacking under the current system.

One of the most important strengths of the proposed system is that agencies would have to present a persuasive business case that demonstrates the project's net benefits to the Commonwealth before proceeding with development and implementation. This would be in sharp contrast to the current system in which there is no requirement that agencies establish a clear link between a sound business case and the strategic goals of the Commonwealth.

Another positive impact of the proposed system is that it would further ensure that the nine elements identified in Chapter II as critical to project success are present in those projects being developed. The approval process would be strengthened by assigning project management specialists to each agency who would require that agencies perform the proper planning before developing an IT project. The project management specialists would combine technical expertise with an understand-

ing of the business needs of their assigned secretariat. In this manner, the project management specialists would assist agencies in the definition of system requirements and the assessment of the technical feasibility of proposed projects. In addition, review of proposed projects by the CIO would further ensure that the procurement process was conducted effectively and was technically sound. Requests for proposals would be subject to detailed review prior to release, and external review committees would closely evaluate contracts before they were signed.

The proposed process and structure would also improve the ongoing oversight of projects. The project management specialists would be able to provide an ongoing assessment of the progress of projects and provide reliable, unbiased reports to the external oversight committee and the Information Technology Investment Board on a regular basis. With this ongoing oversight, problems or challenges could be identified and addressed quickly. In addition, this process would help to ensure that issues were elevated to the level of an oversight committee as needed. Finally, this regular monitoring and oversight should help to ensure that agencies maintain effective project management and oversight structures throughout the course of a project.

While the proposed structure and process is intended to apply to the development of all major projects in executive branch agencies, the extent of the oversight could vary depending on the level of maturity of the agency involved. Some agencies, such as the Department of Motor Vehicles and the Department of Alcoholic Beverage Control, have mature information technology divisions and may be capable of developing complex information systems with little guidance or oversight. Other agencies have less capability and need much more extensive guidance and oversight. For these agencies, the role of the project management specialists would add significant value to the current process. Given this range of abilities, the level of ongoing monitoring and oversight would vary to some extent.

The State CIO might want to consider the implementation of a formal structure to assess the ability of agencies to develop systems projects. Models such as the Capability and Maturity Model developed by Carnegie Melon University might be used to assess the quality of an agency's project management and systems development processes. The Department of Alcoholic Beverage Control used its most recent major project to assess its own capability and maturity under the model, and states such as Michigan and Texas have used this model as well.

Recommendation (5). **The General Assembly may wish to consider amending the *Code of Virginia* to require that all proposed information systems projects with an estimated total cost in excess of one million dollars, or other projects of statewide significance, be approved for planning by the State's Chief Information Officer and approved for development by the Information Technology Investment Board based on established criteria.**

Recommendation (6). **The General Assembly may wish to consider amending the *Code of Virginia* to require that the State's Chief Information Officer be required to review and approve all requests for proposals for the development of information systems in excess of one million dollars and that the external oversight committee established for each major information systems project be required to approve any contract with a private vendor in excess of one million dollars.**

Recommendation (7). **The General Assembly may wish to consider amending the *Code of Virginia* to require that the internal and external oversight committees established for each project conduct ongoing oversight of all major information systems projects.**

NEW FUNDING STRUCTURE IS NEEDED TO SUPPORT INFORMATION SYSTEMS DEVELOPMENT

As discussed in Chapter II, one of the critical elements for the successful development of major information systems projects is a reliable funding source. While projects have been funded from a variety of sources, some projects have lacked sufficient funding, which has ultimately contributed to their failure. In addition, some worthy projects may not have been undertaken because of the lack of available funding. Several of the State's outdated central administrative systems have not received funding for replacement. Moreover, some general fund agencies have not received funding for needed information systems. One of the limitations appears to be the biennial budget process, which does not provide guaranteed funding beyond two years. Additionally, the high cost of some major projects make them difficult to fund through direct appropriations or agency operating budgets.

Given the current funding limitations, the General Assembly needs to explore alternative means of funding enterprise systems and major general fund agency projects. The most logical solution appears to be the adoption of a funding process similar to that used to fund public buildings. This would help to provide a funding source for major projects that need to be undertaken. Under a capital funding approach, the Information Technology Investment Board could be responsible for establishing funding priorities and submitting funding recommendations to the General Assembly, which would have final budget approval authority.

Inconsistent Funding for Information Systems Development

Funding of information systems projects has been varied. Special fund agencies such as the Department of Motor Vehicles, the Department of Alcoholic Beverage Control, and the Virginia Department of Transportation have been able to fund projects primarily through their agency budgets. Agencies such as the Department of Medicaid Assistance have funded projects such as the Medicaid Management Information System primarily with federal dollars. Other agencies, such as the Department of Health, have funded major projects at least partially through agency operating funds. Still other agencies, such as the State Board of Elections and the Department of Corrections, have funded major projects with appropriations by the General Assembly. Finally, the Departments of Taxation and General Ser-

vices are funding major projects using a benefits funding model in which revenue generated by the projects helps to pay for them.

There appears to have been a general lack of funding to pay for major statewide or multi-agency projects. One particular category of multi-agency enterprise systems that have not been funded adequately are central administrative systems, including the Commonwealth Accounting and Reporting System (CARS) and Program Budgeting System (PROBUD), which are both more than 20 years old and need to be replaced. While there has been considerable discussion about the need to replace these systems in recent years, the lack of funding to pay for their replacement appears to have been a significant obstacle to efforts to do so. In addition, other central system projects that have been undertaken, such as IHRIS and eVA, have not received sufficient funding. In both cases, the projects were at least partially funded by treasury loans, but agencies were responsible for repaying the loans. In addition, funding provided for these systems did not pay for line agency costs. There has also been insufficient funding for other types of multi-agency enterprise systems. The Department of Criminal Justice Services has not been able to obtain the funding necessary to develop an integrated criminal justice information system despite numerous requests for funding over the last several years.

With agency-specific projects, special fund agencies such as DMV, ABC, and VDOT have been able to successfully fund projects in recent years. However, general fund agencies have been less successful. For example, the Department of Corrections was not able to obtain full funding for the development of an offender management system. In addition, the State Board of Elections was not able to fully fund a new voter registration system.

Current Funding Structure Is Not Adequate

Lack of an effective structure for funding major information systems hinders efforts to develop them. One of the problems with the current funding structure is that it is linked to the biennial budget process. Some major systems projects will inevitably be multi-year projects. Therefore, funding for some of these projects may need to extend across more than one biennium. Yet there is no mechanism in place to provide this long-term funding, and no guarantee that funding will be available beyond the present biennium. This limitation may restrict the ability of the State to find vendors who are willing to enter long-term contracts in which availability of future funding to pay for a project in later years is uncertain.

Another fundamental problem with funding is that it is difficult to fund these high cost projects through the State's operating budget. The General Assembly is not inclined to directly appropriate the large amounts needed for major projects. Moreover, agencies are not likely to be able to fund high cost projects through their operating budgets.

A final major problem with the current funding system is that there is no formalized structure to consider the overall IT needs and priorities in making funding decisions about information technology. Instead, decisions about funding the

development of major IT projects is generally conducted in isolation without consideration of the State's overall information technology needs or priorities.

New Capital Funding Structure Could Be Developed

Given the need to create a source of funding for major new information systems projects and the problems with the current funding structure, a new funding structure could be developed to fund major new information systems projects that would be similar to the existing capital funding process for buildings. The two primary components of this proposed structure could be the establishment of a process to fund major systems projects through the issuance of bonds or other debt instruments, and the prioritization and approval of projects for funding by the proposed Information Technology Investment Board.

Funding Information Systems Projects Through the Issuance of Bonds. With the difficulty in funding major systems projects through operating budgets or through direct appropriations by the General Assembly, a new source of funding for major information systems projects needs to be established. Generating funds for these projects through the issuance of bonds could serve this purpose. The capital process used to finance the construction of buildings through the issuance of bonds could also be used to fund major information system projects. An IT system is analogous to a public building in many ways. Like buildings, IT projects are often high cost projects that require extensive planning and development over an extended period of time and are as fundamental to the functioning of State government.

According to Department of Treasury officials, the existing structure used to issue bonds to fund buildings also could be used to fund major IT projects. The Public Building Authority, which typically issues bonds annually for the construction of buildings, could also issue bonds to finance IT systems. Like the capital program for public buildings, the General Assembly would need to authorize the IT projects the Virginia Public Building Authority funds and appropriate funds to pay the debt service on the bonds issued. The General Assembly could set a cap each biennium as to the total dollar value of projects that would receive approval for bond financing during the biennium. The amortization of bonds for IT projects would need to coincide with the useful life of the projects.

Several states are using bonds to pay for major information systems. Pennsylvania issued $200 million in bonds to pay for its new police radio system. Massachusetts has also issued bonds to finance major information technology systems. The state of Kentucky recently began funding major information system projects through its capital funding process.

There is precedent in Virginia for financing technology through bonds. The Virginia Public School Authority has issued eight different series of school equipment financing notes to pay for network infrastructure, computers, and other technology equipment in public schools. Furthermore, at least seven other states have also debt-financed educational technology.

Investment Board Would Need to Prioritize Projects for Funding. With a capital funding structure, the Information Technology Investment Board would be a key part of the funding process. Through the project approval process discussed in the previous section, project approval requests would also include an indication of whether a project was requesting capital funding to pay for part or all of a project. Agencies requesting capital funding for their proposed projects would need to submit their proposals by the spring or summer of each year so that they could be evaluated and prioritized prior to the General Assembly session. These projects would then be separately evaluated by the investment board for funding. Factors to be considered in evaluating the projects might include: statewide significance, conformance with the State's strategic plan, extent of the business need, potential benefits provided, risks associated, and amount of funding requested.

Projects would then need to be ranked in order of priority by the board. This prioritized list of proposed projects would be submitted to the General Assembly as part of the Governor's budget submission for the biennium. The proposed projects could then be evaluated and approved by the General Assembly up to the cap amount. It may be preferable to approve projects for funding on an annual basis rather than a biennial basis given the rapid changes in technology needs. The investment board could submit a list of recommended projects to the General Assembly annually, and the General Assembly could apportion the approval of projects over both years of the biennium.

Other Funding Alternatives

In addition to the capital funding model outlined above, the General Assembly could consider other alternatives to help pay for the cost of projects. One alternative would be the creation of a central technology fund to help pay for statewide enterprise systems or other multi-agency projects. However, such a fund would require a revenue source. One possibility would be for the General Assembly to directly appropriate money to the fund. Another potential source of funds might be the identified savings from IT projects.

Several states and at least one Virginia local government have established such funds. The state of Pennsylvania has established a central technology investment fund to help pay for statewide enterprise projects. The Pennsylvania legislature appropriates between 20 and 30 million dollars to the fund each year. The state of New York has established a technology entrepreneurial fund of about 10 million dollars to provide loans and grants to fund the development of multi-agency or statewide projects that are difficult to fund using traditional funding mechanisms. The technology entrepreneurial fund is a revolving fund and loans that are made from the fund must be repaid within five years of project completion. Other states that have used such funds include Maryland and Iowa. Additionally, North Carolina is presently considering the establishment of a central information technology fund under the control of their investment board. In Virginia, Fairfax County has established a technology modernization fund. The county appropriates approximately $20 million to the fund annually to pay for hardware, software, and services.

Another option would be to develop a revolving loan fund that would make low cost loans to agencies to pay for planning or development of information systems. With such a fund, agencies could be required to pay back the funds borrowed over a set period of time. With either type of fund, criteria would need to be developed for receipt of funding.

Recommendation (8). **The General Assembly may wish to consider amending the *Code of Virginia* to establish a funding process for information technology projects. The process may involve the use of bonds or other debt instruments issued for the development of information systems through the Public Building Authority. The Information Technology Investment Board, recommended in this report, should be required to submit a list of recommended projects for funding annually to the General Assembly for its review and approval.**

PROPOSED GOVERNANCE STRUCTURE WOULD INCREASE SUPPORT FOR SYSTEMS DEVELOPMENT PROCESS

Along with an effective process for approval and oversight of major information systems projects, the State needs to provide substantially more support to agencies in systems development than is currently provided. Given the enormous complexities of information systems development, it may not be practical or cost-effective for each agency in the State to retain a highly specialized IT staff with extensive experience in major information systems development. However, it is practical for the State to retain a core of highly experienced and qualified IT professionals who can provide needed support and guidance to agencies. The benefit to the State for providing this support would be substantial savings in the procurement of information systems through better managed projects, a higher project success rate, and less need for agencies to hire outside consultants.

This increased support could be provided through a newly established project management office in the Department of Technology Planning. Through this office, the Chief Information Officer could direct the development of statewide or multi-agency enterprise projects. The project management specialists could provide support to agencies by working in close partnership with them throughout the development process. In addition, the office could provide standards for the management of IT projects and could provide training to improve the skills of the State's IT project managers. The DTP should also serve as a planning and management resource to any agencies that are involved in information systems development. Finally, the proposed CIO position needs to work in coordination with the Secretary of Technology and the Director of the Department of Information Technology to establish a State technology architecture and minimum requirements for future systems development projects.

Office of Project Management Within the Department of Technology Planning

The increased support that needs to be provided by the Department of Technology Planning to agencies in systems development should be focused in one division or office within DTP. This division could be an office of project management that would house the project management specialists previously discussed in this chapter. Along with their role in conducting ongoing monitoring of systems development projects, the project management specialists would also be the key staff to provide support to agencies. This office could also house the State's project management training program and the information clearinghouse that are discussed later in this section.

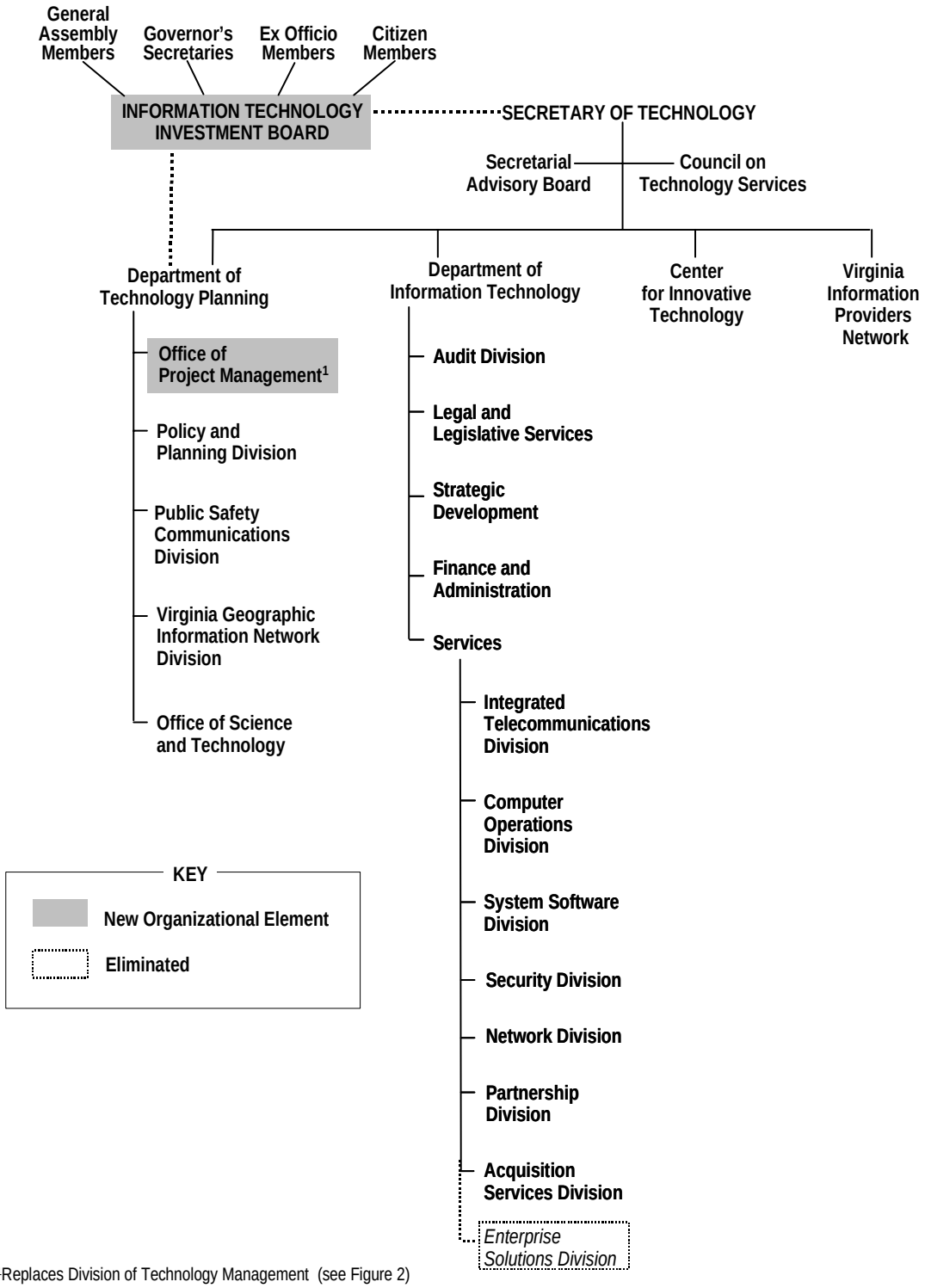
The proposed new structure would not require a major reorganization of the Department of Technology Planning. The current division of technology management could become the office of project management, and the existing positions within the division could be refocused on project management. The Secretary of Technology, the new Chief Information Officer, and the Director of DIT should also review the functions of the other divisions and offices within the department. This review should be to determine whether these functions are related primarily to IT systems development. Functions that are related should be retained within DTP, and functions that are not should be transferred to the office of the Secretary of Technology or DIT.

The enterprise services division, which is currently housed at the Department of Information Technology, should be relocated within the office of project management. Currently DIT provides information systems development consulting services through this division. The division provides consulting to agencies, localities, and institutions regarding IT development and provides IT support to the governor's office. With the CIO responsible for systems development, these staff should be located within the newly created office of project management. Figure 6 illustrates the limited changes to the current organization of the technology secretariat that would be required under the proposed governance structure.

Several states have implemented project management offices to provide agency IT professionals with centralized support for the development of information systems. States such as Georgia, Indiana, Michigan, and Ohio have established project management offices to oversee information systems development across state agencies. Additionally, the state of New York has established a project management office in order to increase project management competence and foster sustained success of systems development project carried out within the State.

Recommendation (9). **The General Assembly may wish to consider amending the *Code of Virginia* in order to establish an Office of Project Management within the Department of Technology Planning and relocate the current enterprise services division at the Department of Information Technology in the proposed office.**

Figure 6
Proposed Organization for Systems Development, Oversight, and Support



[1]Replaces Division of Technology Management (see Figure 2)

Source: JLARC staff analysis of data from the Department of Technology Planning and the Department of Information Technology.

***Recommendation (10)*. The Secretary of Technology should review the current functions performed by the offices and divisions within the Department of Technology Planning and determine whether any of these functions should be transferred to the office of the Secretary of Technology or Department of Information Technology.**

CIO and Project Management Office Would Direct the Development of Statewide Enterprise Projects

One of the critical functions of the CIO and the new project management office would be to direct the development of statewide or multi-agency projects. Given the complexities and challenges associated with these projects, it is essential that the CIO be directly involved in their development to ensure that an adequate project management structure is in place and that the agencies involved in the project are working in collaboration to successfully develop it. Having the CIO in charge of each these projects should help to reduce resistance from agencies and increase cooperation in development of them. If difficulties arise, then the CIO can bring them to the attention of the Information Technology Investment Board, which should be an effective forum to resolve differences given that it is composed of all of the cabinet secretaries.

***Recommendation (11)*. The General Assembly may wish to consider amending the *Code of Virginia* to give the Chief Information Officer the authority to direct the development of any statewide or multi-agency enterprise project.**

Department of Technology Planning Would Provide Support to Agencies Through Newly Established Project Management Office

One of the most important means by which the State can provide support to the agencies in the development of major information systems is through the project management specialists. These project management specialists, who would have monitoring and oversight responsibilities, would also work closely with agencies and project management teams as needed in a support role. These project management specialists could be available to assist agencies in all facets of information development. They could serve as a resource in conducting planning activities and developing the business case for projects. They could also assist agencies with the procurement process by helping to develop RFPs and contracts, providing background and insights on particular vendors, and assisting with contract negotiation.

Another important support role for the project management specialists would be to help agencies identify situations in which specialized expertise should be retained. This expertise might include advice on the development of requirements or the need to obtain legal consultation in developing a contract with a vendor.

Several states, as well as one secretariat within Virginia, have developed support structures for agencies developing major IT projects similar to this concept. In Ohio, a project management office staffed with several certified project managers

both monitors agencies and provides support to them during systems development. In Georgia, a certified project manager is assigned from the central Georgia Technology Authority to work with any agency developing a project in excess of $1 million.

This type of support model is currently being used in Virginia within the public safety secretariat. The office of the secretary of public safety has retained the services of an experienced IT professional who serves in a role similar to that outlined for the proposed project management specialists. One of this individual's primary responsibilities is to provide support to agencies in the development of information systems projects. This individual works closely with agency CIOs and project managers in all facets of project development, from development of the business case through the completion of the project.

Recommendation (12). **The General Assembly may wish to consider amending the *Code of Virginia* to require the chief information officer and the Office of Project Management to provide ongoing assistance and support to agencies in the development of major information systems.**

Formal Project Management Methodology Needs to Be Developed

Another important element of support that needs to be provided by the proposed project management office is a standard project management methodology. As discussed earlier in this chapter, the last effort to develop a project development methodology was the set of standards issued by the Council on Information Management in 1991 that addressed the development of large and small-scale projects. However, these outdated standards were very broad and appear to have had limited practical value. The office of project management should develop an IT project management methodology that can serve as a useful guide to agencies in the development of major information systems. This methodology should be updated by the office on a regular basis.

Other states have developed project management methodologies that are provided to agencies to guide IT project development. States such as California, Maryland, Michigan, Ohio, Pennsylvania, New York, and Washington have all developed statewide project management methodologies. It should be noted that the current Secretary of Technology issued a Technology Management Policy dated October 8, 2002 which states that the Secretary plans to issue standards and guidelines for technology project management.

Recommendation (13). **The General Assembly may wish to consider amending the *Code of Virginia* to require the Chief Information Officer to develop a State project management methodology to be used by agencies in the development of information systems and require the Chief Information Officer to update the methodology on a regular basis.**

Statewide Project Management Training Would Improve Systems Development

Another important support function that could be made available to the State's information technology professionals is cost-effective project management training on a statewide basis. A strong training program would help to improve the quality and skills of the project managers in the development of major information systems projects. With more skilled project managers, IT projects should be better managed and the number of failed projects significantly reduced.

One of the keys to a successful training program is to make it affordable and cost-effective for State agencies. One possible alternative to control costs would be to teach classes using State staff such as the State CIO, the project management specialists, and other experienced project managers in the State as faculty. Another alternative would be to work in partnership with community colleges and universities to develop project management training programs that would meet the needs of State IT project managers.

There is already precedent for establishment of such a program in Virginia. A training program was recently developed in the public safety secretariat that has provided affordable training to project managers. The program, which began in November 2001, has been able to limit the cost to participants by bringing small vendors and former colleagues of the director of the academy to teach the classes. According to the director of the academy, the classes, which typically last one full day, have averaged about $300 per class. Some classes that are taught commercially are as much as $1,100 per class.

Several other states have developed state project management training programs. States such as Kansas, Maryland, North Carolina, New York, Oregon, Texas, and Washington all have programs to train IT project managers. In some cases, the training programs appear to be conducted internally. In other instances, the programs are conducted in partnership with another entity. For example, the state of Oregon offers a project management certification program through a partnership with community colleges. In Oregon, the state seeks to not only train project managers, but also train elected officials and agency executives in the concepts of information systems development to better inform their decision making regarding information systems. The state of Texas requires that agency information resource managers receive annual continuing education to ensure that information systems development is performed effectively. Additionally, the state of New York has developed a project management mentoring program that is designed to increase project management expertise by partnering developing project managers with more experienced colleagues.

Two local governments in Virginia also emphasize project management training. The City of Virginia Beach requires that all persons working on information systems projects receive some training regarding project management. Fairfax County currently requires that all of its project managers be certified in project management by the Project Management Institute.

Recommendation (14). **The Governor and the Secretary of Technology should provide to the General Assembly for its consideration a plan to develop a program to provide cost-effective training to State employees with responsibility for managing information technology projects.**

Additional Resources for Agency Information Technology Professionals Could be Provided

With the complexity of information technology, its evolving nature, and the shortage of high-caliber technology experts, it is unrealistic to assume that each State agency will be able to retain all necessary personnel with the experience and knowledge needed to successfully develop information systems. Therefore, another way in which the Department of Technology Planning could further enhance the development of information systems across State agencies is to provide increased information resources to agencies. The Department of Technology Planning could provide a valuable support service to agencies by providing an information clearinghouse for the exchange of information regarding systems development experiences or best practices. One type of useful information to make available to State agencies would be the systems development experiences of other agencies. One CIO at a major State agency told JLARC staff that prior to developing a major project he "would have killed for a knowledge database regarding state agencies in terms of who has done what, and what their experience has been."

Additionally, the department should develop a technology exchange program to make available to other agencies hardware, software, or software licenses that have been purchased but are not being used by the purchasing agency. The project review for this study revealed that one of the remnants of failed projects is that there is often unused hardware, software, or software licenses. With an effective technology swap shop in which the availability of these unused products could be made known around the State, some of these items could be used by other agencies, with a significant savings to the State.

Recommendation (15). **The Chief Information Officer should establish an information clearinghouse that includes information collected on State agency development experiences and best practices, and should explore other areas in which the State can provide useful resources to assist agencies in the development of information systems. The Chief Information Officer should also establish a program for the exchange of excess computer hardware and software licenses.**

Common State Architecture Needs to Be Developed

A final way in which the technology secretariat should provide greater support is through the development of common architecture standards for the State. Common architecture standards would include common standards for aspects of the technology infrastructure such as the network, security, operating platforms, databases, and applications. As discussed previously, the lack of a common architecture has complicated the ability to develop multi-agency or statewide integrated systems,

and has contributed to at least one major failure, the IHRIS project. The establishment of a common statewide architecture for the development of enterprise systems would facilitate the development of such systems substantially. The Department of Technology Planning needs to work in conjunction with the Secretary of Technology and the Department of Information Technology to develop common technology architecture standards so that the State's technology architecture does not remain so variable.

Other states have developed a statewide technology architecture. States such as Arizona, Indiana, Kentucky, Maryland, North Carolina, and Ohio all have a statewide architecture and require new information systems to be developed in conformance with that architecture. In Virginia, Fairfax County has established a countywide architecture, and all proposed projects are required to conform to it.

Recommendation (16). **The Departments of Technology Planning and Information Technology, at the direction of the Secretary of Technology, should collaboratively develop a statewide information technology architecture and a related set of systems standards.**

STATEWIDE STRATEGIC PLANNING FOR TECHNOLOGY INVESTMENTS SHOULD BE IMPROVED

Along with the need for increased oversight and support for systems development, statewide strategic planning for information systems development needs to be improved. An effective process needs to be established for identifying and prioritizing major information systems development needs and projects. This process needs to involve input at different levels. Agencies need to provide input regarding technology solutions to meet agency business needs. However, the Chief Information Officer, Secretary of Technology, and Information Technology Investment Board need to also play a key role in identifying statewide priorities and considering opportunities for coordination and integration of technology solutions among agencies and institutions. The Secretary of Technology has recently released a new technology strategic plan for the State, but it does not discuss specific project priorities.

As part of the information systems development process, an effective strategic planning process is needed. One of the key aspects of this process should be the continued development of agency-level IT strategic plans. These plans need to be based on identified business needs within agencies that can be addressed with technology solutions. Agency plans should in turn be submitted to the cabinet secretary to whom the agency reports. The secretaries can use those plans to develop priorities for the secretariat. The priorities of each secretariat can then be used to develop a statewide strategic plan. While agency plans are currently required, they do not appear to be effectively used by the Secretary of Technology or the Department of Technology Planning in the development of a State Strategic Plan for Technology that prioritizes project needs across the Commonwealth.

Another key aspect of the strategic planning process needs to be an analysis by the CIO of future systems development from a statewide perspective. The CIO

needs to fully examine opportunities for the development of statewide or multi-agency enterprise systems that will be a cost-effective means to better meet the State's business needs. Development of these enterprise priorities should involve the input of secretaries, central agency directors, and other key State officials. The CIO should also examine opportunities for coordination and collaboration between agencies so that the needs of multiple agencies may be met through more cost-effective solutions.

The Secretary of Technology should continue to have responsibility for developing the statewide strategic plan. The strategic goals and the policy priorities of the secretary and Governor should be key factors in determining the priorities within the plan. However, the agency strategic plans and CIO input on enterprise opportunities should also be weighed heavily in developing the plan. The final plan should set forth the State's strategic goals and policy priorities, but should also include major systems development priorities both in terms of agency systems and interagency enterprise systems.

Given the importance of the plan and the proposed role of the Information Technology Investment Board in the systems development process, the board should have the final authority to approve the plan. This approval would allow the other secretaries who represent the State's business areas to have the final decision regarding whether the plan meets the State's overall business goals and policy objectives.

Recommendation (17). **The Secretary of Technology, with the assistance of the Chief Information Officer, should develop a biennial State Strategic Plan for Technology that sets forth State information technology project priorities based on agency technology strategic plans and an analysis of statewide or multi-agency project priorities by the Chief Information Officer.**

Recommendation (18). **The General Assembly may wish to consider amending the *Code of Virginia* to require that the proposed Information Technology Investment Board approve the biennial technology strategic plan.**

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CASE STUDIES

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ACCURATE, RELIABLE INFORMATION ACCESS

The College of William and Mary's Accurate, Reliable Information Access (ARIA) project was an attempt to replace the university's legacy student information, finance, and human resources systems with a new enterprise resource planning (ERP) system. The ARIA project was cancelled seven months after contracts were signed for the purchase of software and implementation services, because the project was behind schedule and over budget, and because the university reassessed its need for immediate implementation of a new student information system. The university budgeted $9.5 million for the planned implementation of the ARIA system over a period of 18 months, but it soon became apparent that the system could not completed within that budget and schedule. By the time the project was officially cancelled in July 2001, the university had spent a total of $5.7 million on the project, excluding internal staff time dedicated to the project. Except for a university finance blueprint, for which the university spent approximately $800,000, William and Mary received no tangible benefits from its investment.

The project appears to have suffered from a lack of several critical project success elements, including an inadequate feasibility assessment, poor vendor evaluation and selection, and ineffective project management. The exhibit on the following page summarizes the project.

Narrative Chronology of the ARIA Project

Planning for the Accurate, Reliable Information Access (ARIA) project began in March 1998, and the project was officially terminated in July 2001. The bulk of the development effort occurred between February 2000, when the contract was signed, and November 2000, when the university terminated its contract with the implementation partner, Align Consulting. During this time, the university entered into three separate contracts for software, implementation, and quality assurance, and began development of the finance module of the ERP system. Development was suspended following a project assessment by the project manager in fall 2000, and the project was officially terminated in July 2001 following the termination of the maintenance contract with the ERP software vendor, SAP.

The procurement process for the ARIA system began in the winter of 1998 following an identification of the need for a new student information system (SIS) and ERP system that would integrate the SIS with new finance and human resources systems. The College of William and Mary first issued an RFP for combined ERP software and implementation services, but then cancelled this RFP upon a determination that separate software and implementation vendors were needed. The RFP for an ERP software product was then issued in February 1999. The university received responses to the RFP within the deadline from SAP, SCT, and Oracle. A fourth responder, PeopleSoft, missed the RFP response deadline by approximately 30 minutes and was disqualified from the selection process. The selection committee narrowed the selection to SAP and Oracle, and then issued an RFP for implementation services.

Accurate, Reliable Information Access
The College Of William And Mary

Initial Projected Cost	$9.5 million *
Final Projected Cost	$17 million *
Actual Expenditure	$5.7 million *
Projected Timeframe	March 1998 – September 2001
Actual Timeframe	March 1998 – July 2001
Status	Cancelled
Purpose	To develop enterprise resource planning system for human resources, financials, and student information system.
Rationale	Legacy systems had become increasingly difficult and expensive to maintain; university wanted to enhance services to students, faculty, and administrators.
Vendors and Products Used	SAP, Align Consulting, Satori Management.
Problems/Successes	Cancelled before any ERP modules implemented.

* Cost does not include W&M internal costs.

Source: JLARC staff analysis of agency project documentation.

The RFP for implementation services was issued in June 1999, and responders were informed that SAP and Oracle were the two finalists for the software vendor award. Responders were instructed to align their responses with one or both of the software finalists. The university received 12 responses to the RFP for implementation services and narrowed the selection to five qualified responses.

In October of 1999, the university issued a third RFP for consultant services to assist with the vendor selection process. The associate provost for information technology, who was also the project manager, attempted to award the contract on a sole-source basis to Satori Management, because this consultant had performed previous ERP design work for the university. However, the procurement office at William and Mary denied the sole-source request and demanded the RFP be sent to at least six vendors. Satori Management provided the only response to the RFP and was subsequently awarded a time and materials contract at the rate of $2000 per day beginning in November 1999.

With the assistance of Satori Management, the vendor selection committee evaluated the software and implementation vendor proposals and awarded both contracts in February 2000. The software contract was awarded to SAP, while the implementation contract was awarded to Align Consulting. The university agreed to

pay SAP slightly more than one million dollars for 1,295 user licenses plus annual maintenance expenses for five years. SAP, which had not yet developed an SIS component for its ERP system, agreed to deliver the SIS component by June 30, 2000. Further, SAP agreed to pay the university $12,500 per month, not to exceed $250,000 total, in the event the SIS software was not delivered by that date. The implementation vendor contract was awarded to Align Consulting on a time and materials basis, with a $5 million base and $9 million cap.

Following the contract awards in February 2000, development of the ERP system began. Because the SIS module had not yet been developed by SAP, the implementation strategy was to first implement the finance module, then the human resources module, and finally the SIS module. Align Consulting proposed an accelerated SAP implementation strategy that would complete system implementation in 18 months. Align Consulting brought staff on-campus to begin the finance implementation and train William and Mary staff in using SAP software. A financial blueprint was also developed that outlined all the business processes that would need to be addressed by the SAP software.

The College of William and Mary and Align Consulting both experienced turnover in project management during this development phase. William and Mary's original project manager resigned in April 2000 to accept a chief information officer position at another university. The second project manager resigned one month later and followed the first project manager to the other university. The third project manager resigned in July 2000 because of family health problems. The fourth and final project manger, a vice-provost at the university, was assigned to the position in August 2000. Similarly, Align Consulting replaced its project manager three times during the same period. In addition to the steady turnover in project managers, the quality assurance consultant from Satori Management resigned in July to accept a position as president of Align Consulting's North American operations.

In August, William and Mary's fourth project manager was charged by the provost to conduct an assessment of the ARIA project. After reviewing new and higher cost estimates for implementation of the finance module and the revised implementation date, the project manager recommended suspending the project in September 2000. The provost agreed and officially terminated the contract with Align Consulting in November 2000.

Following termination of the contract with Align Consulting, the university undertook an in-depth study to determine if it should continue ERP system implementation with SAP. After determining that the SIS module was the most critical need, William and Mary decided to terminate its software maintenance contract with SAP in June 2001 and seek a software vendor that had a fully developed SIS.

Absence of Critical Elements Contributed to ARIA Failure

Most of the elements critical for the successful implementation of information systems were absent from the ARIA project. The project, which was terminated after seven months, seems to have suffered especially from an inadequate feasibility

assessment, poor vendor and product selection, weak legal contracts, ineffective project management, and ineffective project oversight and control. A summary of the presence or absence of elements critical to project success is provided in the exhibit on the following page.

Technical Feasibility Was Unproven. One of the elements absent from this project was development of a system with proven technical feasibility. Implementing a commercial off-the-shelf ERP system with an SIS module was well established as a feasible technology. However, William and Mary chose to be a pioneer by selecting a vendor that had not yet developed an SIS, even though there was no compelling reason to do so. By choosing a vendor without a developed product, the unproven technical feasibility of the selected product became a significant risk for the project.

Vendor and Product Evaluation Was Inadequate. The vendor selection process for the ARIA project had several shortcomings. The university entered into separate contracts with vendors for software, implementation, and quality assurance. In the cases of the implementation and quality assurance vendors, there was inadequate background research performed prior to the selection of the vendors. William and Mary chose a foreign implementation partner that had little experience working with American universities. Yet the university relied primarily on the written response to the RFP and failed to perform adequate background research on the selected vendor. In addition, the university did not check the references of the consulting firm selected to perform quality assurance for the project before entering into a contract with the company.

The RFP process for the selection of the software vendor also appears to have been problematic. William and Mary received only three responsive proposals for the ERP software by the deadline, and only one of the three vendors, SCT, had an already developed SIS. A fourth responsive proposal was received from PeopleSoft, which had already developed an SIS, but was disqualified because its proposal arrived 30 minutes after the deadline. However, despite receiving only one proposal that included an already developed SIS and knowing that a responsive proposal that included a developed SIS had been disqualified, William and Mary chose not to reissue the RFP, but instead chose to proceed with the selection process.

A further problem with the selection process was that the selection of the implementation partner may have been biased. The quality assurance consultant was a member of the team that selected that implementation partner. Four months after Align Consulting was awarded the implementation partner contract, the quality assurance consultant was hired by Align to be president of its North American operations. The process used to select Align was subsequently reviewed by the Office of the Attorney General and the Auditor of Public Accounts (APA). The Attorney General ruled that nothing illegal took place, because there was no evidence of prior contact between Align and the quality assurance consultant. The APA stated the

Presence of Elements that Contribute to Project Success Accurate, Reliable Information Access			
✔ Present	**✓ Partially Present**	**✗ Absent**	
Identification of Functional Needs and System Requirements		✓	
Proven Technical Feasibility			✗
Adequate Organizational and Business Process Analysis		✓	
Adequate Vendor/Product Evaluation and Selection			✗
Strong Legal Contract			✗
Effective Project Management			✗
Involvement of End-Users	✔		
Effective Project Oversight and Control			✗
Reliable Funding		✓	

legality of the university's process was "in a gray area," and the process was "probably a good case study of how not to do this."

Finally, the selection process for the quality assurance consultant had several irregularities and may have compromised the success of the project. The consultant, who had a prior association with the first project director, had originally been paid $5,000 for consulting services prior to development of the RFP. He was then awarded a sole-source fixed-price contract for $30,000 for RFP development services. In addition to the sole-source contract, he was also paid close to $160,000 from private funds. Upon completion of the RFP, the project director sought to procure the consultant's services on an open-ended basis through a sole-source, time and materials contract. The university denied the sole-source request and required that the RFP be sent to at least six vendors. However, only Satori Management responded to the RFP and was subsequently awarded a time and materials contract at the rate of $2,000 per day. The office of internal audit later discovered that the other five vendors on the distribution list had incorrect phone numbers and addresses and likely never received the RFP.

Legal Contracts With Vendors and Consultants Put William and Mary at Risk. None of three contracts entered with vendors for the project adequately protected the university. The contract with SAP was problematic because it did not sufficiently protect the university if SAP failed to develop an SIS system, which was the cornerstone of the integrated system. William and Mary paid SAP approximately $1.4 million for software licenses and annual maintenance. However,

in the event that SAP did not deliver the SIS module, the refund to the university could not exceed $250,000.

The time and materials contract with the implementation partner was problematic because payments were not tied to deliverables. The contract with Align Consulting had a base of $5 million and a cap of $9 million. Because payments were not tied to deliverables and implementation was taking longer than expected, the university paid approximately $3.8 million to Align Consulting over a period of seven months before terminating the contract without having successfully implemented any of the ERP system modules.

The contract with Satori Management for quality assurance services also did not require specified deliverables for payment, and the contract was unclear regarding payments for travel and other expenses incurred by the consultant. William and Mary spent over $550,000 in consulting fees to Satori Management for the ARIA project. The majority of these costs arose from the open-ended time and materials contract. Under this contract, the university agreed to pay Satori $2,000 per day for the consultant's services. The quality assurance services supposedly performed by Satori were never documented by the consultant. Satori billed the university at this rate plus travel and expenses, even though William and Mary believed that the $2,000 per day amount included travel and expenses. The dispute was settled by paying Satori the additional travel and expense fees through its endowment funds.

Project Management Was Unstable and Ineffective. There were multiple problems with the project management that all contributed to the project's failure. Project management turnover was constant. The ARIA project had four different project managers from the start of the project in February 2000 to its termination in November 2000.

Another problem was the lack of training or experience of the project managers. The first three project managers did not have the necessary training or experience to lead the system development effort. None of the project managers had any formal training in project management or experience managing an ERP project, and none were assigned to the project on a full-time basis. Their lack of experience was exacerbated by the fast track implementation schedule proposed by Align Consulting and the time and materials nature of the contract, which demanded strong contract administration.

A final problem with the project management structure is that the first three William and Mary project managers were from the IT division instead of from an operational unit of the university. The final project manager was an executive from the provost's office and was able to assess the shortcomings of the project and take appropriate action to address them.

Project Oversight Was Inadequate. Another element that was absent was effective oversight. There was a project steering committee established, but it was only minimally involved with the project, and the quality assurance consultant did not provide effective independent oversight. William and Mary leadership appears to have relied too heavily on the recommendations of the CIO, who was the

original project manager, throughout the early stages of the project without any ongoing oversight of the project. After the quality assurance consultant terminated his role with the university to become president of Align Consulting, the university did establish more effective project oversight through the offices of the provost and internal auditor. This oversight eventually led to an assessment and termination of the project.

As mentioned previously, the quality assurance consultant, who was retained to independently review the project, apparently did not perform his job. There is no documentation that he ever performed any quality assurance. Moreover, it would have been difficult for him to effectively perform an independent review, because he was involved in the selection of the software and the implementation partner and part of the project management team.

Solution Did Not Meet Highest Priority Functional Need. One of the elements only partially present was an adequate identification of functional needs and system requirements. While there was effort to involve end-users in developing the system requirements, the College of William and Mary did not select an appropriate solution to meet the university's critical functional needs. William and Mary identified its most critical need to be a new student information system, but its selected solution was an enterprise resource planning (ERP) system that would have provided the university with integrated student information, finance, and human resource systems.

By not focusing on the university's greatest need, a vendor was selected that had not yet completed development of its student information system software product. As a result, William and Mary was forced to proceed with implementation of the finance and human resources modules first while the SIS module was still in development by the vendor. With limited financial resources, this increased the risk of the university not being able to implement the SIS, which is its most critical business need.

Project MAST Has Addressed Shortcomings of ARIA Failure

Following the termination of the contract with Align Consulting, William and Mary reassessed the overall project and decided to terminate its licensing agreement with SAP and to place its focus on developing an SIS. The university reissued an RFP for an enterprise system. This time, the university selected SCT's Banner software product, which had a fully developed student information system module. The new project has been termed Project MAST (Mastering Administrative Systems and Technologies). Planning for the project began in August 2001, and it is expected to be completed by September 2005. The SIS module is expected to be fully implemented by September 2003. Implementation of the SIS is currently ahead of schedule and within budget.

Many of the critical elements missing from the ARIA project appear to be present in the MAST project. This time, the university's highest priority has been development of a new SIS, and it is therefore implementing an established mainstream system (SCT Banner). The university has decided not to customize the soft-

ware and has begun reengineering its business processes to fit the software package. The project management structure for MAST appears to have been improved substantially. The project manager is a business leader, instead of a technologist, and is assisted by a full-time staff person with previous experience implementing SCT Banner at another college. Project oversight also appears to be much improved, with an internal oversight committee responsible for reviewing proposed changes to project scope and quality assurance provided by the office of internal audit.

COMPREHENSIVE ENVIRONMENTAL DATA SYSTEM

The Comprehensive Environmental Data System (CEDS) project at the Department of Environmental Quality (DEQ) is an agency-wide information system designed to provide electronic access to all environmental data. CEDS was initiated to consolidate the agency's disparate systems into a single database as well as correct year 2000 problems in DEQ's information systems. When the project began in December 1996, it was estimated that DEQ had more than 140 individual databases, and that consolidation would reduce costs and allow for increased information sharing within DEQ. An exhibit on the following page summarizes the project.

Narrative Chronology of the CEDS Project

In April 1993, four separate State agencies were combined to create DEQ: the Department of Air Pollution Control, the Department of Waste Management, the State Water Control Board, and the Council on the Environment. The primary business units, or "media," that were created within DEQ are generally labeled the Air, Waste, and Water Divisions. As a result of this recent consolidation, DEQ's information system was decentralized and media-oriented when CEDS was initiated. The pre-existing information systems could not function as enterprise-wide applications in the new agency because each system reflected the business processes used by the older agencies prior to consolidation. When these older systems were aggregated into DEQ's overall information system, their limited ability to integrate and share data resulted in a "stove pipe" configuration. The project was supported by a February 1997 Department of Planning and Budget (DPB) report, which recommended "the effective and rapid implementation of the Comprehensive Environmental Data System."

The CEDS project therefore represented more than just the creation of an integrated database. It was also part of a continuing attempt to unify the older organizations into a single agency. Additionally, the CEDS project was expected to produce other benefits for DEQ. For example, staff productivity might be increased by reducing the number of duplicate databases and by sharing common information within DEQ. Furthermore, by increasing standardization and using common software, DEQ could improve maintenance of the databases as well as improve the agency's ability to respond to new regulatory requirements.

After the project began in 1996, DEQ retained the consulting firm of Coopers and Lybrand to assist in the development of general system requirements. A users group was established to work with the consultants, and in August through November 1997 DEQ held two major end-user conferences. In these user meetings, attendees focused largely on identifying which data would be used across all of the media. These data requirements were used by Coopers and Lybrand to develop the first planning documents: the Pre-development Analysis Document and the System Analysis and Design Document.

Comprehensive Environmental Data System
Department of Environmental Quality

Projected Cost	Not Documented
Actual Expenditure	$13.3 million * (as of August 2002)
Projected Timeframe	Not Documented
Actual Timeframe	December 1996 – December 2001
Status	Operational, but additional development is planned
Purpose	To mitigate year 2000 concerns and to integrate over 140 individual databases.
Rationale	Year 2000 concerns required attention, and further integration was necessary to improve productivity.
Vendors and Products Used	No implementation vendor used. Oracle database was purchased, and temporary contract programmers were used.
Problems/Successes	System is in operation and meets most of the agency's basic needs.

* Cost does not include DEQ internal costs.

Source: JLARC staff analysis of agency project documentation.

The focus of the user meetings and planning documents was directed toward integrating existing systems, and the agency's business processes were not modified. As the Pre-Development Analysis Document states, "the intent of the CEDS 2000 project is not to reengineer the current work processes or DEQ internal organizations." Instead, CEDS was designed to improve existing processes by consolidating "the current information systems into a more effective, efficient, multimedia report supporting, information architecture."

During this planning period, DEQ was approached by American Management Services (AMS), which was beginning to develop environmental database applications. However, after reviewing the AMS software DEQ decided that it was not prudent to consider using undeveloped software. DEQ staff indicate that the need to implement CEDS before the year 2000, and the agency's ongoing federal reporting requirements, played a large role in this decision, but also state that the AMS product was inferior to what DEQ had already developed.

At this time DEQ also decided to discontinue the services of Coopers and Lybrand, because its system design did not meet DEQ's requirements, and to instead develop CEDS in-house. DEQ decided to use an Oracle database and to supplement DEQ's technical staff with "bodyshop" contractor personnel.

After the initial project planning activities were completed in the Spring of 1998, a process that involved the participation of more than 80 DEQ staff representing each of the media, DEQ began software development. DEQ formed a three person project management team consisting of two user representatives and the Director of the Office of Information Services (OIS). The project management team was responsible for all project management activities, and an oversight committee consisting of regional directors and other managers was also formed. New user groups with eight to 15 members were created to represent the three media, and by late 1998 DEQ had supplemented approximately 14 full-time information technology staff with 25 contractual staff from four "body shop" vendors. During the rest of 1998, the initial system design and data structure was developed, along with screen layouts and other basic system features.

Each user group was responsible for assisting in the development of their assigned module, an example of a Joint Application Development methodology. Teams consisting of end-users and technical staff were formed for each CEDS module, and regular meetings were held at which test versions of the software were reviewed. Although this process seems to have worked well, the end-users on each team primarily focused on their own module and relied upon the project management team to examine system-wide issues. However, DEQ states that cohesive project management, along with a consideration of system-wide issues, were lost when the project management team was disbanded.

CEDS Version I began being used by the agency's three largest media – Air, Waste, and Water – on December 1, 1999. At this point, three significant changes occurred. The project management team was disbanded and the OIS director became the project manager. In addition, four additional modules were added to the three already under development. Finally, a second development methodology, Rapid Application Development, was introduced to parallel the JAD methodology. This second methodology involved the use of an iterative process to quickly develop a sequence of prototypes, each including additional refinements and functionality. By delivering prototypes to users at an accelerated pace, Rapid Application Development can decrease the number of changes requested by users and thereby minimize changes to the project's schedule.

Beginning in January 2000, the Rapid Application Development process was used to create specific application screens and reports in successive iterations, and historical data was "cleaned" and then introduced into the new data tables. By March 2001, there were production modules in CEDS for the agency's primary programs. During the rest of 2001, most of the work on CEDS focused on correcting bugs in the software and adding additional features and reports. An effort was also made to begin work on the agency's Internet initiative, e-DEQ. After December 2001, CEDS entered the maintenance phase of its lifecycle, and OIS staff state that CEDS is now in the "operational" phase. The Department of Technology Planning has recently requested that the project be officially closed out, which would remove CEDS from any future State oversight.

CEDS has successfully met its primary objectives. Many of the decisions made during systems development were directed at ensuring that DEQ's informa-

tion systems would be year 2000 compliant. In addition, DEQ needed to ensure that its environmental data was free from errors, that the number of databases was reduced, and that the amount of standardization was increased. In addition, CEDS has allowed DEQ to make some water quality data available over the Internet. Finally, CEDS was also intended to integrate the media within DEQ, in order to provide a multi-media perspective, while also supporting the agency's federal reporting requirements. According to DEQ staff, these goals have been successfully met.

However, the manner in which CEDS was developed may limit its future usefulness. One successful outcome of the CEDS project has been a significant reduction in the number of databases and a corresponding increase in the integration of agency data. Yet CEDS is still a "stovepipe" system in many ways, because the major media areas use different modules. CEDS is only truly integrated at the "core" level, in which common data for each facility is maintained. The three media areas have different modules in part because each area has unique business processes.

Additionally, there are certain features or functions of CEDS in which user expectations have not been met, and in some cases these may hinder agency operations. Users have expressed satisfaction with the series of frequently used reports provided by CEDS, but indicate that they are limited in their ability to perform non-routine searches, as might be required to respond to a Freedom of Information Act request. As a result, some DEQ staff have reported that separate databases are being maintained, a situation which CEDS was supposed to prevent. In addition, CEDS does not provide users with the ability to perform robust statistical or GIS-based analysis.

Users also report a wide-spread expectation that CEDS would enable the general public to access CEDS data over the Internet. Although some water quality data is available on DEQ's website, most information is provided as electronic documents, such as permit applications and other forms, and the entirety of CEDS data is not searchable by the general public. The new Internet initiative, e-DEQ, is designed to increase the amount of publicly available data, but some staff maintain that DEQ is not ready to make CEDS data publicly accessible because of concerns over data quality. There is widespread agreement, however, that CEDS has increased the level of data quality control.

Project Success Was Limited by Partial Presence or Absence of Key Elements

The CEDS project was hindered by the partial presence or absence of key elements, although the strong presence of other elements contributed to the successful completion of most project goals. The strongest elements were the vendor and product evaluation and selection, and end-user participation. Less effective elements were project management, project oversight and control, and access to reliable funding. An exhibit on the following page summarizes the presence or absence of the key elements.

Presence of Elements that Contribute to Project Success Comprehensive Environmental Data System			
✔ Present	**✓ Partially Present**	**✗ Absent**	
Identification of Functional Needs and System Requirements		✓	
Proven Technical Feasibility		✓	
Adequate Organizational and Business Process Analysis		✓	
Adequate Vendor/Product Evaluation and Selection	✔		
Strong Legal Contract	N/A		
Effective Project Management		✓	
Involvement of End-Users	✔		
Effective Project Oversight and Control			✗
Reliable Funding		✓	

Thoughtful Vendor and Product Evaluation Proved to Be Essential. One strength of the project was the decision to not use an undeveloped software product, and instead develop CEDS in-house. DEQ retained Coopers & Lybrand to design the system specifications and assist with developing system requirements. However, after deciding that the vendor's system design did not meet the agency's needs, DEQ staff decided to develop the project in-house with assistance from temporary contract or "bodyshop" programmers.

After beginning this in-house development effort, DEQ was contacted by another vendor, American Management Services (AMS), which was in the early process of developing an environmental database application. DEQ assembled a large group of staff to review the AMS product at a day-long presentation. Subsequently, DEQ decided against using the AMS system because of its cost and the risks associated with waiting for an undeveloped product. Moreover, OIS staff were confident in their ability to develop the system. The decision to not use an undeveloped product allowed DEQ to finish CEDS before the year 2000. The Oracle products selected for CEDS represent a mature database technology and are widely used – a fact that increased the ability of DEQ to use bodyshop programmers as needed.

End-Users Were Heavily Involved Throughout the Project. The CEDS project has been marked by the extensive involvement of users in all aspects of the project. Beginning with the initial planning for CEDS, users have attended focus groups, assisted in the development of requirements, and evaluated vendors. User groups have also assisted in training, validated data conversion accuracy, and worked on the development of user guides.

The decision to use a Joint Application Design (JAD) methodology for systems development further increased the involvement of users. During the most intensive phase of systems development, approximately 125 of the agency's staff belonged to one of seven user groups. These groups were directly responsible for the development of their respective modules, and were also responsible for obtaining input from their peers outside of the user groups. In recent months, user group members have conducted initial system testing, which had previously been done by OIS staff, and this change has decreased the number of user-reported errors associated with new versions of CEDS.

Project Management Structure Was Not Effective. A weakness of the CEDS project was that the individuals assigned project management responsibilities also had other duties within the agency, reducing their ability to exercise full-time project management. When CEDS began, project management responsibility was given to a three member project management team. Two members of the team were business user representatives, and the third member was the Director of the Office of Information Services (OIS), although each individual served in a part-time capacity. In December 1999, project management was assumed by the OIS director. This change eliminated business user representation from the project management structure. Simultaneously, as the project management structure was reduced from three individuals to one, the number of modules under development increased from three to seven. The new project manager, by virtue of his role as OIS director, also had other duties that limited him to part-time project management.

It appears that the ability of the CEDS project to accomplish system-wide goals was hindered by the absence of full-time project management. DEQ staff have described project management as "being done by the seat of their pants," and state that a project management process was developed as the project progressed. DEQ did not have any training requirements for project management, or any guidelines or standards for systems development. DEQ staff have reported that the OIS director was able to provide effective management of the contract personnel, but that the project plan for CEDS did not set overall priorities. As a result, the project did not accomplish some of its overall goals, such as public access to CEDS data over the Internet, but the individual goals for each module were substantially completed.

The specific goals for CEDS 2000 were never fully documented, and it does not appear that the OIS director prioritized the project's goals. According to DEQ staff, each of the user groups followed their own task lists, and no overall project plan was ever developed. Each user group knew which goals were important for the media they represented, but there is no indication that the project manager communicated specific deliverables or goals for the overall project. DEQ staff expected that CEDS would have certain features, such as the provision of publicly accessible data over the Internet, but did not know if these features would actually be developed.

In late 2001, DEQ assigned a separate project manager for daily operational project issues, and for the first time developed a project plan that looks at project-wide issues. Although DEQ still does not have systems development standards, the agency has stated that based upon "lessons learned from the current CEDS project, it will be essential that effective project management and oversight be estab-

lished" for future development efforts. According to DEQ, steps have been taken to provide structure to agency project management efforts, including the implementation of development standards and an Information Technology Investment Management program.

Effective Oversight and Control Was Not Present. DEQ did not exercise effective oversight of CEDS, in large part because the oversight committee rarely met and had little technical expertise. The oversight committee for CEDS consisted of regional directors and other managers, and was tasked with resolving major conflicts that had not been successfully addressed by the project manager and user groups. However, this committee met only two or three times and did not possess an understanding of the technical issues involved in systems development. As a result, the project management team felt that the oversight committee was not providing clear direction and stopped bringing issues to their attention.

In late 2001, DEQ created a core users' group to provide project oversight and to address system-wide issues. The new user group has been assigned responsibility to prioritize tasks based on their overall importance to the project, which represents the first attempt to look at the project on a comprehensive basis across all of the business units, or media, involved.

Adequate Funding Was Not Available for Each Media's Project Team. Another element that was only partially present is adequate funding. DEQ reports that sufficient funding was available for the project as a whole, but that funding constraints have limited the development of certain aspects of the project. Access to federal funds varies across the media in DEQ. For example, the Air media has traditionally been able to access a regular stream of federal funds, while the Water media – which accounts for half of the CEDS project – is wholly dependent upon State general funds. As a result, the Water media has not had a sufficient number of contract staff to develop their modules.

The effects of unequal funding have been present throughout the project. According to the Pre-Development Analysis Document, "there is the belief that programs that receive Federal dollars will drive the priority for development. This concern will remain as a consideration throughout the development period." The fact that federal funding was available only for certain media was emphasized in DEQ's Information Resources Portfolio, which stated that DEQ "will maximize use of non-general funds for certain program areas to minimize impact to general fund use." DEQ has recently taken steps to assign technical staff to media without regard to the level of funding, but future progress may be hindered by the dependence of some media on general funds. The agency states that recent budget constraints have reduced the CEDS programming staff by two-thirds, which will limit future development efforts.

EVA ELECTRONIC PROCUREMENT SYSTEM

The Department of General Services (DGS) is developing an electronic procurement system known as eVA. System development officially began in May 2000 at the direction of the former governor, and the new system was released with limited functionality in March 2001. Full implementation is expected by January 2003, although some State agencies may not fully use eVA until July 2003. eVA is intended to provide new purchasing tools for all State agencies and local governments, as well as gather information on agency buying patterns. In addition, eVA is intended to reduce the need for agencies to maintain their own purchasing software by creating a central purchasing and procurement system. The total cost of the system is projected to be no more than $22.8 million, although an additional $3 million has been set aside for possible upgrades. EVA is not owned by the Commonwealth, but is instead provided by a service contractor, American Management Services (AMS). Use of eVA has increased substantially since March 2001, and DGS reports that over 54,000 purchases have been processed in eVA.

As the project progressed, three major decisions regarding the project have hindered implementation – short deadlines required by the former governor, the adoption of a reverse-funding model for financing, and the shift from optional to mandatory use of eVA during implementation. It appears that these decisions were made at a level higher than the Department of General Services. These three decisions have contributed to the partial presence of most of the elements that are important to project success, and have created additional challenges for DGS during the systems development process. An exhibit on the next page provides a summary of the project.

Narrative Chronology of the eVA Project

In 1999, DGS began a series of electronic procurement initiatives which culminated in the eVA system. These initiatives built upon an earlier DGS effort in 1995 to initiate an electronic procurement project, which was discontinued because the available technology was inadequate. The move toward eVA began in earnest during 1999 when a new director was appointed to head the Division of Purchases and Supply, the division within DGS that promulgates State procurement regulations. DGS implemented a central web site for vendor registration, plus a pilot website for electronic shopping, or "e-mall," similar to the websites of private sector entities like Amazon.com. During this time period, many of the larger State agencies and institutions of higher education were implementing Enterprise Resource Planning (ERP) applications. ERPs integrate electronic procurement functions along with internal audit controls and other financial management tools.

In May 1999, DGS formed an inter-agency design team to develop system needs and requirements. DGS then gave a demonstration to the former governor in August, and preliminary system needs and requirements were presented at a statewide end-user forum in November. Subsequently, the governor's proposed budget for 2000-2002 included $2.5 million in non-general funds "to establish a

eVA Electronic Procurement System
Department of General Services

Projected Cost	$22.8 million
Actual Cost	$22.8 million (estimate as of September 2002) *
Projected Timeframe	May 1999 –June 2006
Actual Timeframe	May 1999 – June 2006
Status	Partially Implemented
Purpose	To provide a single location for State electronic procurement activities, as well as additional procurement tools and information.
Rationale	Additional services are beneficial for agencies and vendors, and by increasing competition eVA will decrease the cost of goods and services.
Vendors and Products Used	American Management Services acts as implementation vendor and provides its Buysense and Advantage products. AMS also uses Ariba software.
Problems/Successes	Full implementation is expected by January 2003. However, problems have occurred with the funding model and system functionality.

* Cost estimate excludes contingency funding of $3 million, and does not include any costs at line agencies or suppliers. According to DGS, the actual cost may decrease if DGS internal costs are lower than anticipated.

Source: JLARC staff analysis of agency project documentation.

statewide electronic procurement system." The source of the nongeneral fund revenues was intended to be internal service fund charges to State agencies.

In January 2000, DGS posted a draft statement of need on the agency's website for comment by State agencies, their suppliers, and potential vendors of an electronic procurement system. In May, the 2000 Appropriation Act provided a $3 million treasury loan to DGS to pay for a statewide electronic procurement system. Loan repayment would be financed by fees charged to State agencies. Before DGS could request the loan, however, it was directed to explore other financing strategies in consultation with the Department of Planning and Budget.

According to DGS staff, the former governor was briefed on the proposed system in March 2000, after which he directed DGS to implement a working system within two months. DGS staff indicated that this was not possible, and on May 24, 2000 the governor issued Executive Order 65, which directed DGS to implement a

web-based electronic procurement system no later than March 1, 2001. The Executive Order also directed all executive branch agencies and institutions to "take advantage of its benefits to the fullest extent possible."

In response to the requirements of the 2000 Appropriations Act, the governor directed the Secretary of Finance to select a financing option for developing the system. The Secretary of Finance's advisory committee chose a "self-funding" model, in which the users of the system – both agencies and suppliers – would bear the costs. DGS then held pre-solicitation conferences in May with end-users and software companies.

The decision to implement a working system within nine months was not consistent with the recommendations of the Council on Information Management (CIM). In December 1998, CIM presented a study on electronic procurement which recommended that any future initiative begin with pilot studies to assess the feasibility of such a system. A pilot study would enable the Commonwealth to gather information on the technical feasibility of a statewide system, the costs and benefits of such a system, and the degree to which existing agency financial management systems would need to be modified. According to DGS staff, the Secretary of Technology stated that pilot studies would slow the pace of development at a time when the governor wanted Virginia to be a leader among other states in electronic procurement. Furthermore, DGS staff have stated that the former governor wanted to complete development of the system before leaving office in case the next governor did not support the project. Also, DGS staff acknowledge that the agency did not want to forego the opportunity.

On June 15, 2000, DGS issued an RFP for an electronic procurement system. Specific requirements included an e-mall, central vendor registration, a requisition and purchasing system, and the collection of purchasing data in a "warehouse." In keeping with the self-funding model, the RFP noted that 20 percent of the evaluation criteria for contract award was based upon the vendor's ability to be "creative and innovative in identifying revenue streams."

Ten vendors responded to the August 9, 2000 deadline for the submission of proposals, and DGS then entered into negotiations with two vendors in the last week of September. On October 27, DGS presented an analysis to the governor's Chief of Staff that discussed the system's anticipated features, benefits, funding model, and risks. As part of this analysis, DGS recommended that the system be mandatory for executive branch agencies.

A contract was awarded to American Management Services (AMS) on October 30, 2000. Under the terms of the contract, AMS operates as an Application Service Provider (ASP) and will provide the hardware and software for eVA until June 30, 2006. The use of an ASP approach for eVA is intended to reduce the systems development costs that are paid by the Commonwealth, although the Commonwealth will not own eVA as a result. Should DGS or AMS cancel the contract, the Commonwealth would retain the purchasing data in eVA, but would have no other rights to the system. The contract states that usage of eVA by suppliers and State agencies is optional:

> As routinely emphasized by COVA in the subject RFP, pre-proposal conference, oral presentations, and contract negotiations, COVA Entities may use all, some, or none of the Solution functionality.

According to DGS, "the contract stated that usage of eVA would be optional as the Commonwealth was still contemplating whether to make eVA mandatory."

The "reverse" funding model proposed by AMS is a variation of the "self-funding" model proposed by the Secretary of Finance. Under this model, the suppliers of State agencies would pay for the development of eVA, but the Commonwealth would not – hence the charges were "reversed." In order to recover their initial capital outlay, AMS proposed charging vendors an annual registration fee, plus a one percent fee on each transaction capped at $500 per order. The contract also guaranteed AMS minimum revenue of $15 million. If the actual revenue from transaction fees is less than the guaranteed level in any given period, the Commonwealth must pay AMS the difference.

The funding model was intended to provide sufficient incentives to both AMS and DGS to provide a quality product on a timely basis. Moreover, the incentives in the funding model were especially important given the optional nature of eVA, a fact recognized by AMS in its proposal:

> Despite aggressive sponsorship by the Governor and the multi-agency committee behind eProcurement, this initiative has been framed as voluntary for government purchasers and suppliers. Therefore, it must succeed on the basis of the value it delivers to all users.

By March 2001, six pilot agencies were using certain core services, including the eVA website or "portal," an updated e-mall, a single vendor registration location, and the electronic delivery of orders for registered vendors. On March 6, 2001, the governor's Chief of Staff issued a memorandum which "strongly urged" agencies to "take advantage of the many benefits of electronic procurement and Virginia's landmark eVA initiative." DGS states that this memorandum, in conjunction with Executive Order 65, mandated the use of eVA by all State agencies. However, agencies continued to believe that participation was optional.

On October 9, 2001, DGS used its rulemaking authority to require that all purchases be made through eVA by no later than December 1, 2001. This rule clearly mandated the use of eVA by specifying the manner of its use and the date for full compliance. DGS states that the rule was necessary because agencies were not adequately using eVA. In addition, DGS also stated that the "extent to which agencies and institutions use eVA will be taken into consideration when evaluating requests for (and maintenance of) higher levels of delegated purchasing authority." In February 2002, DGS extended the deadline to July 2002. DGS also began to amend statewide contracts to require that all agency orders be transmitted through eVA.

Following the October rulemaking, DGS formed an inter-agency design team in November 2001 to design and implement data exchange interfaces between

eVA and line agency ERP systems. Although DGS had been working on interface design prior to November, line agencies had not been included in this process. Several different types of ERP systems exist at line agencies, and a different interface is necessary for each type. The interface design group was also required to develop standards for the data to be exchanged, such as standard units and weights of measure. State data standards had not previously existed, which increased the system development burden for DGS and line agencies.

Another significant change occurred during the 2002 session of the General Assembly, when DGS was granted the authority to charge State agencies $7.1 million in fees for fiscal year 2003. In addition, the Governor increased DGS's treasury loan from $3 million to $8 million, of which DGS has expended $2 million. The decision to charge agencies for eVA in fiscal year 2003 came in response to supplier complaints about the funding model, and their demand for additional time to develop their own electronic procurement capabilities. DGS states that they intend to resume charging suppliers in fiscal year 2004, and may charge agencies a fee for continuing to use suppliers that are not registered with eVA. According to documentation provided to the interface development team, DGS is also considering charging transaction fees "for any intra- or inter-governmental order processed through eVA," which may include sales to State agencies by the Virginia Distribution Center and Virginia Correctional Enterprises.

In July 2002, DGS negotiated a contract modification with AMS. DGS also issued a rule requiring all suppliers to register with eVA. DGS renegotiated the contract in order to accelerate payments to AMS because the reverse-funding model was not providing sufficient performance incentives for the vendor. The new payment schedule also marked the first time that payments were tied to specific deliverables. DGS states that the contract modification will not increase the total amount of revenue guaranteed to AMS, although the agency has requested additional system functions that will cost approximately $1.4 million in the current fiscal year. Additionally, DGS exercised its rule-making authority to modify the State's Vendor Manual. The modification provides that "registration in eVA is required in order to do business with State agencies and institutions." Recent statewide contracts have also stated that "vendors are not allowed to accept or fulfill orders that are not submitted through eVA."

As of November 2002, six agencies have successfully developed interfaces to connect their ERP systems to eVA, and it appears that some other agencies will be able to develop interfaces modeled on those already developed. The interfaces appear to have increased the number of transactions being processed through eVA. However, some line agencies have indicated that a shortage of funds will slow their interface development efforts, as well as curtail their level of spending in eVA. Both the line agencies and DGS have expended a considerable effort designing interfaces, which will need to be updated as changes to either eVA or agency ERPs occur. A substantial amount of this work resulted from the absence of State standards for technology and data.

The State also needs to increase the number of agency suppliers that are registered with eVA, and that have electronic procurement capability. At present,

only 30 percent of agency orders are delivered electronically to suppliers, in large part because vendors are not registered. Orders sent to unregistered vendors are not placed in eVA's data warehouse, but are instead placed in a second database which DGS cannot analyze. This limits the usefulness of eVA by hindering the ability of DGS to analyze statewide purchasing activity. It is important to note that despite these present limitations, eVA has provided the State with the ability to analyze agency purchasing data. The eVA project plan indicates that interface development work will continue through June 2003. In addition, the project plan also indicates that some maintenance tasks, such as upgrading the eVA software and data warehouse, will not be completed until the last half of 2003.

Once eVA is completely developed, DGS expects that the system will benefit the Commonwealth by increasing the efficiency with which State agencies process procurements. This will be accomplished by using electronic transactions to reengineer the procurement process, as well as add new procurement capabilities that are not available to State agencies. DGS also notes that a goal of eVA is to allow "all vendors in the Commonwealth to be able to do business electronically, thus eliminating unnecessary costs incurred by vendors and enabling them to operate more efficiently with greater access to the procurement process." However, DGS also notes that "it takes time to achieve this goal and until it is achieved the Commonwealth will not be able to operate as efficiently as desired."

The total costs associated with eVA over the five year project should not exceed $22.8 million, and DGS states that some of these costs will be paid by the Commonwealth's share of the revenue from eVA. DGS intends to use their revenue from eVA to pay for their internal expenses, including repayment of the treasury loan, as well as to defray the $7.1 million charge assessed to line agencies. However, DGS states that line agencies will not have to pay for the treasury loan "unless eVA does not make enough revenue." The $22.8 million figure includes AMS contract guarantees of approximately $15 million; payments for additional functionality of $1.4 million in FY 2003; DGS staff costs of approximately $3.3 million; and other DGS costs of approximately $3.1 million. In addition, DGS has set aside an additional $3 million as a contingency for the remaining years of the contract. DGS states that internal costs should decrease over time, and may be less than currently anticipated.

The $22.8 million cost does not include any additional implementation costs for interface development or hardware purchases that are borne by line agencies, or by suppliers. For example, AMS recently changed the minimum specifications for the type of personal computer required to use eVA, and informed DGS that if agencies or suppliers begin to experience problems using eVA, "they should be encouraged to upgrade to personal computers that meet the new requirements." However, DGS states that they may decline to upgrade the eVA software in the future if an upgrade would require State agencies to purchase new computers.

Development and Implementation Have Been Hindered by the Partial Absence of Most Key Elements

Most of the elements identified as critical to the success of a major IT project have not been fully present in eVA. The partial presence of some of these elements can be largely attributed to major decisions regarding the project that appear to have been made at a level higher than the Department of General Services. One of these key decisions was the former governor's decision to drastically accelerate the timeframe for development and implementation. This limited the ability of DGS to perform all of the elements required to successfully implement the project. The second decision that adversely affected the project was the use of a reverse funding model to help pay for the project. Use of this model appears to have given revenue generation equal importance with systems development. The third adverse decision was the decision to change participation in the project by State agencies and suppliers from optional to mandatory. This change fundamentally altered the nature of the project, but the consequences of this change were not fully addressed. Finally, an adequate business case was not developed prior to the start of the project. An exhibit on the next page summarizes the presence or absence of the key elements.

Identification of System Requirements Was Good, But Identification of Functional Needs Was Inadequate. DGS used an effective process to define the system requirements. A design team was created with membership from the technology secretariat, three State agencies, three local governments, and three institutions of higher education to develop the requirements. In addition, DGS held focus group meetings and two conferences with vendors of electronic procurement systems. The RFP contained a very detailed set of system requirements, and the process used by DGS to define system requirements made innovative use of technology by posting the statement of need on their website to solicit commentary from agencies and their suppliers.

By contrast, the functional needs of the project were not adequately identified. A functional need identified for the eVA project was the provision of a "single face for procurement" that would leverage the State's purchasing power and reduce the costs associated with procurement. However, it was also determined that eVA needed to be an optional system that agencies could elect to use. To the extent that agencies elected to not use eVA, the ability of the system to satisfy the need for a single system for procurement was diminished. In an attempt to reconcile these two competing aspects of eVA, it was decided that the project "must succeed on the basis of the value it delivers to all users." In other words, eVA was implemented with the understanding that its features would have to provide a sufficient benefit such that agencies would voluntarily use the system. If this occurred, then eVA would also create a single procurement system.

The tension created by these competing functional needs proved to be unworkable, and DGS was required to forego the optional nature of eVA in order to achieve the need for a single statewide system. However, the shift from an optional to a mandatory system has created problems. Many agencies and suppliers have resisted the system's mandatory nature and have been reluctant to use eVA.

Presence of Elements that Contribute to Project Success eVA Electronic Procurement			
✔ Present	**✓ Partially Present**	**✗ Absent**	
Identification of Functional Needs and System Requirements		✓	
Proven Technical Feasibility			✗
Adequate Organizational and Business Process Analysis		✓	
Adequate Vendor/Product Evaluation and Selection		✓	
Strong Legal Contract		✓	
Effective Project Management		✓	
Effective Project Oversight and Control		✓	
Involvement of End-Users		✓	
Reliable Funding		✓	

In addition, DGS was required to initiate development of software interfaces for ERP agencies earlier than anticipated, which has placed unanticipated demands upon DGS and line agency staff. The need to mandate use of eVA indicates that the it was not possible to meet both of the initial functional needs of eVA, and that the implementation strategy based on optional use of eVA was flawed.

Technical Feasibility Was Unproven. One element of this project that was clearly absent was the use of a proven technical solution, because eVA is a pioneering effort to increase the use of Internet-based electronic commerce in the public sector. eVA is intended to offer more functionality, and to more levels of government, than any other public sector initiative. DGS staff characterize eVA and its interfaces as "leading edge," in recognition that eVA is a path-breaking endeavor. However, as DGS staff have stated, "with leading edge technology you run into ugly things." In addition, the independent review of eVA notes that it has been "more of a development project than anticipated." The AMS software used for eVA has only been used by two other public sector entities: the State of Washington, which cancelled their contract with AMS in April 2002, and Arizona State University.

The scarcity of previously implemented electronic procurement projects in the public sector has increased the burden upon DGS to pioneer new techniques and develop solutions to previously unknown problems. During the planning stage of the project, DGS staff looked for best practices in other electronic commerce initiatives, most of which were in the private or defense sectors. Although eVA has some similarities to these projects, there are some significant differences that limit the applicability of private sector best practices. For example, private sector organizations

use fewer suppliers, while the *Code of Virginia* requires eVA to incorporate as many suppliers as possible. This requires accommodating wide variations in suppliers' technical expertise and capacity, technology standards, and willingness to participate.

Product Evaluation Was Mixed. Some aspects of vendor and product evaluation were performed adequately. DGS used an unbiased, competitive selection process, held pre-solicitation conferences, and used objective criteria for the evaluation of proposals. DGS also formed an inter-agency design team to review the potential products.

However, it appears that the effectiveness of this process was limited by the short timeframe in which to conduct the evaluation and selection, as well as the lack of a full review of product functionality. DGS staff have stated that the ten days allotted for contract negotiation did not provide enough time "to walk away and read it [the contract] cold." An additional problem with the process, which does not appear to be related to the former governor's timeframe, was the inadequate use of software demonstrations. As a result, the eVA software provided by AMS does not presently contain the type of change order functionality needed by the Commonwealth. According to DGS staff, the AMS product was the only software that included change order capability. However, DGS did not notice during the product evaluation that the Commonwealth's definition of a change order differed from that of AMS, and as a result the capability provided by AMS does not meet the needs of the Commonwealth. Change order functionality is scheduled to be provided in January 2003.

Initial Contract Had Weaknesses. Two of the three elements identified by JLARC staff as necessary for a strong contract were not present in the initial contract with AMS. First, the original contract did not tie payments to deliverables, which resulted in the underperformance of required activities by AMS. This situation was corrected by the July 2002 contract renegotiation. Second, even though eVA has been developed modularly, the contract does not include exit points that would grant DGS the flexibility to terminate the contract at various points after the completion of stand-alone modules. This creates greater risk for the Commonwealth because DGS will either have to pay the full contract amount and receive the benefits of a fully developed system, or else cancel the contract after paying a substantial amount and not have use of the system. According to DGS staff, exit points are precluded because of the requirement that all modules be developed in order for AMS to profit, in combination with the fact that AMS owns the system. In other respects, however, the contract has proven to be an effective vehicle because it details specific functional deliverables and service levels that are required of AMS, and has allowed DGS to effectively control the project's costs to this point.

Project Management Has Been Effective Overall, but Implementation Process Was Flawed. Overall, DGS appears to be doing a good job of project management, given the challenges associated with implementing a statewide system in a decentralized environment. The structure appears to be strong and the project management team includes business project managers, technical project managers, and contract administrators. DGS also required that AMS follow an established project management methodology. In addition, DGS appears to be effectively perform-

ing contract administration and technical change control. DGS has identified areas in which AMS is not meeting contractual obligations and compliance is required, and DGS staff have also demonstrated effective oversight of AMS during user acceptance testing. For example, during acceptance testing DGS discovered that AMS was not adhering to a contractual requirement to encrypt agency small purchase charge card data stored behind the firewall.

Project management was weakened, however, by the decision to mandate use of eVA by State agencies without adequate time to develop software interfaces or data standards. Although DGS recommended during project planning that use of eVA be mandated, the contract contemplated that participation by State agencies would be optional. According to DGS, in early 2001 the project team determined that mandatory use was required in order to fully test the developing system, and then in October 2001 a rule mandating its use was promulgated. However, DGS did not adequately manage this substantial change in the project. DGS mandated that all agencies begin using eVA by December 2001, but it did not involve agencies in interface development, or the development of data standards, until November 2001. This led to the inability of line agencies to use eVA by the required deadline. Presently, six agencies have implemented interfaces, although the remaining interfaces will not be completed until mid-2003.

In addition, project management has not made sufficient use of project documents that appear to be important to the management of the project. The contract states that AMS must provide specific project management documents, including plans for risk management and change management. However, DGS states that these documents will not be provided by AMS until the first quarter of 2003, approximately two and one-half years after the project began.

Effectiveness of Project Oversight and Control Has Been Limited. A strength of the eVA project is the high degree of commitment exercised by DGS management, but this has been tempered by some apparent inadequacies in the oversight process. DGS has established an internal oversight committee consisting of the Secretary and Deputy Secretary of Administration, the Director of DGS, and an AMS vice president. According to DGS, this committee has final authority for approving changes to the project's schedule and budget. External oversight is provided by the Secretary of Technology's oversight committee. The use of AMS as an application service provider requires that DGS exercise control over changes to the project's scope and expenditures, and their efforts to this point appear to be effective.

However, a weakness of the oversight structure is the lack of independent review for this project. The only independent review has been a risk assessment conducted by CACI in October 2001, although DGS plans to have CACI return at the end of this year. There does not appear to have been any ongoing or even periodic review of the technological aspects of this project. This type of periodic review appears to be needed in this instance for several reasons. First, eVA is a pioneering effort that uses leading edge technology. Second, eVA is a central administrative system of the State and has significant strategic importance. Third, eVA will affect every private sector entity that wishes to do business with Virginia.

End-User Involvement Has Been Limited. At the outset of DGS' electronic procurement initiative, end-user involvement appears to have been thorough, but it has not been adequate during systems development. Before the eVA project officially started in May 2000, DGS organized user groups to define system requirements and provide comment on a draft statement of need, and many opportunities for user input were provided. DGS has also formed a user group consisting of representatives from 14 agencies, in addition to interface development groups.

However, once DGS used its rule-making authority in October 2001 to mandate use of eVA by all agencies, eVA became another central administrative system of the State and as such required a higher level of end-user involvement. In addition, DGS does not appear to have involved end-users – both State agencies and suppliers – in the decision to fundamentally change the nature of the project by making use of eVA mandatory. In addition, end-users in the agency or supplier communities do not appear to have been consulted on how to address the issues created by the shift to a mandatory model despite the significance of the impact. Moreover, some State agencies indicate that their support for eVA was based in part on the fact that it would not be mandated, and as a result end-user participation – which is critical for a reverse-funded project – has been harmed.

Reliability of Project Funding Has Been Mixed. Funding for the eVA project has been provided in two ways: direct charges to State agencies, and a reverse-funding model. It appears that the treasury loan and the $7.1 million charge to line agencies has given DGS access to a sufficient amount of funding. However, the reverse-funding model has not provided the stable funding source that was anticipated, nor has it provided the intended incentives for vendor performance.

When eVA was planned, reverse-funding models were highly regarded, and the Secretary of Finance approved this approach. Use of this funding model reduced the need for the Commonwealth to provide up-front funding for eVA. However, the viability of this model is highly dependent upon vendors' levels of acceptance as well as the level of State agency purchasing activity. The reluctance of vendors to pay a transaction fee resulted in a charge to each State agency in fiscal year 2003. These agency charges further affected the funding model, because generating income from transaction fees requires that State agencies have the funding to engage in a sufficient level of purchasing activity.

In addition to not providing the anticipated level of revenue, the funding model has not provided the intended incentive to AMS. DGS modified the contract in July 2002 after finding that the reverse-funding model was not providing sufficient performance incentives for the vendor, and that AMS was meeting only the minimum level of effort required.

Adequate Business Case Was Not Prepared Prior to Systems Development. The eVA project is another example of inadequate business case analysis, in part because the former governor did not require that a cost-benefit analysis or any other estimation be conducted that quantified the costs and benefits expected from eVA. DGS states that the former governor was provided a cost-benefit analysis that "included consideration of interfacing agency ERP systems and impact on pro-

curement modules." However, the "Costs/Benefits/Risks" document provided to JLARC staff does not include either a quantitative cost-benefit analysis, or any mention of agency ERP systems or interfaces. In addition, when the project was changed from an optional to mandatory system, there does not appear to have been an analysis of the benefits in relation to the costs incurred by agencies that would be required to interface their own ERP procurement systems with eVA.

DGS also asserts that eVA reduces the need for agencies to maintain independent purchasing systems, although no analysis of this assertion was included in the business case analysis. DGS states that agencies have spent significant amounts of State funds on individual ERP systems which provide varying degrees of purchasing functionality, are unstandardized and often duplicative, and do not provide data that would allow the Commonwealth to leverage statewide buying power. DGS further states that a goal of eVA is to provide "the most value possible so that agencies would choose the option of migrating to the eVA procurement solution instead of paying millions to upgrade their ERP procurement modules." As such, if eVA replaces agency purchasing systems in the future, DGS anticipates that eVA will "reduce the millions of dollars spent on maintaining and upgrading the procurement modules of these ERPs." However, no analysis of these assertions was presented in the business case, and no analysis of these savings – or the need to replace agency purchasing systems – has been provided to JLARC staff. Finally, the assertion that eVA would save money through increased efficiency and lowered prices is not supported by any analysis in the business case.

INVENTORY AND CONDITION ASSESSMENT SYSTEM

In November 1998, the Virginia Department of Transportation (VDOT) contracted for the development and implementation of an automated Inventory and Condition Assessment System (ICAS), as part of the broader Integrated Maintenance Management Program. ICAS would serve as the repository for data collected on the condition of the State's transportation assets. Phase I of the project called for the development of data collection software, and for the actual collection of data in three pilot counties. This first phase, which had an actual cost of $21.4 million, was completed late and over budget. While this phase of the project ultimately met many of its goals, most of the elements that are key to the project success were either absent or only partially present. The exhibit on the next page summarizes the project.

Narrative Chronology of the ICAS Project

From 1995 through 1996, VDOT conducted a major business process review of its maintenance operations and determined that a fundamental change was needed in the way highway maintenance was conceived, planned, implemented, and funded. As a result of this business process analysis, VDOT determined that an inventory and condition assessment of the State's transportation assets should be conducted. The asset management approach would focus on the condition of an asset and establish simple, practical definitions of performance targets that address specific maintenance activities and desired outcomes. Furthermore, the implementation of an asset management approach to highway maintenance would fundamentally change the computation and distribution of available maintenance funds to reflect asset quantity, condition, and work needed to meet performance targets. In addition, several changes were enacted within the VDOT maintenance division. Among these changes was the creation of the Integrated Maintenance Management Program to improve the way in which maintenance activities were scheduled and funded. As part of the Integrated Maintenance Management Program, the need for an automated Inventory Condition and Assessment System was identified.

During the first part of 1997, initial planning for the ICAS project was conducted. An ICAS Tactical Implementation Committee, consisting of maintenance employees from around the State, was formed to provide ongoing input and oversight of the ICAS project. Additionally, a project manager was assigned from the maintenance division, and a project sponsor was assigned from the VDOT executive leadership. A steering committee for the entire Integrated Maintenance Management Program was established, under the direction of the assistant commissioner for operations.

During the summer of 1997, a request for proposals (RFP) was developed and issued. The RFP was comprehensive, containing more than 200 separate technical requirements and more than 140 discreet deliverables. The RFP required that independent verification and validation of both the project management structure and specific deliverables be provided throughout the initial phase.

Inventory Condition And Assessment System
Department Of Transportation

Projected Cost	$53.6 million (Phases I & II)
Actual Expenditure	$21,420,825 (Phase I)
Projected Timeframe	November 1998 – January 2000 (Phase I) March 2000 – March 2003 (Phase II)
Actual Timeframe	November 1998 – December 2002 (Phase I)
Status	Phase I Completed, Phase II Terminated
Purpose	To provide accurate information on the location, quantities, and condition of maintainable highway assets.
Rationale	To address identified business need to implement an asset management based approach to highway maintenance.
Vendors and Products Used	Parsons-Brinckerhoff Facilities (prime contractor), KPMG (software integration), Michael Baker (GIS orthographic conversion), Price Waterhouse Consulting (independent verification and validation).
Problems/Successes	Phase I was completed and met most of its goals but was substantially behind schedule and over budget.

Source: JLARC staff analysis of agency project documentation.

Final vendor proposals were received in December 1997, and vendor negotiations continued throughout the first part of 1998. While there were a number of responses to the initial RFP, the proposal of Parsons-Brinckerhoff Facilities (PB) was determined to be the best response. VDOT conducted negotiations with PB though most of 1998 and signed a contract with the vendor in November of 1998 for $36.7 million. The contract divided the project into two distinct phases, as well as an ongoing maintenance phase. In the first phase, the software would be developed and inventory condition data collected for three counties. The agreed upon contract cost of phase I was $7.9 million. Phase II of the ICAS project was determined to be the statewide data collection and implementation of the ICAS system. The agreed upon contract cost for the second phase of the project was $25.1 million. Additionally, the contract provided for the collection of statewide pavement condition data for three years to be used in the Pavement Management System. While the collection of this pavement condition data was not essential to the development of the ICAS project, it was included at an additional cost of $3.8 million. Furthermore, the contract included an exit clause that allowed VDOT to terminate its agreement with PB after the completion of Phase I for a separation fee of $148,000.

Detailed project planning and development activities began in December 1998 with the development of an initial workplan that broadly outlined when PB

was responsible for submitting deliverables, and the specifications for those deliverables. Additionally, VDOT hired a consultant to serve as contract administrator to coordinate VDOT review of PB deliverables and ensure that payments were made according to the specific deliverable. However, a clear schedule of the project's development activities was not provided by PB. As a result, in February 1999 the VDOT project manager began expressing concern to PB staff regarding the quality of required deliverables, the lack of a formal concept of operations document or official project plan, and the appropriateness of the vendor's level of staffing.

As development work continued in March 1999, VDOT received notification from PB that the pavement data collection subcontractor would be unable to provide the data as required under the contract. As a result, PB requested that a contract modification be enacted in order to remove the subcontractor and change the deadline for the deliverable. Also in March, PB acknowledged that VDOT had reason to be concerned with vendor performance to date, stating that the pavement data collection could be delayed by as much as 12 months and that PB would hire additional staff to oversee the subcontractor development activities. Furthermore, PB agreed to co-locate staff within the VDOT offices and hold weekly meetings with the Integrated Maintenance Management Program steering committee.

While these efforts were an attempt to get the project back on schedule, in April 1999 the VDOT project manager again expressed concern to PB regarding problems with pavement data collection, as well as other performance problems. While PB challenged VDOT's concerns, an agreement was reached between the two parties to place half of the payments for pavement data deliverables in escrow until successful completion of the deliverable. Additionally, PB announced that a new subcontractor had been selected to perform the pavement data collection, and VDOT agreed to renegotiate the pavement data collection base year from 1999 to 2000 through a formal contract modification.

A report to the Integrated Maintenance Management Program steering committee in September 1999 raised several concerns about the project. One concern was that the data collection activities were well behind schedule, that the PB project management plan did not contain realistic dates, and that there was no way to accurately track the status and progress of the project. Additionally, no formal risk analysis had been developed, although it was a deliverable, and several additional deliverables were considerably behind schedule. Finally, concern was raised that the schedule remained inadequate and did not include time for review of deliverables by VDOT.

During the first half of the year 2000, PB encountered some difficulty in integrating the asset condition data into the software application. However, PB was having some success collecting the geo-location data for highway centerlines, and the decision was made in July to modify the contract to allow the statewide collection of this data, originally scheduled for Phase II, to be advanced to the first phase. As a result, $6.5 million in work originally included in Phase II was transferred to Phase I development. Throughout the spring and summer of 2000, the asset condition data collection activities continued. However, in July 2000 VDOT was forced to authorize only partial payment of a PB invoice for this work, stating that PB had "failed to de-

liver a complete set of asset information for any of the three counties." In August 2000, PB submitted a formal project plan outlining the required tasks, however the estimated completion dates that were included did not reflect the actual project schedule to date, and could not be effectively used to identify the contractor's progress.

As development continued through the fall of 2000 and into early 2001, substantial effort was made to implement the ICAS software with the data that had been collected in the pilot counties. In October 2000, PB submitted a formal user acceptance testing plan to provide guidelines for ensuring that the system worked as intended and satisfied all functional requirements. However, in that same month, VDOT was again forced to send PB a memorandum of concern regarding PB's delay in providing an operable system with accurate data for actual user acceptance testing.

Subsequently, as the result of VDOT user acceptance testing, concern was raised in January 2001 regarding the functionality of the ICAS software and the appearance that programming changes had been made without documentation. There was also concern that the current design would not work in the VDOT computing environment. PB also acknowledged that the pavement data collection subcontractor would again be unable to meet the contract deadline, marking the third time that PB would be unable to meet its contractual obligation to provide pavement condition data. Given the ongoing concerns with the ability of the contractor to provide pavement condition data or a functional condition assessment system, in February 2001 the VDOT project manager began providing periodic status reports to an executive oversight body of the entire maintenance division.

While a technical solution was implemented to allow the software to run in the VDOT computing environment in May 2001, the VDOT project manager recommended holding PB in default for failure to meet several key contract deliverables. However, in an effort to obtain a working ICAS system, the Integrated Maintenance Management Program steering committee continued to allow PB to develop the project, but rejected all pavement data that had been submitted as unacceptable. Given the inability of PB to successfully deliver the pavement condition data, in September 2001 PB requested a contract modification to remove this requirement.

In December 2001, user acceptance testing of the asset condition data that had already been collected raised serious concerns regarding the quality of the data provided including: missing assets, additional assets, misclassification of assets, and wrong condition assessments. Because of VDOT's ongoing concern with the quality of the ICAS deliverables and the decision in July 2000 to advance the statewide collection of centerline data, PB attempted to renegotiate the payment rates and methodology in early 2002. VDOT did not agree to this request, and PB submitted another request for contract modification, requesting $4.4 million in additional compensation.

Based on a business case analysis of the additional compensation requested, VDOT determined that some compensation was due as the direct result of changes that had been requested by field staff during the development process. In

March 2002, VDOT agreed to award PB an additional $3.2 million based on the higher quality of the data provided and successful centerline data collection. Following this modification, the total contract value of Phase I was increased to $17.6 million and the total contract value for Phase II work was reduced to $18.5 million.

Final integration and testing activities continued throughout the fall of 2002. Then on November 1, 2002, VDOT decided not to execute the second phase of the ICAS project and to terminate the contract with PB as of December 31, 2002. At the completion of Phase I, VDOT will have invested more than $21.4 million. While the completion of Phase I has been delayed by almost three years, the intended deliverables, including an operable asset condition database, asset data for the three pilot counties, and the geo-location of statewide roadway centerlines, will be received by December 18, 2002. These deliverables should enable VDOT to successfully implement the ICAS project statewide using existing resources.

Presence of Critical Elements Contributed to Project Delivery

While it appears the ICAS project will meet many of its initial goals, most of the elements that are key to successful project development were either absent or only partially present. Elements that were fully present include participation of end-users and reliable funding. However, two of the most important elements for project success – effective project management and effective project oversight and control – were both absent. The exhibit on the next page provides a summary of the presence or absence of each element.

Adequate Involvement of End-Users. One strength of the ICAS project was the involvement of end-users. During the initial review of agency business processes, VDOT field staff were extensively involved in generating ideas and formulating recommendations for business process improvements. Additionally, the Tactical Implementation Committee, consisting of maintenance personnel from across the state, was established at the outset of the project and was used throughout the development of phase I. Through their involvement on this committee, end-users were involved in establishing the initial business requirements that were included in the request for proposals. Furthermore, the end-users were extensively involved in the final acceptance testing of the ICAS deliverables in order to ensure that the system performed the required functions and adequately met VDOT's business needs. As a result of the involvement of the end-users in the testing process, a number of problems with the software were identified and addressed prior to acceptance of the deliverable.

Reliable Funding Was Available. Another strength of the ICAS project was the ongoing availability of funding for the first phase of the project. Because the project was funded entirely out of VDOT allocations for maintenance and operations, ongoing costs were budgeted within the maintenance budget for each year of the project. The allocations designated for the project were sufficient to pay all of the project costs.

Presence of Elements that Contribute to Project Success Inventory and Condition Assessment System			
✔ Present	**✓ Partially Present**	**✗ Absent**	
Identification of Functional Needs and System Requirements		✓	
Proven Technical Feasibility		✓	
Adequate Organizational and Business Process Analysis		✓	
Adequate Vendor/Product Evaluation and Selection		✓	
Strong Legal Contract		✓	
Effective Project Management			✗
Involvement of End-Users	✔		
Effective Project Oversight and Control			✗
Reliable Funding	✔		

Initial Identification of Functional Needs Was Effective But Systems Requirements Definition Was Not Adequate. One of the strengths of the ICAS project was an extensive analysis of agency functional needs, but one of the key requirements was not adequately defined. Beginning in 1995, VDOT undertook a comprehensive agency-wide business needs analysis in order to identify the business areas in which services could be improved or efficiencies realized. One of the recommendations of that study was the need to shift the current management practices and funding mechanisms for highway maintenance from a district-based approach to a statewide needs-based approach. The ICAS project was identified as a necessary foundation for a comprehensive, objective assessment of State maintenance needs.

The development of systems requirements was not as effective. One of the key requirements called for the vendor to collect an enormous amount of data to a very precise level. While an external review of this requirement found that this level of specificity was attainable, it was subsequently determined that this level of detail was unnecessary. Collecting data to this unnecessary level of detail caused the project to be delayed substantially.

Quality of the Contract Was Mixed. One of the critical elements that was partially present during the development of the ICAS project was a strong legal contract. While there were several key strengths of the ICAS contract, there were also provisions that hindered the project's development. One of the contract's strong points was that it provided a phased approach. The contract was divided into two major phases, and VDOT had the option of ending the project after each phase. VDOT relied upon this phased approach to cancel the contract after the completion

of phase I and receive a product of value without paying a significant penalty. Additionally, the payment structure established within the contract clearly tied payments to deliverables by establishing milestone payment dates. Furthermore, the contract required that independent verification and validation be performed for all contract deliverables.

While the contract had several strengths, there were problems with the initial contract as well. One problem was that the scope was too broad and included all aspects of systems development, data collection, and implementation. In addition, the contract required that pavement condition data be collected for federal reporting and for use in the Pavement Management System. This work was not directly related to the development of ICAS, and difficulties in obtaining this data diverted resources from other aspects of the project and significantly delayed the overall project.

Lack of Effective Project Management Contributed to Project Delays. One of the critical elements that was absent from this project was effective project management, which ultimately led to substantial delays and increased costs. The VDOT project manager did not have any formal project manager training. However, a more serious problem appears to have been that the development effort was managed as a turn-key project with PB responsible for establishing the project schedule and managing the development activities of the sub-contractors with only minimal involvement by VDOT employees. As a result, VDOT had only limited control over the project's development.

Another problem with project management was that from the outset the project did not have detailed project planning documents or project schedules. This led to lengthy delays and the inability of VDOT to manage the contractor to a set schedule. When a project plan was finally submitted, it was flawed because it did not provide a set of realistic dates for completion of various tasks. However, an improved project plan was provided towards the end of the project that helped to guide the completion of phase I.

The project management structure also lacked an effective change control process. As a result, employees in the field requested the contractor to perform additional work, as well as to perform some of the data collection activities in ways that differed from the requirements of the contract. These changes contributed to delays in project delivery and increased contract costs.

Lack of Effective Oversight and Control. Another weakness of the ICAS project was that it lacked effective oversight and control. While VDOT had several established oversight boards during the development of ICAS, none of these bodies had direct oversight responsibility for the project. For example, the Integrated Maintenance Management Program steering committee was responsible for directing the development of ICAS as well as the other component systems, but did not have clear decision-making responsibility for the project. Moreover, while the contractor agreed to provide ongoing reports to the steering committee, it does not appear that these reports were regularly provided. Additionally, the Maintenance Program Leadership Group, consisting of the directors of the statewide maintenance

program, was not involved in the ongoing oversight of the project until the vendor had failed to provide the contractually required pavement condition data, placing the State pavement schedule at risk. Furthermore, while VDOT's agency-wide technology steering committee approved the initial ICAS development, it appears to have played only a minimal role in providing ongoing oversight.

The only other form of oversight or review of ICAS was limited to independent review by Price Waterhouse. This review involved ongoing independent verification and validation of project deliverables, as well as an overall analysis of the success of the project. These services were valuable to VDOT in administering the contract and in the decision to not proceed with the second phase. However, this independent oversight did not constitute the type of external oversight role played by the secretarial oversight committees.

INTEGRATED CORRECTIONAL INFORMATION SYSTEM

The Integrated Correctional Information System (ICIS) project was an attempt by the Department of Corrections (DOC) to implement an enterprise resource planning (ERP) system that would replace the department's aging finance, human resources, and correctional enterprises systems and also provide the department with an offender management system (OMS). The OMS would enable DOC to meet its critical need for automated tracking of prison inmates and parolees. The other components of ICIS were also needed, because DOC's administrative processes were largely paper-based, and the existing information systems did not provide quality data in a timely manner. ICIS, if fully implemented, would have integrated all administrative systems across the department in one Web-enabled system and provided DOC leadership and end-users with access to all critical information contained in the department's database.

The ICIS project was terminated following the inability of DOC and the implementation vendor to successfully negotiate the terms for a contract to begin implementation of the system. At the time the project was terminated, DOC had spent approximately $4.9 million on software licenses and planning activities. The final estimated cost for implementation, financing, operation and maintenance of all but the OMS module was $71.3 million. Implementation costs for the OMS module were never formally estimated, but were expected to be at least an additional $15 million. A summary of the project is provided in the exhibit on the following page.

Narrative Chronology of the ICIS Project

In 1995 DOC pursued the development of an offender management system (OMS). This initial effort was not successful, and in 1998 the agency again proceeded with the development of an OMS. However, this time DOC's new chief information officer encouraged agency leadership to develop an integrated enterprise resource planning project (ERP) that would integrate the finance, human resources, and correctional enterprise systems with an offender management system. A committee of executive leaders and end-users was formed to assess the needs of the department and create a series of strategic direction statements. These strategic direction statements were subsequently incorporated in a request for proposals (RFP). The General Assembly, through the 1999 Appropriations Act, also established an oversight committee comprised of the Secretaries of Public Safety and Technology and staff from the Departments of Technology Planning, Planning and Budget, and Information Technology with authority to oversee the project.

On July 1, 1999, DOC issued one RFP for both software and implementation vendors upon approval of the oversight committee. DOC received six responses from software vendors and ten responses from implementation vendors. DOC narrowed the software responses to two vendors, SAP and Oracle, and scheduled product presentations for each. After reviewing the presentations, DOC selected SAP as the software vendor primarily because of SAP's plan to develop an OMS module that would be fully integrated with the rest of its ERP package. After a competitive process, DOC selected KPMG as the implementation vendor.

Integrated Correctional Information System
Department of Corrections

Initial Projected Cost	$45 million *
Final Projected Cost	$71.3 million (excluding offender management system) *
Actual Expenditure	$4.9 million *
Projected Timeframe	November 1998 – July 2005
Actual Timeframe	November 1998 – September 2001
Status	Cancelled
Purpose	To develop enterprise resource planning system (ERP) for human resources, financials, correctional enterprises, and offender management system.
Rationale	Automate and integrate administrative processes to achieve time and cost savings; real time tracking of offenders.
Vendors and Products Used	SAP, KPMG.
Problems/Successes	Cancelled after planning phase – contract negotiations failed.

* Cost does not include DOC internal costs.

Source: JLARC staff analysis of agency project documentation.

Upon approval by the oversight committee, both contracts were awarded in March 2000. DOC agreed to pay SAP approximately $4 million for 5,250 software licenses, and SAP agreed to develop an OMS module within three to five years of the contract date. The OMS module was being developed by SAP with a consortium of states, including Virginia, Pennsylvania, and Kentucky. SAP would fund the development of the OMS software, which was to be fully integrated with its core ERP software product for marketability to state departments of corrections.

KPMG proposed implementing an integrated ERP system consisting of the finance, human resources, and correctional enterprise modules over a period of three years for $28.8 million. DOC agreed to pay KPMG $600,000 for the initial system design, business process analysis, and implementation strategy. KPMG completed the planning document in May 2001, and then proposed implementing the system in three phases at a cost of $38.2 million for consulting services. The first phase would implement most of the finance system and components of the human resources and correctional enterprise systems over a period of 12 months. The proposed price for the first phase was $14.6 million.

DOC had several concerns regarding KPMG's implementation strategy as it entered into contract negotiations for the implementation of Phase I of the ICIS project. DOC was concerned that the price for Phase I had nearly doubled from KPMG's original proposal of $7.6 million for implementation of the finance module. Another DOC concern was that, under KPMG's strategy, the department would not have full finance system functionality until the end of Phase III. A final concern was that KPMG wanted DOC to make milestone payments upon the completion of certain tasks, while DOC wanted to withhold payment until the entire phase was completed.

KPMG, however, claims that the reason the cost estimates increased was because DOC increased substantially the scope of the Phase I project. KPMG also contends that with the increased scope, the project would have taken over a year and that it could not afford to defer payment for that long. Finally, KPMG contends that the optimal way to develop this system involved work on aspects of each module as the project progressed. Along with these disagreements, another factor that impacted the contract negotiation was that the General Assembly had not appropriated funds to pay for further development.

Contract negotiations ultimately broke down, and the ICIS project was suspended. Recently, SAP announced that it has no plans to complete development of the OMS module. The Department of Corrections is currently upgrading its network and technical infrastructure in preparation for the development of an OMS system in the near future. The department does not plan to develop a fully integrated ERP system.

Presence of Key Elements Was Mixed

Several of the key elements for project success were absent. However, there were also some elements that were either fully present or partially present. Among the elements absent were: proven technical feasibility, adequate vendor and product evaluation and selection, and reliable funding. However, the project did involve a thorough business process analysis and active end-user participation. The presence or absence of the key elements is summarized on the following page.

Technical Feasibility of ICIS Project Was Unproven. One of the elements that was absent from the ICIS project was proven technical feasibility. DOC was a pioneer by attempting to implement an ERP system with an integrated OMS module, which had never been accomplished by any other correctional system. Because DOC was attempting to be the first state corrections department to have such a system, the risk of failure was significant and the probability of success was less certain than if the department had chosen to wait until the technology was established.

Vendor and Product Selection Was Inadequate. Another element that was absent from the ICIS project was adequate vendor and product evaluation and selection. DOC received only two responses to the RFP, and neither vendor proposed a satisfactory solution. One vendor, SAP, proposed to develop an OMS

Presence of Elements that Contribute to Project Success Integrated Correctional Information System			
✔ Present	**✓ Partially Present**	**✗ Absent**	
Identification of Functional Needs and System Requirements		✓	
Proven Technical Feasibility			✗
Adequate Organizational and Business Process Analysis		✓	
Adequate Vendor/Product Evaluation and Selection			✗
Strong Legal Contract	NA		
Effective Project Management	NA		
Involvement of End-Users	✔		
Effective Project Oversight and Control		✓	
Reliable Funding			✗

module within the next three to five years. The other vendor, Oracle, proposed to interface its ERP system with an OMS product that DOC determined was not acceptable. Given the limitations of both of these proposals, it appears that a more prudent decision would have been to wait until a satisfactory commercial product was developed or explore the possibility of building the system in-house.

Funding Was Unreliable. Another element that was absent was reliable funding. DOC, which is mostly reliant on general fund appropriations, received funds from the General Assembly to pay for the planning phase and some initial startup costs. However, DOC did not receive funds to fully pay for needed network upgrades and did not have assurances that it would receive funds to pay for the next phase of development, even as it negotiated the contract for this phase. Failure on the part of DOC to develop a business case for the development of ICIS likely contributed to the General Assembly's reluctance to provide further funding for the project.

One of the consequences of unreliable funding for the project was the premature full payment to SAP for software licenses. The Department of Corrections prepaid the full amount for SAP user licenses because it had the money at that time, but was unsure if the money would be available in March 2002, when the balance would be due. According to DOC staff, funds were available at the end of FY 2001 because of staff vacancies. With the uncertainty of future general fund appropriations and declining out-of-state prisoner revenue, DOC decided prepay the additional $2.2 million for SAP software licenses that may never be used. The project was terminated soon after the payment was made.

End-User Involvement Was Adequate. The involvement of end-users within DOC was a strongpoint of the ICIS project. Business end-users of the system were highly involved during the early planning stages and assisted with development of the RFP. DOC established a committee of business users to define the requirements for ICIS. In addition to executive level staff, the committee was composed of selected end-users down to the local office level where the processes are carried out. The RFP contained a series of strategic direction statements resulting from these committee meetings.

Business Process Analysis Was Completed Before Attempted System Implementation, but After Vendors Were Selected. One of the strengths of the project was that the business process analysis was conducted in order to assess what aspects of DOC's business processes could be modified to conform to the SAP software. The Department of Corrections contracted for an analysis of its business processes during the initial planning phase of the project. KPMG produced an analysis of the department's business processes and compared them against the structure of the SAP software to determine compatibility gaps and corrective changes. This analysis was a necessary and valuable step in determining the needed business process modifications for full system functionality.

Although a thorough business process analysis was conducted for SAP software functionality, there appears to have been no concerted effort to analyze the department's business processes prior to the selection and purchase of SAP software. An analysis prior to software selection might have enabled DOC to better evaluate the vendors' proposals, and could have identified areas of inefficiency that could be addressed without the procurement of an automated system.

External Project Oversight Was Generally Effective, but Internal Project Oversight Was Not. One element that was only partially present in the ICIS project was effective project oversight. While external oversight was generally strong, internal oversight appears to have been weak. The external oversight committee, which consisted of the Secretaries of Technology, Public Safety, Finance, and staff from the Department of Technology and Planning and Department of Planning and Budget, had responsibility for providing approvals at key points in the process through decision briefs. For example, the oversight committee had responsibility for approving the RFP and all contracts with software or implementation vendors.

In contrast, there apparently was no internal oversight committee structure in place. There was no committee of executives within the DOC to provide ongoing oversight of the project. Instead, the director of DOC appears to have been the sole person in the department with active oversight responsibilities for the project. An effective internal oversight structure might have helped to address some of the issues raised in contract negotiations with KPMG and assessed the advisability of the prepayment to SAP of $2.2 million for the purchase of software licenses.

INTEGRATED DOCUMENT MANAGEMENT SYSTEM

The Integrated Document Management System Project (IDMS) was a major information technology project undertaken by the Virginia Department of Transportation. The primary purposes of the project were to develop document retention policies for the agency and to develop an integrated document management system. Virtually all of the elements identified as critical for the success of projects were absent in the IDMS project. As a result, the project ultimately failed and provided none of the functionality sought by VDOT when it entered the contract. The exhibit on the following page provides a summary of the project.

Narrative Chronology of the IDMS Project

In 1994, VDOT made the decision to contract with a private sector vendor to develop an integrated document management system. VDOT had identified a document management system as a need, but as a relatively low priority need relative to other systems needs in the department. VDOT issued a request for proposals (RFP) in February 1995. The RFP was mailed to 26 prospective vendors, but only two proposals were received that were considered responsive. Follow-up negotiations were conducted with those two vendors, and their proposals were scored and ranked by a VDOT panel. The cost of the two proposals varied substantially. Woodside Summit Group (Woodside) initially proposed to develop the system for $25 million, while the other finalist, Xerox-USI (a subsidiary of Xerox Corporation), proposed to provide the system for $4 million. The Woodside proposal was determined to be more responsive to the request for proposals, and a contract was awarded to Woodside in October 1995.

The contract was a fixed price contract for $22.4 million. The major deliverable included the design of an integrated document management system which was to integrate the records of three VDOT divisions in one system for the purpose of increasing efficiency in the retrieval and generation of documents. Along with the design of the system, Woodside was to develop specific requirements that could be used to procure the services of a vendor to complete the development and implementation of the system. The initial contract was only for the design of an integrated document management system for three VDOT divisions – Location and Design, Structure and Bridge, and Right-of-Way and Utilities. The contract also called for Woodside to provide records management consulting services, including the development of records management retention policies and an inventory of VDOT records. The lump sum contract was to be paid to Woodside on a monthly basis over a five-year period beginning in January 1996.

In October 1996, a proof of concept demonstration was held by Woodside to demonstrate how the document management system would work. The proof of concept, which involved the use of a software product called Livelink, was accepted by VDOT.

Integrated Document Management System
Department of Transportation

Projected Cost	$22 million *
Actual Expenditure	$45.8 million *
Projected Timeframe	December 1995 – January 2001
Actual Timeframe	December 1995 – November 1999
Status	Cancelled
Purpose	To develop automated records management system.
Rationale	Increase productivity by establishing greater efficiencies in the generation and retrieval of documents.
Vendors and Products Used	Woodside Summit (Integration), IBM (System Design), Sequoia (Software Development), Fujitsu (Commercial Software), plus numerous sub-contractors for training and systems integration.
Problems/Successes	Vendor never developed functional system.

* Cost does not include VDOT internal costs.

Source: JLARC staff analysis of agency project documentation.

In December 1996, three change orders totaling $7.4 million were issued which broadened the scope of the work to be performed by the vendor. The most significant change order required that Woodside expand its work to include the design of imaging and repository services for VDOT's new financial management system, which was also being developed at the time. Change orders also included work on the development of a common interface for all computer users within the agency as well as evaluation of client/server electronic mail systems that could be implemented agency-wide. Finally, the change orders required Woodside to provide the detailed design and implementation of the integrated system for the three divisions.

Two significant events occurred in the first half of 1997. First IBM, which had been presented by Woodside as its primary partner in the project, terminated its involvement. Then in June 1997, the decision was made that the software that had been used for the proof of concept was too expensive, and Woodside was authorized to seek another software package even though design efforts up to this point had been based on the Livelink software.

Another pivotal point in the project came in August of 1997. The decision was made again to substantially expand the scope of the project and retain Woodside to provide the design and development of the integrated system for all 29 of VDOT's divisions. In September 1997 VDOT submitted and received approval from the gov-

ernor's office to enter a time and materials sole source contract with Woodside for the "complete development and installation of the Automated Records Management System (ARMS) throughout the Commonwealth." (ARMS was the name of the integrated document management system). This sole source time and materials contract was for $22 million. The initial fixed price contract for $22 million continued to be in force as well. It was subsequently concluded by VDOT's internal audit division that VDOT presented misleading information to the governor's staff when the agency sought approval of the sole source contract.

In July 1998, Woodside informed VDOT of problems with meeting project milestones. In August 1998, the VDOT project manager formally protested Woodside's lack of resources dedicated to the project, but confirmed that planned deployment of the system would be May 1999.

In January 1999, the VDOT project manager began sending letters to Woodside expressing concerns with the lack of progress of the project. Then in April 1999, the project manager advised Woodside that the level of resources being devoted to the project was unacceptable. Also in April, Woodside proposed the advanced deployment of the software and hardware of the system even though the system design had not been completed. VDOT then began the acquisition and deployment process. This involved the purchase of hardware and software, including several thousand software licenses, even though there was not yet a final design of the system.

In the late summer of 1999, VDOT began to have serious reservations about continuing with the project. VDOT management issued a memorandum in August 1999 directing that the department limit expenditures for information technology in FY 2000 to $3 million, and equipment deployment was halted. In September 1999 VDOT issued a cure letter demanding that certain issues be resolved and mentioning the possibility of default. Also in that month, a replacement project management team was selected at VDOT. Woodside still did not deliver the key design document as agreed. In November 1999 the contract was "cancelled for convenience." The following March Woodside submitted to VDOT a notice of intent to file a claim. Legal settlement was reached in September 2001 with VDOT agreeing to pay Woodside $800,000 to resolve all outstanding claims.

The final amount paid to Woodside was $45.8 million dollars. VDOT's internal audit division conducted a valuation of the deliverables received and concluded that they had a value of $34.8 million. However, this valuation is misleading. It placed values on design documents that were only partially completed and hardware and software that was purchased but never used. VDOT received virtually no value from a functional standpoint for the $46 million spent. VDOT did not receive a functional system, although the agency claims to have received some value from the document retention policies that were developed.

Lack of Key Elements for Success Contributed to Project Failure

Most of the elements that appear to contribute to a successful information systems development project were not present with the IDMS project. Among the

elements absent were extensive planning, analysis of the business processes, adequate vendor evaluation and selection, a strong legal contract, effective project management, a formal change control process, and effective project oversight. In fact, the only element that appeared to be clearly present was a reliable funding source. VDOT appears to have been able to meet its funding commitments under the contracts for the project up to the time that the contract was terminated. An exhibit on the next page provides a summary of the presence or absence of the key elements for project success.

Proven Technical Feasibility. One of the major weaknesses of this project was that VDOT undertook the development of a system for which the technical feasibility had not been established. Woodside was the only vendor that submitted a proposal to build a system as VDOT envisioned. Several VDOT documents refer to the agency's opportunity to be a "pioneer" in the development of the system. However, there does not appear to have been any corresponding consideration of the risk involved in trying to develop an unproven system. Woodside was not even required to demonstrate a proof of concept prior to signing the contract.

Lack of Business Process Analysis. Another element that appears to have been absent in this project was adequate analysis of the business processes and development of policies necessary to identify VDOT's software needs. At the time that the initial contract was entered into with Woodside, the agency did not have up-to-date records management policies or a certified records manager.

It is apparent that VDOT was not ready to automate its records processes because it did not even have adequate records management policies. Without such policies or an inventory of its records, the agency was not in position to identify the software needs for managing records. The tasks specified in the contract with Woodside reflect this. They included the development by Woodside of an inventory of the agency's records as well the development of record retention policies. The contract also describes one of Woodside's tasks to be identifying the "specific needs for the integrated document management system."

Inadequate Vendor Evaluation and Selection. Another element not present was an effective process for the evaluation and selection of the vendor ~~chosen~~. Woodside Summit was evaluated and scored by a panel, and follow-up discussions were held with the vendor. However, VDOT's internal audit division concluded that VDOT did not review the bidder's financial statements, other projects that the contractor had performed, or references to confirm that Woodside was a viable candidate for selection. In fact, had a vendor with Woodside's financial condition bid on a highway construction project, it would have been disqualified because of VDOT's financial requirements.

It appears that the lack of responses to the RFP should have prompted a more thorough evaluation of Woodside as suggested by VDOT's internal audit division. Woodside itself developed the requirements for the request for proposal, and its proposal was the only one deemed to be truly responsive to the RFP. In addition, Woodside had not previously developed such an integrated document management system.

Presence of Elements that Contribute to Project Success Integrated Document Management System			
✔ Present	**✓ Partially Present**	**✗ Absent**	
Identification of Functional Needs and System Requirements		✓	
Proven Technical Feasibility			✗
Adequate Organizational and Business Process Analysis			✗
Adequate Vendor/Product Evaluation and Selection			✗
Strong Legal Contract			✗
Effective Project Management			✗
Involvement of End-Users		✓	
Effective Project Oversight and Control			✗
Reliable Funding	✔		

Lack of a Strong Legal Contract. Another critical element that was absent in this project was a strong legal contract that clearly defined deliverables and services to be provided, linked payments to deliverables, and included terms that adequately protected VDOT's interests. The initial contract between VDOT and Woodside was a fixed price contract, but the contract did not link the payment schedule to the deliverables. Payments were scheduled on a monthly basis over a five-year period without regard to tasks completed by Woodside. In addition, the contract contained no penalties for failure on the part of the vendor to meet its proposed schedule. The first contract also had ambiguous language regarding the contract requirements for the latter phases of the work. It stated that the vendor would provide resources at the procurement, development, and implementation phases of the process but is ambiguous as to what those services would be. The contract states that the vendor "may assist" with certain tasks but includes no requirement that it do so.

The second major contract entered into with Woodside was also problematic. It was a time and materials contract that less clearly defined the deliverables that would be required than the initial fixed price contract but enabled the vendor to bill VDOT for any expenditures incurred. Like the initial contract, the payments to the vendor were not tied to any required deliverable. The contract did not include any agreement on labor rates or mark-ups that the vendor would apply. A report by VDOT's internal audit review team concluded that "VDOT gave Woodside an open checkbook."

One of the results of this contract was that Woodside applied high mark-ups to goods and services. VDOT's internal audit review team concluded that Woodside was using mark-up rates as high as 81 percent for sub-contractor labor, 159 percent for consultants, and 53 percent for equipment purchased.

A further problem with the contractual arrangement was that the fixed price and the time and materials contracts were in effect simultaneously. This complicated contract administration given the overlap between the two contracts in terms of the work to be performed and the different payment structures. The weakness of the contracts is evidenced by the fact that VDOT ultimately terminated the contract for convenience and paid the vendor an additional $800,000 to settle the contract despite spending $45.8 million and never even receiving a final approved design for the system.

Lack of Effective Project Management. Another element that was not present was effective project management. Staff resources available for management were extremely limited at the outset. This appears to be the result of management's view, as well as the view of VDOT's agency-wide technology steering committee, that this could be a "turnkey" project with the vendor assuming primary responsibility for the work, and VDOT having only a limited role. The project manager was assigned to the project part-time while he maintained his position as Assistant Division Administrator in the Administrative Services Division. The project manager had received no formal training in project management and did not have an information systems background. In addition, there was no separate contract administrator assigned to the project.

Although the project manager lacked a technology background, there was no technology manager assigned to the project. A report by an internal VDOT review team examining the project concluded, "There was inconsistent ITD [Information Technology Division] participation on the project with the result that technical advice was unavailable to the Project Manager. Technical issues were either slow to be addressed or neglected entirely."

As a result of the management structure, there was limited management of the project or contract with Woodside. According to a VDOT internal review of the project, "VDOT did not manage the project. It allowed the Prime Contractor to do so. Cost overruns and project schedule slippages were managed at the expense of both the project and VDOT's best interest."

Lack of Effective Oversight and Control. Effective oversight and control of the project do not appear to have been present either. The project did have an internal steering committee, but the committee does not appear to have played a separate oversight role. The project manager was one of two co-chairs of the steering committee and the other co-chair apparently did not attend many of its meetings. This committee had only limited involvement in some of the key decisions during the course of the project. The committee apparently was not involved in the decision to sign the sole-source contract and expand the development of the system to all 29 VDOT divisions. In addition, the committee apparently did not participate in the decision to authorize the switch to a different software product.

VDOT's agency-wide technology steering committee appears to have played a minimal oversight role. The committee received periodic reports about the project but does not appear to have provided any meaningful oversight of the project.

In addition, there does not appear to have been effective ongoing external oversight of the project. VDOT retained an independent verification and validation consultant to provide an external independent review of the project more than a year into the project. However, this individual began to serve in a support role for the project and did not maintain an independent position. Therefore, there was no entity conducting an external review of the project as it progressed.

As a result of this lack of internal or external oversight, key decisions that resulted in major changes in scope or direction were made without any process for consideration of the changes or the impact that they might have on the primary project. At two points in the process, there were decisions made to significantly expand the scope of the project that did not receive any review through a formal oversight structure.

The initial contract was to develop a design for an integrated document management system as well as detailed specifications so that such a system could be procured. The design was supposed to be limited to three VDOT divisions – Location and Design, Structure and Bridge, and Right-of-Way. Within a year of signing the initial contract, the scope of the project had expanded substantially. Change orders totaling more than seven million dollars expanded the scope of the project to include developing records automation for VDOT's financial management system that was being developed at the time, development of a common interface system for all VDOT computer users, and an evaluation of client/server e-mail systems. This decision was made without any formal evaluation process.

A further major expansion in the scope of the project occurred with the signing of the sole source contract. The project advanced from one in which the vendor was developing the design of an integrated document management system that would serve three divisions to one that involved the design and implementation of a system for all 29 VDOT divisions. This expansion in scope occurred despite the fact that VDOT had never received a final design for the system under the initial contract. The decision was made without input from the project manager, any information technology staff at VDOT, or members of the project steering committee. Instead, it was made by a three-member executive team consisting of the VDOT Commissioner and two assistant commissioners who had limited direct involvement with the project and likely did not fully understand the implications for the project of this major decision.

INTEGRATED HUMAN RESOURCE INFORMATION SYSTEM

For more than twenty-five years, the Commonwealth has attempted to integrate its personnel and payroll computer systems. The attempts at integration have ranged from interfaces that would share some data, to the development of a fully integrated system known as the Integrated Human Resource Information System (IHRIS). Systems development for the project began in 1996 and was stopped in January 1999 after the two partner agencies, the Department of Accounts, and the Department of Personnel and Training (now the Department of Human Resource Management), failed to resolve many technical problems that largely resulted from a lack of State technology standards. In addition, the two partner agencies were unable to successfully administer the project across secretarial lines. An exhibit on the next page summarizes the project.

Narrative Chronology of the IHRIS Project

In 1978 the Department of Personnel and Training (DPT) implemented the mainframe-based Personnel Management Information System (PMIS), anticipating that "PMIS at a future date will be integrated with the State payroll system" maintained by the Department of Accounts (DOA). In 1985, in response to a General Assembly mandate, DOA began installing a commercial software package that included fully integrated personnel and payroll functions, which was then named the Commonwealth Integrated Payroll and Personnel System (CIPPS).

Shortly after the purchase of CIPPS, the Director of DOA (the State Comptroller) and the Director of DPT examined the possibility of either abandoning PMIS or else developing an interface between PMIS and CIPPS. However, both agency heads expressed concern that their respective missions could be jeopardized by integration and were unable to agree on how to proceed.

In the 1990 Appropriations Act, the General Assembly directed a study committee to examine central administrative systems. The committee's report noted that there were 300 agency-based "mirror" systems which existed to provide functions not contained in the two central administrative systems. The committee recommended that the Commonwealth pursue an integrated system to replace PMIS and CIPPS, but noted that all agencies must first "work to resolve systems management issues prior to the implementation of logically integrated systems." In other words, the report argued that before developing an integrated system, State agencies needed to first improve their administrative processes, an exercise known as business process reengineering.

In 1991 the Auditor of Public Accounts (APA) released a report on internal controls that discussed PMIS and CIPPS, and concluded that "correcting the significant system weaknesses is not cost beneficial and replacing the two existing systems with an integrated human resource system should occur." In 1992 a steering committee was formed consisting of the Director of the Council on Information Management (CIM), the State Comptroller, and the Director of DPT. The Department

Integrated Human Resource Information System
Department of Human Resource Management
Department of Accounts

Projected Cost	$5.7 Million *
Actual Expenditure	$9.25 million * (through December 1998)
Projected Timeframe	September 1991 – June 30, 1998
Actual Timeframe	September 1991 – December 1998
Status	Cancelled
Purpose	To integrate the State's central payroll and personnel functions, and replace similar systems at line agencies.
Rationale	State desired greater access to data at central and line agencies, and APA called for an integrated system.
Vendors and Products Used	Project was developed by agency personnel with the assistance of a services vendor, The Hunter Group. No implementation vendor was used. PeopleSoft and Oracle software were purchased.
Problems/Successes	Many unresolved problems including project management, network administration, software customization, and lack of oversight contributed to project's failure.

* Cost does not include central agency internal costs, or any line agency costs.

Source: JLARC staff analysis of agency project documentation.

of Information Technology (DIT) was later included on the committee. In October 1992, CIM issued a request for proposals (RFP) to conduct preliminary planning and analysis for an Integrated Human Resource Information System. IHRIS was intended to meet the human resource and payroll needs of all line agencies as well as the smaller State-supported colleges and universities.

In June 1993, a consulting group completed a conceptual design which recommended that the Commonwealth implement an integrated system based on a client/server platform. The move toward client/server platforms in the 1990s was driven by a desire to avoid the costs of mainframe processing, and also to provide line agencies with greater local data processing capability. Client/server platforms required the purchase of personal computers (PC) for use as "clients" at line agencies, which in turn required decentralizing additional technical support and control tasks to line agencies. IHRIS was intended to be the Commonwealth's first implementation of a statewide client/server platform, and the new system was estimated to cost $5.1 to $7.8 million. This cost estimate did not include the costs of computer hardware at line agencies because it was a long-standing practice of systems devel-

opment projects to require line agencies purchase and maintain any locally required hardware.

In the 1994 Appropriations Act, the General Assembly directed DOA to seek proposals for a statewide integrated human resource information system, and also directed the Secretary of Finance to provide an interest-free treasury loan to DOA. In July 1994, all State agencies and institutions of higher education were notified that IHRIS would replace CIPPS and PMIS, and agencies were also advised to reconsider any human resource-related software procurement or development that was underway.

In May 1995, the Secretary of Finance approved a $6 million treasury loan to DOA, making IHRIS the first State systems development project to be internally funded through a loan from the general account of the Treasury. The cost estimates were based upon the initial implementation of IHRIS at pilot agencies, or "lead sites," including the Department of Transportation (VDOT), the Virginia Community College System (VCCS), the Health Department, and the 23 agencies served by DOA's Payroll Service Bureau. The cost estimates excluded any expenditures required of the lead sites, because the steering committee decided that "It will be the responsibility of each client agency/site to have the necessary hardware in place."

An RFP was issued in 1995 for the development of system specifications, for which Arthur Andersen was hired. On September 29, 1995, CIM certified the Agency Procurement Request (APR) for IHRIS, which indicated a total cost of $5.7 million, but excluded any hardware costs. DOA and DPT finalized the system specifications in December 1995, and an RFP to develop IHRIS was issued.

The steering committee decided that the only viable approach was to frame the RFP so that only system integrators could respond, who would provide all services and software necessary to replace the existing systems. However, the only responsive bidder, Arthur Andersen, submitted a bid of $35 million, which was significantly over the project's anticipated total budget. The steering committee then decided to have the State itself serve as the system integrator, with DOA and DPT staff working with an implementation vendor. The first RFP was withdrawn and reissued the next week with reworked specifications calling for proposals from a software vendor and a separate implementation vendor.

In response to the software section of the second RFP, Arthur Andersen and PeopleSoft submitted proposals which both called for using a PeopleSoft suite of human resource and payroll software. In response to the implementation section of the RFP, Arthur Andersen and The Hunter Group each submitted proposals. Of the two, only Andersen had installed PeopleSoft human resource software in another state (Kansas), a project with which the steering committee was already familiar.

In September 1996 the IHRIS steering committee decided to procure the PeopleSoft software and to use Oracle as the database management system. The Hunter Group was also retained to provide technical expertise and assistance to the DPT project manager. Oversight would be provided by the steering committee. Although DOA had disbursement and accounting responsibility, DPT was assigned

project management responsibility for IHRIS, and the Director served as chair of the steering committee.

The summer of 1997 was a critical time for the IHRIS project, for many of the problems that would ultimately cause the project to fail began to appear. There were growing tensions between the individuals responsible for oversight of the project. In addition, DOA and DPT experienced difficulty attracting and retaining qualified personnel, a situation that worsened as year 2000 remediation efforts increased demand for technology workers nationwide.

The major technical problem with IHRIS began to appear at this time as well, and was referred to by the general term "connectivity." It involved the ability of the project team to administer PeopleSoft over DIT's statewide network. The version of PeopleSoft available in 1997 was optimized to run on local area networks, which are usually located within one building. Although PeopleSoft stated that its product could be used on a statewide network, problems began to appear when the project team tried to establish connections between DIT's network and each agency's local area network, in large part because the networking and security software used by agencies was not standardized.

The next critical time for IHRIS occurred in the spring of 1998. In April, a new director of DPT was appointed, who reestablished regular meetings of the steering committee after discovering that the members were "not speaking to each other." In May, testing began on the first working model of IHRIS, but deployment of IHRIS was six months behind schedule, slipping to the first quarter of 1999. As a result, statewide deployment of IHRIS was affected, with the implication that IHRIS would no longer be able to serve as the year 2000 solution for DPT and DOA. Additional staff were then diverted from IHRIS to the year 2000 needs of both agencies.

The connectivity issue was still unresolved, and lead sites continued to experience connectivity problems throughout the summer of 1998. The connectivity problem was exacerbated by the fact that two additional telecommunications networks had been developed by Virginia Tech and the Department of General Services, and that the lead sites were also using these networks. Each of the three networks were capable of supporting IHRIS, but no mechanism existed for their coordination in support of a single application. Looking forward, the IHRIS project team realized that because agencies could use any, or all, of the three networks to connect to the IHRIS computer at DIT, that connectivity problems would escalate as IHRIS was implemented statewide.

In an attempt to resolve the connectivity issue, the steering committee retained a consulting firm to study the infrastructure needs of IHRIS. In a report delivered to the steering committee in late October 1998, the consultant recommended that the steering committee use a different type of network software in order to decrease the amount of data sent between the client and the server. The steering committee felt that this recommendation was not feasible because it would require additional hardware, which the steering committee felt that line agencies would not be able, or willing, to purchase and support.

In December 1998, the Comptroller withdrew DOA from the project. The first working model of IHRIS had been completed and was ready for deployment to the lead sites, but the connectivity issues had not been resolved. By January 1999, the IHRIS project had effectively ended. Although work on IHRIS-related activities continued into 2000, the project was fundamentally different than originally envisioned. DPT did continue to explore possible means of implementing the personnel functions without using PeopleSoft, but there were no plans for an integrated payroll and personnel system.

Absence of Key Elements Contributed to Project Failure

The key elements for success were absent in the IHRIS project. Among the elements which contributed to the project's failure were the decision to implement a pioneering client/server platform, an underestimation of the total cost of the project; the decision to proceed with the project when only one qualified software application was available, and the failure of the steering committee to exercise oversight. An exhibit on the next page summarizes the presence or absence of the key elements.

Key System Requirements Were Not Identified. The IHRIS steering committee did not identify key requirements, and this contributed to the ultimate failure of the project. First, the system specifications did not contain any information regarding the hardware or software used by line agencies, and this omission laid the foundation for the connectivity problems that followed. Second, the steering committee did not adequately consider the problems associated with the use of more than one telecommunications network. Third, the steering committee gave insufficient consideration to the need for State technology standards, which were necessary given the degree of decentralization. As a result of the steering committee's failure to consider these factors, the software procured for IHRIS could not be implemented in the State's technology environment.

The system specifications did not contain any information regarding the hardware or software used by line agencies – the firewall software, the type of client computers, or the local area networks. Additionally, the specifications also provided inconsistent information regarding the type of data transmission rate that was available at line agencies. Finally, no information was provided regarding the telecommunication networks used by DGS or Virginia Tech, and only the technical specifications of DIT's network were described.

In addition, the steering committee gave insufficient consideration to the problems associated with managing more than one telecommunications network. During project planning, the steering committee decided to "assume the use of the DIT network for telecommunications support," but did not mandate its use. As a result, the steering committee was unable to prevent agencies from using the competing networks managed by DGS and Virginia Tech. Each network had sufficient capability to provide the needed services, but difficulty was encountered in "coordinating the usage of all three networks in support of a single application."

Presence of Elements that Contribute to Project Success Integrated Human Resource Information System			
✔ Present	**✓ Partially Present**	**✗ Absent**	
Identification of Functional Needs and System Requirements			✗
Proven Technical Feasibility			✗
Organizational and Business Process Analysis			✗
Adequate Vendor/Product Evaluation and Selection			✗
Strong Legal Contract	N/A		
Effective Project Management		✓	
Involvement of End-Users		✓	
Effective Project Oversight and Control			✗
Reliable Funding			✗

Finally, the steering committee did not adequately consider the need for State standards for telecommunications networks given the degree of agency autonomy over technology decisions. As a result, the technology decisions at line agencies hindered the ability of IHRIS to function. Technology standards were necessary because the project would only succeed if line agencies maintained hardware and software that was compatible with the IHRIS server at DIT. The absence of State standards for firewalls, local area networks, desktop computing, or telecommunications protocols was another factor that led to the connectivity problems that contributed to the project's failure.

IHRIS Failed in Part Because Technical Feasibility Was Not Proven. The lack of proven technical feasibility contributed directly to the project's failure because the software chosen for IHRIS would not operate in the State's technical environment. Because IHRIS was the first attempt to implement a statewide client/server platform in Virginia, the project team had limited precedent to use as a guide. During project planning, consultants recommended that IHRIS be implemented on a client/server platform. During earlier mainframe-based projects, such as CARS, CIPPS, and PMIS, line agencies had been required to procure and maintain the local hardware necessary to connect to the mainframe at DIT. The hardware used by line agencies consisted of basic terminals – screens with keyboards attached – while client/server software required line agencies to maintain personal computers with data processing capability.

What the steering committee failed to account for was that client/server software was not designed for implementation where each business unit, or agency,

could make independent decisions about the type of hardware and software that would be used locally. Moreover, by assigning responsibility for procuring hardware to the line agencies, the steering committee did not directly consider the technical feasibility of the client/server system until connectivity problems arose. Within the first year of the project, there was growing agreement that client/server software simply would not work over more than one statewide network, a fact which was compounded by the absence of State standards for agency hardware and software. The connectivity problem was never solved, and is one of the reasons that IHRIS was cancelled.

Organizational and Business Process Analysis Was Inadequate. The IHRIS project was severely hindered by a failure to conduct organizational changes, and instead attempted to use technology alone to solve business problems. IHRIS was designed to replace the duplicative payroll and personnel systems maintained by line agencies, but insufficient consideration was given to whether or not line agencies should maintain independent systems, or whether any single system could encompass their needs. The steering committee did not examine which functions should be performed centrally, and which by line agencies, before the project began. Instead of making organizational changes that would better align the division of responsibility between central and line agencies, the IHRIS software was customized during development to look like what it was replacing.

Vendor and Product Evaluation and Selection Was Flawed. The process for selecting the IHRIS software appears to have favored a predetermined outcome, and the software itself did not have some necessary functionality. In 1995 Arthur Andersen was awarded a contract to write the system specifications for IHRIS, and an RFP was subsequently issued to which Andersen responded with a bid. Concerns were then raised that participation by Arthur Andersen was inappropriate, and disagreement arose between DPT and the Department of General Services (DGS) over whether Andersen should be barred from bidding. DGS was concerned that the system specifications, which Andersen drafted, may have unduly favored Andersen, while DPT maintained that the RFP was neutral. In March 1996, the Office of the Attorney General noted that "a disqualification of Andersen under APSPM 2.25(b) would probably be upheld on appeal."

The steering committee decided to re-issue the RFP with modified specifications, and it appears that a lack of support for the IHRIS project may have pressured the steering committee to proceed without thoroughly evaluating the software. On March 6, 1996, prior to the re-issuance of the RFP, the State Comptroller wrote the IHRIS project manager, stating that:

> VDOT has committed to PeopleSoft and Oracle and will not support anything else for IHRIS.... The pressure for fast action is really building and I am convinced we have only another few months to get a software commitment. Otherwise our support in the user community will evaporate.

In response to the re-issued RFP, proposals were submitted by both Arthur Andersen and PeopleSoft. Both proposals recommended the use of PeopleSoft software, which the steering committee determined was the only qualified software

package proposed. The steering committee decided to continue with the IHRIS procurement, and requested that DPT and DOA staff evaluate the PeopleSoft software. The evaluation noted a few areas in which the PeopleSoft software would "require major modifications," along with several areas in which PeopleSoft "does not meet (DNM) the requirement."

Specific concern was also raised by DPT staff about the PeopleSoft benefits module, which was intended to replace the Benefits Eligibility System (BES), a major subsystem of PMIS. In June 1996, DPT staff found "serious deficiencies in the proposed system," particularly the loss of interactive voice response functionality. During IHRIS development, it was determined that PeopleSoft would not provide the functionality needed to replace BES, and an interface was proposed to link BES and IHRIS. The failure to implement this interface was among the reasons cited by the Comptroller when he withdrew DOA support from the project.

Project Management Did Not Effectively Perform Technical Change Control. The IHRIS software was highly customized as a result of poor control over technical changes to the software, and the degree of customization slowed the project and diverted key resources. The customizations also contributed to the decision to cancel the project, because the steering committee realized that the highly customized software would be very difficult and expensive to upgrade in the future.

Technical change control was poorly managed because decisions on whether to modify existing agency processes, or to modify the PeopleSoft software, were made on the basis of "avoiding pain" rather than as a result of an objective, rational process. The technical change control process for IHRIS was conducted by the Change Management Group, which was chaired by the DPT project manager. In spite of this formal process, DOA staff felt that many of the changes made to PeopleSoft were not sufficiently tested. DOA staff also state that there was insufficient authority to refuse changes requested by the lead site agencies. An analysis of the IHRIS software performed by PeopleSoft in 1999 stated that "the Commonwealth's database is considered to be highly customized."

Although there is some disagreement over the extent of the customizations, all parties agree that the changes were performed to maintain the support of line agencies. The IHRIS project manager has stated that the changes made to PeopleSoft were not significant, but he notes that disagreements between DOA and DPT arose when "a group would take ownership of a data field and would not let it be changed." Yet both the project manager and the Comptroller agree that PeopleSoft was customized to look like PMIS in order to maintain the buy-in of line agencies.

Project Oversight and Control Was Very Poor. The steering committee charged with oversight for IHRIS failed to adequately perform its responsibility to ensure that project objectives were met through effective project management. Furthermore, as the project progressed it began to be hindered by the steering committee's inability to require that line agencies operate in a more uniform manner.

As the only official oversight body, the steering committee had responsibility for the project. Four central agencies were represented on the steering commit-

tee: The Departments of Information Technology (DIT), Accounts (DOA), Personnel and Training (DPT), plus the Council on Information Management (CIM). DPT and DOA had primary responsibility for the project, as the agencies to which project management and fiscal responsibility were assigned, respectively. The project manager, a DPT employee, reported to the steering committee. For several months prior to the appointment of a new DPT director in April 1998, the steering committee did not meet regularly.

The steering committee also failed to compensate for the problems generated by having two agencies with different missions jointly administer the same project. DPT had project management responsibility, but DOA was responsible for project expenditures. As a result of this dual responsibility, the project experienced organizational inefficiencies, such as gaps or overlaps in staffing, as well as poor communication and coordination of staff activities. Although the Comptroller has stated that "the steering committee was not well served by the consultants or project management group," he also noted that "the steering committee had no particular expertise, it turns out."

The Steering Committee Failed to Obtain Adequate Funding. The steering committee purposefully excluded the cost of procuring and maintaining hardware at line agencies in order to obtain approval for the project. Had the total cost of IHRIS been known, the project may not have been approved. The Agency Procurement Request (APR) for IHRIS, which was approved by CIM before the RFP was issued, indicated a total cost of $5.7 million. Line agency hardware costs were not included. One year later, when the IHRIS software was purchased, the Comptroller expressed concern with the projected budget of $8.1 million because it was anticipated that the steps necessary to deploy IHRIS statewide would require a total of $13.2 million. The Comptroller suggested that a modest appropriation might be necessary in the 1997 General Assembly session, and that the project could "still survive if that is rejected by slowing the project in FY 1998 to spread out the disbursements."

By not obtaining sufficient funding for the hardware needs of line agencies, the steering committee reduced its ability to ensure that line agencies would expend their own funds to procure hardware for an unproven project. These problems became acute in 1999 when the steering committee realized that the total cost of the project could approach $30 million. Consultants reported that an additional server would be required at each agency, and the steering committee was concerned that line agencies would be unwilling to pay for their procurement and maintenance. According to the Director of DPT, who sought input from the Comptroller and the Director of CIM, another $30 million would be required. However, by not accounting for the total cost of the project at its inception, the steering committee was not in a position to obtain additional funding for the project at this critical point.

MANAGEMENT OF INVENTORY AND PRODUCT SALES

The Management of Inventory and Product Sales (MIPS) project undertaken by the Virginia Department of Alcoholic Beverage Control (ABC) was a comprehensive systems development initiative to evaluate and improve the automated systems controlling the acquisition, distribution, and sale of alcoholic beverages throughout the State. This initiative was undertaken to address identified problems with the existing product distribution and point-of-sale systems at all ABC retail locations and allow the agency to more efficiently support its business operations. Initial planning for this project began in April 2000 and the final rollout was completed in October 2002. Although technically the MIPS project and the point-of-sale replacement were two separate projects, this review addresses the management and development of both systems as one project because of the critical dependence of the MIPS system on the data provided from the point-of-sale system. The total cost for the development effort was $18.3 million, including the replacement of the point-of-sale system. All of the elements that appear to contribute to successful project delivery were present throughout the project's development. The exhibit on the following page provides a summary of the project.

Narrative Chronology of the MIPS Project

Prior to April 2000, ABC's wholesale/retail division had identified several substantial issues regarding the existing product distribution and point-of-sale systems. Of particular concern were issues with data integrity that impacted ABC's ability to effectively manage warehouse inventory and accurately forecast distribution to retail stores. Issues with data integrity also impeded the ABC's ability to accurately report and transfer profits to the State general fund as required by the *Code of Virginia*. Additionally, ABC was not able to provide accurate inventory reports to the vendors who, since 1996, have been required to own the stock of their product that resides in the ABC warehouse. Moreover, the existing point-of-sale system was not able to accommodate debit cards, thereby impacting customer service. Finally, the vendor support contracts for the existing point-of-sale and product distribution systems were scheduled to expire in December 2001 and May 2003 respectively, and the cost for continuing vendor support of the product distribution system was $55,000 per month.

In April 2000, a project team of representatives from the ABC wholesale/retail, finance, and information technology services divisions was assembled to study the business of product distribution and make recommendations for improvement. At the same time, the MIPS Management Committee was established, consisting of the ABC director of wholesale/retail, chief financial officer, chief information officer, and audit director. This committee was responsible for providing ongoing internal oversight of the project and approving the direction of the project.

The project team was responsible for first developing a business model in order to identify the current business processes for receiving, distributing, and selling alcohol in Virginia. Additionally, a formal business case was developed in

Management of Inventory and Product Sales
Department Of Alcoholic Beverage Control

Projected Cost	$17 million
Actual Expenditure	$18.3 million
Projected Timeframe	April 2000 – March 2003
Actual Timeframe	April 2000 – October 2002
Status	Implemented
Purpose	To replace the automated systems that control the acquisition, distribution, and sale of alcoholic beverages in Virginia.
Rationale	To address known problems with current automated system and reduce monthly expenditures for systems support.
Vendors and Products Used	Triversity (Point-of-Sale), Gartner (Vendor Evaluation).
Problems/Successes	Mandatory systems functionality has been met.

JLARC staff analysis of agency project documentation.

May 2000 to educate and inform ABC executive management of the business need for improved automated systems to control ABC's wholesale/retail operations, and provide a general product description. Furthermore, the business case identified the project's key business objectives, initial schedules, proposed budget, and potential threats to successful implementation.

Detailed project planning for the MIPS system was initiated in the summer of 2000. Because MIPS addressed 26 functional business areas, and because there were more than 50 critical components for successful completion of the project, a risk management plan identifying and prioritizing the threats to the systems' successful delivery was developed in order to minimize the overall risk to the State's investment. The risk assessment identified 16 components that had the potential to impact the project and established processes for monitoring these areas throughout the project's lifecycle. Additionally, the detailed technical and functional requirements were developed during this time period and approved by the MIPS Management Team in September 2000.

Throughout the fall of 2000, detailed development work continued, and, in November, the project team released the MIPS project charter. Although the project charter was not developed prior to beginning initial design work on the MIPS systems, the charter did provide a detailed project work plan and description of the project's scope. Additionally, the project charter clearly defined the development approach, organization, deliverables, and revised schedule for completion of the

project. During the detailed development of the project charter, the development team identified the need to replace the point-of-sale system prior to full implementation of MIPS in order to meet established auditing and reporting requirements. Subsequently, the project development approach and implementation schedule were revised, and an eight-phase development and implementation approach was established that would to meet a revised project completion date of April 2002.

Full development of the MIPS applications continued into the spring of 2001 with development of the detailed design document and the applications and database design plans. The project team developed the basic applications and database needs of the MIPS system using a project management methodology based on the Project Management Body of Knowledge. The development of the MIPS applications was managed as a research and development effort using the rational unified process and joint applications development approach for identifying gaps in the existing functionality as well as desired improvements. In July 2001, a quality assurance plan was published in order to ensure that the processes and products that constitute MIPS conformed to established ABC standards and practices.

In July 2001, ABC also issued a request for proposals (RFP) for replacement of the point-of-sale system. There were eight offerors who responded to the initial RFP, and the Gartner Group, who assisted ABC throughout the procurement process, evaluated all of the proposals in accordance with pre-determined evaluation criteria. ABC then invited the vendors with the two highest rated proposals to conduct a gap analysis and provide a demonstration of the proposed technology solution. The two vendors were rated again after the product demonstration. In November 2001, ABC issued a notice of intent to award the contract for the point-of-sale replacement to Triversity.

Development of the point-of-sale replacement systems began in November 2001 with a defined rollout date of May 2002. The development of MIPS continued during this period as well. In January 2002, a change control board was established consisting of the project manager, technical and business area lead representatives, and members of the user community. The change control board was responsible for approving proposed changes to the project's functionality or requirements, setting priorities for software modifications, and communicating changes in the software requirements to the user community.

Parallel development of the two projects continued through 2002. Because the completion of the MIPS project was dependent on the point-of-sale data, the detailed development activities were closely coordinated and managed as one development effort. During 2002, there were seven modifications to the point-of-sale contract, primarily for additional hardware needs identified during the development effort, totaling $572,000.

In April 2002, ABC had to stop the full roll-out of the point-of-sale system to address several problems identified with the credit card processing component, and the implementation date had to be delayed. Following technical modifications to the point-of-sale-system, the final roll-out began in July 2002. While some supplemental functions of the MIPS system have still not been fully developed, final

implementation and acceptance testing for both the point-of-sale system and the mandatory requirements of the MIPS system were successfully completed in October 2002.

Presence of Critical Elements Contributed to Successful Project Delivery

All of the elements that appear to contribute to successful project development were present with the MIPS project. The remainder of this section discusses the presence of several of these elements, and the exhibit on the following page provides a summary of the presence or absence of the key elements for MIPS.

Technical Feasibility Was Proven Prior to Project Initiation. One strength of the MIPS project was that the technical feasibility was clearly established prior to initiating development work. As part of the initial planning, substantial research was conducted by the project team in order to identify the technical feasibility of the database conversion. Given the size and complexity of the inventory database, and the critical relationships with other ABC automated systems, an extensive software architecture analysis was completed in order to establish the technical feasibility of the project.

Additionally, a proof-of-concept demonstration was undertaken, and an outside consultant was used to review both the technical requirements and the results of the demonstration in order to ensure technical feasibility. This external review not only evaluated the strengths and weaknesses of the proposed system requirements, but evaluated the applications development and project management structures as well.

Adequate Organizational and Business Process Analysis. Contributing to the success of the MIPS project was an extensive business process analysis that outlined both the daily business workflow and reporting requirements of the existing automated systems. The business model provided a comprehensive evaluation of the role that the warehouse, wholesale/retail, financial management, and information services divisions perform in the management and sale of alcoholic beverages across the State. Furthermore, the business model provided a detailed analysis of the existing computer systems that were in place to support the business operations.

The MIPS business model appears to have been a useful research tool used by the MIPS project team to develop the conceptual model and detailed project plan. One of the critical strengths of the business model is that it presents complex business processes as pictorial relationships, and uses clearly defined relationship tables to illustrate how the business flow relates to the existing inventory and point-of-sale systems. Prior to establishing the detailed project plan, representatives from each business area reviewed the business model for completeness and identification of those areas to improve the operations, accountability, and profitability of the agency.

Adequate Vendor and Product Evaluation. Another critical strength of the MIPS project was an extensive vendor selection process for the point-of-sale

Presence of Elements that Contribute to Project Success Management of Inventory and Product Sales			
✔ Present	**✓Partially Present**	**✗ Absent**	
Identification of Functional Needs and System Requirements	✔		
Proven Technical Feasibility	✔		
Organizational and Business Process Analysis	✔		
Adequate Vendor/Product Evaluation and Selection	✔		
Strong Legal Contract	✔		
Effective Project Management	✔		
Involvement of End-Users	✔		
Effective Project Oversight and Control	✔		
Reliable Funding	✔		

replacement that was well documented and followed a clearly established vendor selection model. All proposals were evaluated in accordance with clearly defined evaluation criteria, and a gap analysis was performed to determine which proposals most appropriately fit ABC's defined systems requirements. Additionally, the Gartner Group provided an external review of the vendor proposals as well as documentation of the vendor selection process. Gartner also facilitated contract negotiations with the selected vendor and performed an external analysis of the contract and statement of work.

Strong Legal Contract Contributed to Project Success. Another key to the success of the MIPS project was the development of a fixed-price contract with clearly defined deliverables and a payment structure that was linked to both the project schedule and deliverables for the point-of-sale contract. In order to minimize the risk to both the vendor and the State, a tiered payment structure was established. Using this tiered approach, vendor payments were directly linked to actual deliverables, but the amount of the payment varied by the size and nature of deliverable. For example, a relatively small payment was linked to the provision of the development plan and project specifications. In contrast, the majority of the payment was contingent upon the final roll-out of the system. Costs for vendor consulting services were fixed at the outset and a percentage of the total agreed upon costs were included on each vendor invoice.

Effective Project Management Facilitated Successful Project Delivery. Critical to the success of the MIPS project were strong project management and software development methodologies. The project used an established project man-

agement methodology that was consistent with the Project Management Body of Knowledge guidelines. This provided a clear set of project reporting requirements and facilitated the establishment of a defined project management structure.

Another key to the successful development of the project was the use of an industry standard software development methodology. The Rational Unified Process, a software development methodology designed for large scale, custom software solutions, provided the development team with a tool for managing system requirements, a process for documenting requirement changes, and criteria for the successful testing of the final product.

Additionally, the project had a full-time project manager assigned from the ABC's IT division. Designated business analysts and business area sponsors were assigned to the management team from the finance, wholesale/retail, and marketing divisions. The business and technical representatives, under the direction of the project manager, had the authority to manage any changes to the business processes, make decisions on how the technology impacted business practices, and evaluate how well the technology solution met the business needs of the ABC.

Another strength of the project management structure was the effective use of the CIO to provide contract administration for the point-of-sale contract. Use of the CIO as the contract administrator not only ensured direct involvement by an agency executive in the management of a large contract, but also provided considerable benefits to the project management process.

Finally, the management was strengthened by the establishment of a formal change control board. This board was comprised of end-user representatives and the project's business and technical managers, and was responsible for evaluating all proposed changes to the system. Because the project was primarily a software development effort, the board was given the authority to approve changes to procedural and business requirements, provided they did not impact the project's scope, schedule, or budget. All change requests reviewed by the board were extensively documented and provided to the project management team.

Extensive Involvement of End-Users. Another key element to the success of the MIPS project was the extensive involvement of end-users throughout the project's planning, development, and implementation. The end-users were initially identified as the key stakeholders in the development process, and both technical and business area representatives were assigned to the project management team from the outset. Technical advisory groups were established in order to advise the project management team on issues related to areas of technical expertise, such as networking, telecommunications, systems software, applications software, and user support. Additionally, business area representatives from the wholesale/retail, finance, warehouse, and store systems division were designated to help answer technical questions about daily operations and process workflow for their respective business areas.

The systems end-users were also involved in the detailed development of the MIPS applications. Through the use of a joint applications development ap-

proach to develop the core MIPS components, the end-users were able to provide direct advice and comment on the applications' strengths and weakness and identify gaps in the intended functionality. End-users also played a key role in testing and acceptance of the prototype.

Effective Project Oversight and Established Change Control Process. One of the key strengths of the oversight model for this project was the establishment of the MIPS Management Committee, consisting of the Director of Wholesale/Retail (the project's executive sponsor), the Chief Information Officer, the Chief Financial Officer, and the Director of Internal Audit. A representative from the Auditor of Public Accounts Office played an informal role on the management committee as well. The committee was responsible for providing general oversight of the project development effort and approving any changes to the project's scope, schedule, or budget. Furthermore, the committee was responsible for authorizing all contract modification agreements.

Reliable Funding Was Available Throughout the Project. A final key to the success of the MIPS project was the availability of reliable funding over the life of the project. Critical to the successful funding of the project was a detailed project budget that estimated total cost from the outset and amortized costs over five years. Additionally, while the budget was developed in the first year, the funding was allocated annually. When approved changes to the project required funding in excess of its annual allocation, the ABC finance division was able to shift funding from other programs. In addition, ABC used the Master Equipment Lease Program offered by the Department of Treasury to finance purchase of the point-of-sale cash registers and software.

MEDICAID MANAGEMENT INFORMATION SYSTEM

The Medicaid Management Information System (MMIS) project is an effort to replace the existing MMIS, which was developed in the 1970s, with a new system that will enable the Department of Medical Assistance Services (DMAS) to better manage payments to Medicaid providers. The new MMIS, when fully functional, will lower operating and maintenance costs, assist DMAS in reducing insurance fraud, produce automated fiscal management reports, and allow for increased electronic transfer of data. In addition, the new MMIS will be compliant with Health Insurance Portability and Accountability Act (HIPAA) regulations, which is a requirement for obtaining the maximum level of federal funding for State Medicaid payments after October 16, 2003.

The current MMIS project was expected to be completed in December 1999 at a cost of $22.5 million. However, due to implementation delays and an expanded project scope, the expected completion date is now June 2003. The total implementation cost is now estimated at $60.6 million, of which $13.8 million is the result of additional functionality for HIPAA-compliance. The total cost overrun for the MMIS project, excluding costs associated with making the system HIPAA-compliant, is $24.4 million. The federal government provides 90 percent of the funding for the project. The initial lack of several elements critical to project success has slowed the project and contributed to substantial cost increases. A summary of the project is provided in the exhibit on the following page.

Narrative Chronology of the MMIS Project

Procurement efforts for a new Medicaid Management Information System (MMIS) began at the Department of Medical Assistance Services in 1991. The current MMIS project is the second attempt by DMAS to implement the new system. The first effort was terminated after the vendor, Electronic Data Systems (EDS), was unable to develop a satisfactory system. The current development effort involves a contract with a single vendor, First Health Services, for both the design and implementation of the system. The contract has been modified twice to increase payments to the vendor, add functionality to the system, and extend the project schedule.

DMAS first began preparation for a new MMIS in March 1991. The Health Care Finance Administration (HCFA) approved the department's request for federal funding for the design and implementation of a replacement MMIS. DMAS, with the assistance of the Department of Information Technology, issued a request for proposals (RFP) in December 1993 for the design, implementation, and operation of the replacement MMIS. A contract was awarded to EDS in July 1994. EDS was unable to develop an effective system, and the contract was terminated in April 1997. DMAS had paid EDS $1.5 million for development efforts, but the money was refunded upon termination of the contract.

Following the termination of the contract with EDS, DMAS again requested and received approval for federal funding from HCFA to implement the MMIS under

Medicaid Management Information System
Department Of Medical Assistance Services

Projected Cost	$22.5 million
Actual Cost	$60.6 million* (estimate as of November 2002)
Projected Timeframe	April 1997 – December 1999
Actual Timeframe	April 1997 – June 2003
Status	Ongoing
Purpose	To develop a new CMS-certifiable/HIPAA-compliant Medicaid payment system with automated reporting and electronic transfer of data.
Rationale	Needed to replace legacy system that has been in operation for nearly 30 years.
Vendors and Products Used	First Health Services.
Problems/Successes	Implementation delayed 3.5 years; price and project scope increased.

* This figure includes $13.8 million for procurement of services to make the MMIS system HIPAA-compliant, which was not part of the original project.

Source: JLARC staff analysis of agency project documentation.

a new contract. DMAS issued a new RFP, but only received two responses. The low number of responses was due to the fact that only four companies were in the marketplace for the development of state MMIS systems, and one of these companies, EDS, had already failed to develop a system for DMAS. Although both proposals received were technically equivalent, DMAS selected First Health Services (FHS) due to the lower cost of its proposal and the department's belief that FHS had successfully implemented an MMIS in Mississippi.

DMAS awarded a contract to FHS in February 1998. The agency agreed to pay a fixed-price amount of $15.5 million for implementation of the MMIS in December 1999 and an additional $45 million over five years for operation of the system beginning in January 2000. DMAS staff stated that FHS might have purposely underbid the design and implementation of the MMIS in order to secure the more lucrative operations component of the contract.

The planned completion date for the MMIS was December 31, 1999, but this implementation date soon proved to be unrealistic. In 1999, it was determined that the implementation date could not be met and efforts were diverted to make the

existing MMIS year 2000 compliant. This further delayed progress with design and implementation of the new system.

In February 2000, FHS made a unilateral decision to change the technical architecture of the system without prior notification to or the approval of DMAS. FHS abandoned its effort to modify the Mississippi baseline system for Virginia, as was delineated in their proposal, and began the construction of a new MMIS system based on a new database architecture, IBM's DB2. DMAS had explicitly stated in its RFP that the winning vendor would either enhance the existing Virginia MMIS or install a certified MMIS product from another state. This was done to reduce the cost of development and minimize the risk of failure. The result of this change to the technical architecture by FHS was that almost all of the programs needed to be rewritten, and the project was further delayed.

Following disputes between FHS and DMAS over this change and the extent of work performed that was beyond the scope of the project, the contract was modified in April 2000. Through the contract modification, DMAS agreed to pay FHS an additional $10 million to complete implementation of the system, including all changes considered beyond the scope of the original contract, and the implementation date was adjusted to June 2001. Following the contract modification, both DMAS and FHS changed project managers.

More system development delays occurred after the April 2000 contract modification, and these delays caused the scheduled implementation date to slip from June 2001 to early 2003. Disputes continued between DMAS and FHS project management over the viability of the FHS project schedule and the extent of systems acceptance testing. DMAS claimed the FHS implementation schedule was not possible given the current rate of development and systems testing progress. FHS claimed that DMAS was needlessly delaying the project by being overly critical in its review of FHS systems testing, while DMAS claimed FHS was delivering a poor quality system that had been inadequately tested.

Beginning in January 2002, development of the MMIS project began to progress more rapidly. FHS replaced its project manager, and DMAS claims the new FHS project manager has been more effective and more responsive to the department's requests. In March 2002, DMAS proposed a detailed implementation plan and critical path for deliverables that would fully implement the system in June 2003, and FHS agreed to this schedule. Shortly thereafter, DMAS and FHS agreed to a schedule change that would accommodate HIPAA-compliant development and testing and result in a June 2003 implementation date. DMAS completed acceptance testing on the first set of subsystems in May 2002 and completed the second set in October 2002. System development has proceeded according to the agreed-upon critical path.

The primary challenge now facing the system development effort is to make the MMIS compliant with the Health Insurance Portability and Accountability Act (HIPAA). The Centers for Medicare and Medicaid Services, formerly HCFA, requires that all states be HIPAA-compliant by October 16, 2003. If Virginia's MMIS is not HIPAA-compliant by that date, federal assistance of Medicaid payments will

be withheld until the MMIS is made HIPAA-compliant. DMAS expects the MMIS to be HIPAA-compliant by June 2003, and has modified the contract with FHS to accomplish this.

In June 2002, DMAS entered into contract modification negotiations with FHS to complete implementation of a HIPAA-compliant MMIS. The modifications were agreed to in October 2002. Under the agreement, DMAS agreed to pay FHS $11.3 million on a time and materials basis for work to make the new MMIS HIPAA-compliant. In addition, DMAS also agreed to pay FHS an estimated $1.5 million on a time and materials basis for changes to the new system that have been added to the existing system since development efforts began. Finally, DMAS agreed to a $4.5 million lump sum payment demanded by FHS to enable the company to continue development efforts. Thus, the total implementation costs paid to FHS will be approximately $43.3 million. In addition to the amount paid to FHS, DMAS will have also spent more than $17 million on other MMIS project costs, the majority of which is for contractor support staff and internal staff time. Nearly 90 percent of the project is federally funded.

Absence of Critical Elements Has Led to Cost and Time Overruns

Although changes to the project management and oversight structures appear to have produced significant recent progress in development of the Medicaid Management Information System (MMIS), an initial lack of several critical elements has led to substantial cost and time overruns with the project. Poor identification of system requirements, unproven technical feasibility, poorly defined deliverables in the contract, and ineffective project oversight throughout much of the project have caused the project implementation to be delayed and the estimated price for the core MMIS to increase from $22.5 million to $46.8 million. However, a project management change in April 2000, strong end-user participation, and reliable funding appear to have improved progress toward implementation of the MMIS. The exhibit on the next page summarizes the presence or absence of the key elements.

Identification of System Requirements Was Inadequate. One element that was absent from the MMIS project was an adequate identification of functional needs and system requirements, which adversely affected timely progress in development of the MMIS. DMAS professional staff were assigned to teams to create requirements analysis documents (RADs) for their functional areas. These RADs became the basis for the system design and determination of contract deliverables. According to DMAS project management staff, the teams were not provided with adequate direction and monitoring. As a result of the inadequate requirements definition process, the functional requirements for the system were not fully developed. A significant amount of time was spent after project initiation on disputes between DMAS and First Health regarding what the contract deliverables should be and the extent of the project scope. Poor requirements definition ultimately resulted in the contract modification of April 2000 and additional payments of $10 million to the vendor.

Presence of Elements that Contribute to Project Success Medicaid Management Information System			
✔ Present	**✓ Partially Present**	**✗ Absent**	
Identification of Functional Needs and System Requirements			✗
Proven Technical Feasibility			✗
Adequate Organizational and Business Process Analysis		✓	
Adequate Vendor/Product Evaluation and Selection		✓	
Strong Legal Contract			✗
Effective Project Management		✓	
Involvement of End-Users	✔		
Effective Project Oversight and Control		✓	
Reliable Funding	✔		

Technical Feasibility Was Unproven. Another element that was absent from the project was proven technical feasibility. The feasibility of successfully developing and implementing an integrated MMIS was unproven, as no other state had managed to implement a fully functional integrated MMIS within budget, and the previous attempt in Virginia was unsuccessful. When DMAS chose First Health Services (FHS) to develop the MMIS for Virginia, it believed that FHS had successfully developed an MMIS for Mississippi. However, it was later discovered that the Mississippi model had significant flaws, which DMAS apparently could have uncovered through a more thorough evaluation.

Virginia is now a pioneer for the MMIS being developed by FHS, and as a result may pay more for the system than states that will follow. FHS has begun to capitalize on its efforts in Virginia in marketing to other states. In fact, FHS has recently been awarded contracts to develop an MMIS system for the states ofNevada and Alaska. These states will likely benefit from Virginia's pioneering effort. Given that Virginia already had a federally certified MMIS, it may have been prudent to continue maintaining the current MMIS and upgrading pieces of the system until a vendor had proven its ability to develop a fully functional state MMIS.

Contract Deliverables Were Unclear; Not All Payments Are Tied to Deliverables. Presence of a strong legal contract was another element absent from the MMIS project. The absence of a strong legal contract has adversely affected the MMIS development and may have caused the additional expenditure of $15 million through contract modifications. The content of the contract deliverables was not clearly specified in the original contract with FHS, which led to numerous disputes

concerning the scope of work being performed by FHS. These disputes cost both parties valuable time that could have been spent on system development and testing. As the implementation schedule slipped and FHS could no longer absorb the development costs within the fixed-price contract, DMAS was under pressure to complete the project and agreed to pay FHS an additional $10 million to cover system requirements that FHS claimed were beyond the scope of the RFP. As the implementation schedule slipped more and disputes persisted, DMAS agreed in August 2002 to provide FHS with an additional lump sum payment of $4.5 million to complete development of the MMIS.

With the contract modifications, not all payments are tied to deliverables. Although the original $15.5 million fixed-price contract tied payments to the completion of specific tasks, subsequent modifications required DMAS to provide lump sum payments to FHS for continuing development efforts. DMAS agreed to these modifications partly because it believed it could not afford to terminate its contract with FHS. DMAS did not feel confident that CMS would approve another (the third) MMIS funding request and did not think its staff could support that third effort. Also, implementation of the Health Insurance Portability and Accountability Act (HIPAA) compliance as part of the MMIS will result in an additional $11.3 million payment to FHS, mostly in project startup and estimated time and materials costs.

According to DMAS staff, the MMIS project was too complex to be designed and implemented under one fixed-price contract. They now believe it would have been better to have entered into a time and materials contract for an analysis of the system requirements and system design, and then a fixed-price contract for implementation of the designed system. This process may have avoided many of the contract challenges and given both parties a better idea of the true implementation costs.

End-User Participation Has Been Strong. While several of the success elements were absent throughout much of the MMIS project, a few elements have been present throughout the project. One element that has been present is involvement of end-users. DMAS staff have been involved in both planning and development of the system. End-users were involved in defining the system requirements that were used in the RFP. In addition, DMAS business area experts led the various teams for the development of each of the subsystems that comprise the MMIS, such as the management and administrative reporting (MARS), surveillance and utilization review (SURS), early periodic screening, diagnosis and treatment (EPSDT), claims, finance, and drug subsystems. The team leaders work with contractor IT staff and the First Health staff to perform system acceptance testing and report periodically to the DMAS project manager.

Project Funding From Federal Government Has Been Reliable. The other element that has been present for the MMIS project is reliable funding. DMAS has received funding from the Centers for Medicare and Medicaid Services (CMS), which pays 90 percent of the systems development costs. In order to receive CMS funding, DMAS must submit an Advanced Planning Document detailing the purpose and rationale for the funding. CMS has never denied a request for funding from DMAS. Because of the availability of federal funds and State matching re-

quirement of only ten percent, DMAS and First Health have been able to continue their implementation efforts despite significant increases in development costs.

Project Management Has Improved. One element that has been partially present is effective project management. Project management by DMAS was ineffective during the early stages of system development, but has improved since 2001. During the early stages of system development, from February 1998 through 2000, DMAS project management and FHS never agreed on a detailed project plan. As a result, FHS was able to repeatedly miss task deadlines, unilaterally change the technical architecture of the system platform, and continue the system development effort at a pace that caused numerous delays. Although these incidents may have represented a breach in the contract, DMAS did not elect to terminate the agreement or seek other available corrective action. Because of these problems, the implementation date has slipped from December 1999 to June 2001 and finally to June 2003, and the price for implementation of the core MMIS components has increased from $22.5 million to $46.8 million. Better contract administration by the project management team could have reduced delays and enabled implementation at a lower cost to the Commonwealth and federal government.

Project management of the MMIS implementation appears to have improved significantly in the last two years. When the current project management team was assigned to the project, it raised concerns with First Health about schedule slippages and noted the improbability of the June 2001 implementation target date. The team developed a detailed implementation plan and critical path for successful implementation, which was agreed to by First Health and led to common acceptance of the June 2003 MMIS implementation date. In addition, the current project management team has been diligent in documentation of problems with the vendor and addressing project issues as they arise.

Project Oversight Has Been Ineffective But Has Improved. Another element that was partially absent throughout much of the project was effective project oversight. From project initiation in February 1998, there was no internal oversight structure in place to address major decisions regarding time delays, increased costs, and project scope changes. According to DMAS project management staff, the project management team did not receive adequate project oversight from leadership staff when the implementation schedule began to slip and disputes with FHS arose. DMAS leadership allowed FHS to deviate from the RFP by changing the technical architecture of the system, which considerably delayed the implementation date. A more effective internal oversight structure might have been able to more effectively limit changes to the project scope and reduce some of the delays that have occurred.

More recently, oversight has improved within DMAS, and the project now has external oversight as well. Project oversight has improved through better communication between the DMAS project manager and DMAS leadership, the use of an independent quality assurance consultant, and external secretarial oversight. The deputy director at DMAS now meets weekly with the project management team and consults with the Department of Technology Planning to help ensure the project remains on track for the remainder of the MMIS implementation. Quality assurance is being provided by CACI, Inc. to help ensure the product will meet the depart-

ment's needs. The secretarial oversight committee, chaired by the Secretary of Technology, has been briefed periodically on the project progress and development costs and has helped the project team identify risks.

SERVICE 2000

The Service 2000 project undertaken by the Virginia Department of Motor Vehicles (DMV) was a $25.6 million infrastructure replacement project designed to upgrade and replace the IBM Series 1 operating system with a Unix based platform at DMV's central office and all branches. The project required the replacement of not only the operating systems at more than 75 customer service centers, but also the wide-area network connections between the branch offices, the central office, and the Department of Information Technology's (DIT) data center. Eight of the nine elements that are critical to project success were fully present and the ninth element was partially present. The exhibit on the following page provides a summary of the project.

Narrative Chronology of the Service 2000 Project

The Service 2000 project required the complete overhaul of the DMV core customer service center system in order to improve the ability of the field offices to manage licensing and registration transactions. Additionally, the project improved the ability of the DMV central office to track and report data from its central database, and improved security of all data within the Department of Information Technology's data center.

DMV's IT division first identified the need for replacement of the IBM Series 1 minicomputers that DMV relied upon for business operations at its customer service centers in the early 1990s. Due to an aging technology infrastructure, and the discontinuation of technical support for the system by IBM, neither replacement hardware nor additional software had been made available for the Series 1 system since 1991. Therefore, the IT division began to research available replacement options. In the summer of 1994, a proof-of-concept project was conducted in order to assess the feasibility of re-writing the software for the applications currently based on the IBM platform to a Unix platform. Following completion of this proof-of-concept, it was determined that the software could effectively be re-written in a modern programming language to provide the desired functionality on the Unix operating platform with minimal changes to the existing customer service applications.

After the initial planning and successful proof-of-concept demonstration were completed, the project was officially initiated in early 1995. In January, a full-time project director was assigned from the IT division. Several development teams and an executive steering committee were also established. Five principal development teams were established to direct the activities of various aspects of the project. These five teams included a project management team, a hardware replacement team, a network conversion team, an applications software team, and a user team. In addition, an executive steering committee comprised of the DMV Commissioner, finance director, field commissioners, and the chief information officer was established. The steering committee was responsible for authorizing changes that impacted the project's scope, schedule, or budget and addressing other major issues as they arose.

Service 2000
Virginia Department of Motor Vehicles

Projected Cost	$20.7 million
Actual Expenditure	$25.6 million *
Projected Timeframe	March 1995 – March 1997
Actual Timeframe	March 1995 – July 1998
Status	Implemented
Purpose	To replace outdated computer equipment in all DMV customer service centers throughout the State with equipment, networks, applications, and organizational infrastructure adequate to support customer service center operations.
Rationale	To address identified deficiencies with the existing customer service center system, and reduce annual maintenance and support costs.
Vendors and Products Used	Amdahl Corporation.
Problems/Successes	Project was successfully completed.

* Does not include agency costs.

Source: JLARC staff analysis of agency project documentation.

Substantive planning for the replacement project began in early 1995 with a comprehensive analysis of the existing DMV technology architecture and the development of a capacity plan for the agency's technology needs. In April 1995, the project team prepared an initial systems architecture and project blueprint for the replacement of the IBM Series 1 operating system. This document served as the basis for guiding the development and implementation of the entire project. The DMV project team estimated that the replacement of the IBM Series 1 in all DMV customer service centers would be completed by March 1997.

The planning process included extensive involvement by DIT staff as well as training provided by IBM. Moreover, following completion of the systems architecture analysis, an outside consultant was hired to provide independent verification and validation of the identified technology needs. The consultant also established a network performance benchmark in order to develop a baseline for the desired response time for the system under the new centralized computing approach.

In the summer of 1995, an effort to develop a prototype Unix application was initiated, and in July 1995, the project team began full development of the pilot

demonstration project. Because the entire replacement effort would require the replacement of not only the applications programming language but the entire operating system, the pilot demonstration effort was undertaken to train the project team in the skills and tools that would be required to facilitate project delivery. This pilot development effort continued through the fall of 1995.

Additionally, in the fall of 1995, the project team completed a formal cost-benefit analysis that outlined the estimated project costs, quantified the desired benefits, and assessed the total cost of ownership for the systems replacement. The cost-benefit analysis estimated the total cost of the replacement effort at approximately $21 million. This analysis determined that there was the potential for substantial cost savings associated with replacing an operating system that would no longer be supported, and improving the overall stability and security of the State's most extensive database. As part of the cost-benefit analysis, DMV staff estimated that the project had the potential to save the department more than $4.3 million annually in equipment and support costs.

Detailed project planning activities continued through early 1996. Because there were no other state DMV models identified during the initial planning phase, the business requirements were established by the executive steering committee after they were developed by the user groups and approved by the group's project manager. A business process analysis was conducted in order to determine the specific business processes that could be improved, altered, or impacted by the implementation of the system. The business process review incorporated the business user group to identify areas for improved efficiency by field staff.

The request for proposals (RFP) seeking a hardware and applications provider was issued in June 1996. A number of responses to the initial RFP were received, and three vendors were identified for additional presentations. Through the fall of 1996, DMV conducted extensive evaluations of the two final vendors, and negotiations continued into early 1997. Throughout this process, DMV followed a documented vendor selection process with clearly established selection criteria.

In February 1997, DMV posted an official notice of intent to award a final contract to the Amdahl Corporation, and a formal contract with Amdahl was signed in March 1997. The final contract was for an agreed upon fixed-price of $20.7 million, with the final installation to all DMV customer service centers completed by April 1998. All post-implementation training and technical assistance was scheduled to be completed by October of 1998.

Development and system installation work, initially scheduled to begin in April of 1997, was rescheduled to July of that year. This delay resulted from a request by the steering committee that a formal change control study be completed in order to identify processes for ensuring that customer service would not be substantially impacted during the conversion activity. Full systems development activities began in the summer of 1997, and the development team was responsible for providing demonstrations and testing opportunities to members of the user groups on an almost monthly basis. Throughout this development effort, a joint applications development approach was used to ensure that the existing functionality was being

provided on the new platform, and to identify areas in which efficiency improvements could be made to the existing functionality.

Given the technical complexity of replacing all operating systems at the DMV customer service centers, the project followed a phased implementation plan. Because of the delays in the initial development and implementation, the installation date for the first customer support center was delayed from September 1997 to January 1998. Following the successful implementation of the operating system at the pilot customer service center, full product installation of the Service 2000 replacement hardware and software at all customer service centers began in March 1998. With the opening of several additional DMV customer service centers during project development, the cost of the project increased by $4.9 million to pay for additional hardware and cabling needs in these new centers. Due to delays in the initial project planning and vendor selection processes, as well as the additional work required in the new service centers, final implementation of the project was completed in July 1998, more than 15 months beyond the original scheduled completion date.

Presence of Critical Elements Contributed to Successful Project Delivery

All but one of the elements that appear to contribute to successful project delivery were fully present in the development of Service 2000. The remainder of this section discusses some of the elements in detail, and the exhibit on the following page provides a summary of the presence or absence of each of the elements.

Technical Feasibility Was Clearly Established. One of the key strengths of the Service 2000 project was that the technical feasibility of the project was clearly established. A comprehensive pilot project was undertaken prior to the release of the RFP. Furthermore, DMV consulted DIT extensively regarding potential technical issues that might arise because the project involved upgrades to the DMV statewide wide-area network as well as connections to the Commonwealth Telecommunications Network. A proof-of-concept demonstration was also conducted in order to determine if it was technically feasible to re-write the existing software to a Unix platform. Finally, an outside consultant was retained to review and evaluate both the project plan and the systems architecture documents in order to assess the overall technical feasibility of the project.

Project Had a Strong Legal Contract. The contract with the Amdahl Corporation was another strength of the Service 2000 project. The payment structure established within the contract clearly tied payments to deliverables by establishing milestone payment dates. In several instances, DMV withheld payment until the contractual obligations of the vendor were satisfied. Furthermore, the payment structure enabled DMV to manage development progress by establishing target dates for the completion of each milestone.

The technical specifications established within both the RFP and contract documents allowed DMV to successfully manage not only the vendor's performance in developing the application, but the performance of the product as well. For

Presence of Elements that Contribute to Project Success Service 2000			
✔ Present	**✓ Partially Present**	**✗ Absent**	
Identification of Functional Needs and System Requirements	✔		
Proven Technical Feasibility	✔		
Organizational and Business Process Analysis		✓	
Adequate Vendor/Product Evaluation and Selection	✔		
Strong Legal Contract	✔		
Effective Project Management	✔		
Involvement of End-Users	✔		
Effective Project Oversight and Control	✔		
Reliable Funding	✔		

example, the specifications clearly established the minimum delivery time for data exchange between the central server and field offices. Furthermore, the contract established clearly defined service levels that enabled DMV to monitor the system for operational performance. The agreed upon service levels and system performance requirements included in the contract allowed DMV to ensure a guaranteed level of system operability and stability, while at the same time providing a mechanism for DMV to withhold payment to the vendor if the system did not perform as required.

Effective Project Management Contributed to Project Success. The presence of a strong project management structure contributed to the success of the Service 2000 project by establishing clearly defined roles and responsibilities for the planning, development, and acquisition of all hardware, software, and services. The project management team consisted of the project director and separate project managers for each of the development teams. The project management team was responsible for planning, organizing, directing, and controlling all project development to ensure that the project was completed on time and delivered the expected services. The project director, as part of the executive project management team, was responsible for the coordination and oversight of three development teams, and was also responsible for reporting the project status to the executive oversight committee.

Additionally, the development managers assigned to the functional development teams were critical to the success of the project, because these managers were representative of the key business units affected by the project. The technical manager was from the IT division and was responsible for the network design and

hardware acquisition. The business manager was a representative of the customer service unit and was responsible for the identification of the business needs, as well as oversight of the implementation and user acceptance and training. Finally, the application manager was responsible for the design of software as well as managing the interface between the service centers, the central DMV office, and DIT. Each of the managers was responsible for the oversight of their respective project teams. While the project managers did not receive specific project management certification, these employees did receive training for specific skills that would be needed and received extensive on-the-job project management training during the project.

Another key to the success of the project was the use of the technical manager as contract administrator to ensure that the physical inventory acquired under the contract was actually provided to DMV. Because this was a highly technical project, the technical project manager had responsibility for ensuring that the system was designed and delivered properly. Due to the technical specifications of the contract document, effective contract administration was critical for ensuring the success of the project.

Extensive Participation of End-Users Facilitated Successful Development. Extensive participation by end-users was also important to the success of the Service 2000 project. Because the project was a replacement of the existing customer service system, DMV field office staff were identified as key stakeholders from the outset of the project and were utilized in the planning, design, implementation, testing, and training of the system. Prior to the release of the RFP, the end-users directed the development of the technical and functional specifications. User groups, consisting of DMV field staff from across the State, were established to develop the functional requirements for the RFP, and the user project manager was responsible for approving the final functional requirements.

In addition, the end-users were extensively involved in the design and testing of the applications on a monthly basis. The extensive use of end-users in the applications development allowed the programmers to more easily migrate the existing functionality to the new system and also identify areas in which business processes could be improved. The user groups also served as the initial field trainers because of their proficiency with the system.

Effective Ongoing Project Oversight. Critical to the success of the Service 2000 project was a clearly defined ongoing project oversight body consisting of key DMV executives with the authority to approve changes to the project's scope and resources. While the project director had overall responsibility for the day-to-day oversight of the development teams and the contractor, the executive steering committee was responsible for making critical decisions to advance the project throughout its development stages. Executive steering committee meetings were held at least monthly for the project director to provide updates and request guidance on issues affecting project funding or agency business processes.

STANDARDS OF LEARNING TECHNOLOGY INITIATIVE

The Standards of Learning (SOL) Technology Initiative is providing funding to school divisions for the provision of computer hardware and the development of online high school SOL tests. The project was proposed by the previous Governor and was approved by the 2000 Virginia General Assembly. According to DOE, the project will be considered a success when the following benchmarks have been met:

- All high schools are capable of administering SOL assessment examinations via online technology;
- All high schools have access to high-speed, high-bandwidth capabilities for the use of instructional and remedial software applications;
- All high schools have Internet-ready local area network capability; and
- All high schools attain a minimum ratio of 5 students to every Internet-capable computer.

The SOL project appears to be successful at this point, and DOE expects that most high schools will be capable of administering on-line SOL tests by the Spring of 2004. The success of this project appears to derive from a thorough vendor selection process, high involvement of end-users, effective project management, and access to sufficient funding. However, DOE needs to improve school division oversight and provide an independent review of the software product. An exhibit on the next page provides a project summary.

Narrative Chronology of the SOL Project

The SOL project was first proposed in September 1999 in response to school division interest in online testing. School divisions were particularly interested in reducing the four week turnaround time for test scoring and reporting, which was deemed unacceptably long. Furthermore, it was anticipated that online testing would increase test security and reduce the logistical burden of handling paper tests and answer sheets. Some aspects of the SOL project are a continuation of earlier State goals. The State has provided funding for educational technology in school divisions since 1988, and the specific goal of a 5 to 1 ratio of pupils to computers has been in place since 1996.

An initial project scope was developed by DPB staff, and the 2000 Appropriations Act provided a total of $6,271,362 from general funds for the administrative costs of the project in FY 2001 and FY 2002. These costs include expenditures for items such as a request for proposal (RFP), consulting services, training, administration, and the publication of architectural guidelines. A portion of these funds were used to hire a consultant to serve as project manager until DOE staff could assume that role. The consultant assisted DOE staff in the preparation of a detailed project plan, which was published in August 2000. An additional $6,423,263 was identified from general funds for the administrative costs of the project in FY 2003 and FY 2004. However, the 2002 Appropriations Act deferred the FY 2003 funds until the second year to grant DOE an additional year to anticipate and correct any issues involved with going on-line.

SOL Technology Initiative
Department of Education

Projected Cost	$256 million plus approximately $147 million in undocumented local and federal funding.
Actual Cost (as of Sept. 2002)	$183 million plus approximately $134 million in undocumented local and federal funding.
Projected Timeframe	September 1999 – April 2003
Actual Timeframe	September 1999 – April 2004
Status	Under Development
Purpose	To provide Internet-capable technology to high schools and to create a statewide Standards of Learning test delivery system.
Rationale	Initiated in response to Executive Orders 51 and 65, as well as the 2000 Appropriations Act.
Vendors and Products Used	NCS Pearson provides the testing software.
Problems/Successes	System is under development, and some school divisions have begun to provide limited testing.

Source: JLARC staff analysis of agency project documentation.

The 2000 Appropriations Act also authorized the Virginia Public School Authority (VPSA) to issue approximately $115 million in bonds in FY 2001 and FY 2002 for distribution to school divisions as grants to reimburse expenditures on qualifying hardware purchases. The budget for this project may not exceed the amount approved by the General Assembly, which appropriates funds from the State Literary Fund to pay debt service on the VPSA bonds. In FY 2003 and FY 2004, it is anticipated that a total of $117 million in VPSA bond proceeds will be available for grants to school divisions.

The VPSA bond funding for divisions is based upon a $26,000 per year allocation for each school in a school division, regardless of grade level, and a $50,000 payment each year for division-wide expenditures. Funds are received by the school divisions after the local board of education has adopted a resolution and has requested reimbursement for qualifying expenditures. Localities are also required to provide matching funds equal to 20 percent of the grant amount.

In addition to the administrative funds and VPSA bond proceeds, approximately $15 million in State funds, referred to as the Technology Support Payments, will be made available to school divisions during fiscal years 2002 through 2004 to offset the cost of hiring technology personnel. Finally, DOE staff anticipate that ap-

proximately $100 million in federal E-Rate funding will be available to school divisions in fiscal years 2001 through 2004, which will be primarily used to pay for telecommunications costs.

In combination, the total expenditure on the SOL project is projected to be approximately $403 million during fiscal years 2001 – 2004. This figure includes $9,259,899 in administrative costs, $232 million in VPSA bond proceeds, $46,400,000 in local matching funds, $15 million in Technology Support Payments, and $100 million in federal funds. DOE staff anticipate that an equivalent funding stream will be necessary indefinitely in order to extend the initiative to middle and elementary schools, as well as maintain the current information systems at the high schools.

In August 2000, DOE invited school divisions to participate as pilot sites for a demonstration of online SOL testing. A total of 57 school divisions responded and agreed to provide staff and student participants, as well as any other necessary support. In order to ensure that the demonstration sites were representative, DOE rated the participating school divisions according to a number of different factors. For example, a broad geographic representation was desired, as were a variety of schools that had differing student population sizes and technical capacity. In December 2000 DOE selected nine high schools to serve as demonstration sites.

In October 2000, DOE issued an RFP for a "turnkey" solution for online SOL testing. A total of eleven proposals were submitted, and DOE formed an evaluation committee whose members reviewed all proposals independently and then convened to reach a final decision. In December 2000, DOE awarded a contract to three vendors recommended by the evaluation committee. After their selection, the three vendors developed their online versions of the SOL tests, and also worked with DOE and school division staff to complete site evaluations and install any additional equipment or needed upgrades. Funds provided by the 2000 Appropriations Act helped to defray the cost of administering the demonstrations.

The three software demonstrations were evaluated by the teachers and administrators involved in the demonstrations, who were asked to complete an evaluation form that addressed the specific criteria of the original RFP. Students were also provided with the opportunity to submit comments. In addition to the evaluations completed by demonstration site participants, DOE retained an independent consulting firm to provide a detailed technical review of the proposed software.

A significant product of the demonstration phase was the publication of a set of minimum technical specifications by DOE staff in collaboration with the vendors' technical staffs and an independent technical consultant. The Architectural Guidelines for High School Readiness document was published on DOE's website in July 2001, and it specifies minimum technical requirements and best practices in five areas: planning, infrastructure, computers, networks, and network servers. The technical information provided includes the type of desktop computers required and the amount of network bandwidth needed. Detailed network specifications were also provided, including a required telecommunication protocol and the type of net-

work cable. Additionally, these guidelines could be used by school divisions in conjunction with the results of a DOE survey of each division's existing technology infrastructure. In combination, the survey results and the guidelines enabled DOE, the vendor, and the divisions to determine the technology gap that existed at each individual school, and then identify what steps had to be taken to address this gap.

Although DOE staff are responsible for ensuring that the software vendor provides the test materials, the actual work necessary to install, configure, and test desktop and network hardware and software is conducted at the division level, either with school division resources or contracts with vendors. The SOL project requires that school divisions be capable of administering online tests by Spring 2004.

To assist school divisions, DOE created a phased development approach consisting of a three-stage certification process. Once a stage is completed, school divisions may request VPSA funds for expenditures made in middle schools, but school divisions are responsible for ensuring that sufficient funding is still provided for high school needs. Stage 1 is a self-certification checklist that measures school division progress toward the attainment of the minimum standards in the architectural guidelines. As of August 1, 2002, 100 of 132 school divisions have achieved Stage 1 certification.

Stage 2 certification requires school divisions to submit planning documents to DOE that specify the maximum number of computers to be used for online testing, the total number of tests that will be administered, and the number of scheduled administrations per day. School divisions must also test the capacity of their local networks, which can be accomplished by using load test software developed by the testing vendor. As of August 1, 2002, 20 of 132 school divisions have completed Stage 2 certification. Stage 3 certification is a 96-hour checklist that school divisions will complete not more than 96 hours before the start of online testing.

In the Spring of 2002, approximately 8,732 online tests in five subject areas were administered in a total of 21 school divisions. Three of these subjects, Algebra I, English: Reading/Literature and Research, and Earth Science, were conducted in a live, scored administration. DOE surveyed school divisions in May 2002 to ask if they were willing to participate in online testing in Summer 2002, Fall 2002, or Spring 2003. Of 132 school divisions, 107 responded to the survey. Of the responding school divisions, 19 wanted to participate in online testing in Summer 2002, 48 wished to participate in Fall 2002, and 69 were interested in participating in Spring 2003. As of August 1, 2002, 32 school divisions, or 24 percent, have participated in online testing to some degree.

The project timeline, as revised by the 2002 General Assembly, indicates that all high schools will be capable of conducting online testing by the Spring of 2004. In accordance with language from the Appropriations Act, DOE staff indicate that project success will be measured by the number of school divisions that are capable of testing, not by the number that actually conduct testing. Moreover, DOE staff anticipate that an unknown percentage of school divisions will not meet the Spring 2004 deadline.

The project plan anticipates that upon completion of the project, a comprehensive review and evaluation will be conducted to assess how well the implementation plan was executed. The project management team will compare completed objectives with those listed in the project plan and document the advantages or disadvantages of certain tasks, procedures, and plans. The intent of this process is to create a "Lessons Learned" document that can be used as a reference when planning another technology initiative.

Presence of Key Elements Has Contributed to Apparent Project Success

In many ways, the SOL Project exemplifies the presence of those key elements that contribute to project success. The project is a pioneering effort to institute an electronic high-stakes testing system, though this does not appear to have weakened the project thus far. The only weakness presently exhibited is in project oversight, because DOE staff have not instituted independent oversight in the form of Independent Verification and Validation (IV&V) for either DOE staff activities or vendor performance. In addition, DOE staff report that they have limited ability to independently assess the progress made by school divisions. An exhibit on the next page summarizes the presence or absence of the key elements.

Vendor and Product Evaluation and Selection Was Thorough. DOE's process for evaluating vendors and their products was exemplary. DOE and consulting staff prepared an RFP that requested vendors provide demonstrations of their proffered solutions. A total of eleven proposals were received, and three vendors were selected to provide demonstrations. Using funds provided in the Appropriations Act, nine demonstration sites were prepared across Virginia, which were designed to represent combinations of school demographics, geographic location, and school division technological expertise. At the conclusion of the demonstrations, input from school divisions was requested, and these scores were reviewed by a DOE team. Finally, DOE retained a consulting firm, which tested each vendor's software on both PC and Macintosh computers, and a network engineer provided feedback on the connectivity and transmission methods of each solution.

Strong Involvement of End-Users. The involvement of end-users in this project has been strong. Local administrators, teachers, and students were all given an opportunity to provide input on the proposed software alternatives. The project was initiated in part because of school division requests for an electronic testing system, and a goal of the project is to ensure compatibility with school division student information systems. In practice, the project is largely run by the end-users, because school divisions are responsible for developing local testing capability.

DOE Staff Have Exercised Effective Project Management. DOE staff have developed an effective project management methodology that follows established systems development best practices, and staff also have provided project management training to school divisions. The DOE project management team consists of a business or functional representative and a technical representative, who communicate regularly with their counterparts at the software vendor. A

Presence of Elements that Contribute to Project Success SOL Technology Initiative			
✔ Present	**✓ Partially Present**	**✗ Absent**	
Identification of Functional Needs and System Requirements		✓	
Proven Technical Feasibility			✗
Organizational and Business Process Analysis		N/A	
Adequate Vendor/Product Evaluation and Selection	✔		
Strong Legal Contract	✔		
Effective Project Management	✔		
Involvement of End-Users	✔		
Effective Project Oversight and Control		✓	
Reliable Funding	✔		

modular development approach was established by the project management team which consists of five phases and follows the model established by the Project Management Institute. Project plan and charter documents are used, and the project management team is authorized to approve minor changes to the project plan. Major changes must be approved by the Executive Steering Committee (ESC).

Funding Has Been Reliable. Funding for the project has been reliable and adequate, but project success requires that this continue. Initial proposals for the project estimated that $16.5 million in general funds would be needed, with an additional $128 million in nongeneral funds from the Literary Fund. Funding is currently provided by means of bonded indebtedness, and between $50 and $60 million is distributed to school divisions each year in a continuation of intermittent VPSA bond issuances for school division technology that began in 1989. These funds are used primarily for hardware purchases, and must be accompanied with a 20 percent local match. School divisions are encouraged to apply for federal E-rate funding, which primarily provides discounted Internet service as determined by a needs-based formula.

Project Oversight and Control Structure Needs Improvement. The only element absent from this project is an effective oversight structure for vendor and school division activities. There is oversight of DOE staff at the State level, but without the ability to independently assess school division progress or vendor performance this oversight is limited. At the State level, monthly updates are provided to DTP, a process which predates the inception of DTP's "Dashboard" status report process. DOE also established an Executive Steering Committee (ESC) which meets

regularly. The ESC is the main decision-making body that evaluates and approves recommendations by advisory and work groups assigned to the project.

However, DOE staff must rely upon school division staff, and the certifications submitted by local superintendents, to ensure that the project is proceeding as planned. DOE staff state that they do not have the ability to withhold funds from school divisions, or to independently assess their progress. Moreover, school divisions have not been submitting monthly project management reports as required by DOE. As a result, the agency has limited knowledge of – or authority over – project activities at the local level.

The inability to directly assess school division progress is especially problematic in the SOL project, because it consists in large part of 132 independent projects at the local level. DOE states that the school divisions have complete autonomy, and that this limits the agency's ability to oversee local activities. However, the Appropriations Act states that DOE "shall be responsible for the project management of this program", and as a result, DOE should address the need to independently assess school division progress. In the absence of this assessment capability, the first opportunity available to DOE to directly determine the overall progress of the project will be when students actually take their tests in the Spring of 2004.

A further weakness is the lack of Independent Verification and Validation (IV&V). During the vendor evaluation phase, IV&V was present in the form of an independent review of the demonstration projects, but has not been present since that time. DOE considered contracting with an outside consultant for IV&V after the vendor was chosen, and obtained an estimated cost of $30,000 to meet with an IV&V vendor twice a year. However, they did not pursue IV&V because they were not given any funding for this purpose. Moreover, although DOE staff have provided some Quality Assurance (QA) through a review of the network test software provided by the vendor, no independent party has reviewed or tested this software.

TAX PARTNERSHIP PROJECT

The Tax Partnership project is a major information technology project between the Department of Taxation (Tax) and American Management Systems (AMS). The new system developed through the partnership will replace the existing State Tax Accounting and Reporting System (STARS), which is the primary hardware and software supporting the State's tax revenue accounting system. In addition, the project includes the implementation of software and hardware to improve tax filing, processing, collecting, auditing, and customer service. The project is scheduled to be completed by July 2004 and has an estimated total cost of $214 million. The project has met many of its goals thus far and appears to be on track to meeting its remaining ones. However, the ultimate success of the project cannot be assessed until the new Advantage Revenue System is implemented over the next year. Most of the elements identified in this study as critical to the success of major IT projects have been present for the Partnership Project. The exhibit on the following page summarizes the project.

Narrative Chronology of the Tax Partnership Project

In 1993 the Joint Legislative Audit and Review Commission recommended that Tax replace its existing STARS system, because STARS was becoming obsolete. The same year, Andersen Consulting was retained to develop a strategic plan for the department. Andersen interviewed more than 100 Tax employees to gather input on ways to improve the business processes at the department.

The decision was subsequently made to proceed with the development of a system, but Tax was unable to secure funding for the project through general fund appropriations. Therefore, Tax began to explore other funding options. Through its research, the department discovered that the state of California was pioneering a new funding mechanism with AMS, referred to as benefits funding. With the benefits funding arrangement in California, AMS provided the hardware, software, and consulting services to improve collections performance and aid in compliance. The additional revenue generated from these improved processes was then used to fund the project without the need for an appropriation.

Tax sought and received legislative authority in 1996 to enter into a public-private partnership using a benefits funding model to pay for the project. The statute providing the authorization also required the establishment of an external oversight group consisting of the director of the Department of Planning and Budget, the State Internal Auditor, the State Comptroller, one representative appointed by the President pro tempore of the Senate, and one representative appointed by the Speaker of the House of Delegates. The external oversight group was established to review and approve the contract terms relating to the measurement of revenue attributable to the new program.

After receiving authority to proceed from the General Assembly, Tax began work on the request for proposals (RFP). An invitation to bid on the project was sent

Tax Partnership Project
Department of Taxation

Initial Projected Cost	$35 to $40 million* ("estimated procurement cost")
Final Projected Cost	$214 million ** (estimated total cost as of November 2002)
Projected Timeframe	July 1996 – June 2003 (as of execution of contract with AMS)
Actual Timeframe	July 1996 – June 2004 (As of November 2002)
Status	Ongoing
Purpose	To replace core revenue accounting system and provide other applications to assist Tax in performing its mission.
Rationale	Need to replace obsolete revenue accounting system and take advantage of software development that will improve service.
Vendors and Products Used	American Management Systems.

* The 1993 estimated procurement cost was based on the anticipated vendor cost to replace STARS software using a general fund appropriation and did not include training/change management services, hardware/third-party software, Tax's payroll costs, and systems outside of STARS such as imaging, lifeworks, collections, audit, customer relationship management, and Internet-based customer services.

** November 2002 estimate includes cost to replace STARS as well as a number other technology-based systems and Tax's payroll costs for employees assigned to the project.

Source: JLARC staff analysis of agency project documentation.

to 1,000 prospective vendors in July 1996. The department qualified 15 vendors as potential partners. An RFP was published in October, but by November only two vendors had submitted responses to the invitation to participate – Andersen and AMS. Both vendors were invited to spend time on-site at Tax between November 1996 and January 1997 to evaluate the department and its processes and operations before submitting draft proposals. Tax reviewed the draft proposals from each vendor and provided feedback. Both vendors were then invited to submit final proposals. The proposals were evaluated, and each vendor was invited to provide an on-site presentation of its proposal. Then in September 1997, Tax selected AMS for further negotiation. Tax negotiated with AMS through June 1998 and signed a contract with the company in July.

The original contract was for $123 million plus interest and was to extend over five years, with a completion date of July 2003. The contract called for AMS to develop multiple projects, which included imaging, electronic filing, and replacement

of the core tax accounting system. The contract expressly assigned specific responsibilities to AMS and to Tax for each major project initiative. The project was to be funded from additional revenue gained by the implementation of certain projects, referred to as "fast track" projects. Under the terms of the contract, 90 percent of the funds gained from new revenue generating projects would be used to pay AMS invoices as they were submitted. The remaining 10 percent would be paid to Tax for use as needed.

During the first year of the project, AMS implemented a series of fast track initiatives to begin the generation of revenue needed to fund the project. In September 1998, AMS implemented new discovery audit tools designed to match its taxpayer database with other government and private databases. The purpose of this was to discover individuals and businesses operating in Virginia who were not registered or not paying appropriate taxes. In October 1998, AMS installed the STRATA Risk Management System to prioritize delinquent accounts based on the potential for collection. This software organizes current tax receivables into risk categories designed to help collectors determine which accounts and associated collections strategies would produce the best return. Early activities also included other initiatives to improve auditing. In June 1999, the partnership replaced laptops used by field auditors with new state-of-the-art laptops that increased their efficiency. In addition, new audit selection models were developed that were designed to improve the candidates picked for field audits. Another fast track initiative was the implementation of data matching tools developed by AMS to identify lien sources for accounts that were previously written off by Tax.

During the first year of the project, Tax also retained TRW to conduct independent verification and validation of the project. TRW is paid by Tax to independently evaluate the project on a regular basis. TRW evaluates the progress of various aspects of the project, including progress with the design, testing, and data conversion. Through its review process, TRW also identifies potential risks to the project and makes recommendations to address them.

In the second year of the project, Tax focused on the agency-wide blueprint, the redesign of Tax's website, and the individual income tax Telefile pilot. The major initiative in the second year of the project was the blueprint development. The blueprint project, which lasted nine months, studied existing operations and identified opportunities for improving the way Tax performs its work. The purpose of the blueprint was to identify new and reengineered business processes and recommend strategic initiatives, including state-of-the-art technology initiatives. Additionally, a newly designed web page was rolled out, and a pilot consisting of 17 localities was conducted which allowed taxpayers to file short forms by telephone.

In the third year of the project (FY 2001), several additional initiatives were undertaken. The first two phases of the imaging system were developed and installed during the third year. This allowed Tax to electronically image 1999 and 2000 tax returns as well as business registration forms. The individual income tax return and instructions were also redesigned. Additionally, a new data entry system was installed that is capable of handling any tax form in use by the department. Telefile was expanded to the entire State for filing the short form. Internet applica-

tions were developed that allowed businesses and individuals to file year 2000 taxes over the Internet, and businesses to register over the Internet. The business filing and registration Internet functionality were integrated with the Virginia Employment Commission, and a tax policy library was made available over the Internet. Finally, phase I of customer relationship management was rolled out, which provided a series of tools to customer service representatives to provide better access to all information about customers.

In the fourth year of the project (FY 2002), several additional initiatives were completed. The tax remittance process was replaced with new equipment and a reengineered workflow, and imaging was implemented for corporate income tax returns. Also, the new automated collections system was installed for both the delinquent collections unit and the court debt collections operation. In addition, a new version of the customer relationship management was implemented, which provided additional functionality to record and manage the workflows regarding e-mails and phone calls coming into the customer service unit.

Simultaneous with the development of these initiatives, AMS and Tax were developing the design of the Advantage Revenue System to replace STARS. The design work on this system began in year two of the contract and was scheduled to be completed in July 2003 as the final phase of the project.

However, in 2001 the contract was renegotiated. The contract amount was increased by $30.3 million from $122.9 to $153.2 million. In addition, Tax and AMS negotiated a one-year delay in the completion of the project from July 2003 to July 2004. The amount of the contract was increased due to Tax's decision to exercise additional contract options. These included replacement of Tax's collection system, acquisition of additional Internet tools, movement of the new integrated revenue management system from a mainframe to an enterprise server platform, and the provision of an auditor's tool kit. The increased contract amount was also to compensate AMS for costs resulting from delays caused by the collapse of the ceiling at the Department of Taxation. However, the additional cost was partially offset by lower than expected interest payments to AMS because of better than projected income from the fast track initiatives. The one-year time extension was for time lost as a result of several factors that included the ceiling collapse, the exercise by Tax of the additional contract options, more time required to complete the general system design, delays in the formation of work teams, and delays in document reviews and approvals.

While there have been some delays in recent months in the completion of certain tasks, the Advantage Revenue System still appears to be on schedule for final implementation in October of 2003. Testing of the Advantage Revenue System is scheduled to be completed by January of 2003, and integration testing of the system is scheduled to be completed by end of January of 2003. User acceptance testing is scheduled to take place during the spring of 2003.

Revenue generated from the early initiatives has been sufficient to pay for the costs incurred to date. In fact, revenues have exceeded projections by $22 million. As a result, Tax projects that the interest costs required to be paid to AMS will

be $2.7 million instead of the $17.5 million that was projected. The current projected date to fully pay the contract is June of 2004.

Presence of Key Elements Has Contributed to Apparent Project Success

Most of the key elements that contribute to project success have been present in the Tax Partnership Project. Several of the strongest elements included the vendor and product evaluation and selection, project management, the involvement of end-users, and effective project oversight and control. The exhibit on the following page summarizes presence or absence of the key elements for success.

Vendor and Product Evaluation and Selection Process Was Strong. One of the strengths of this project appears to have been the time and effort taken to select the vendor for the project. Each of the prospective vendors were brought on-site for a period of three months prior to the submission of proposals. Draft proposals were submitted by the vendors. Tax reviewed them and provided feedback. The vendors then submitted final proposals that were evaluated and scored. In addition, each vendor spent three days conducting walkthroughs of their proposals. Tax also submitted questions to both vendors based on their proposals and received written responses.

Tax also devoted substantial resources to researching the vendors. As part of this research process, Tax sent multiple teams to two California agencies that had implemented AMS tax systems, as well as to the Kansas Department of Revenue. The purposes of these visits were to observe the operation of AMS systems first-hand and to discuss the quality and performance of AMS.

Effective Project Management. One of the strongest elements of this project has been effective project management. A strong management structure was established in which there are group leaders and project teams. Project teams have focused on single projects and are led by team leaders. Team leaders report to a group leader who has responsibility for several project teams. The group leaders report to one of two project managers. The team and group leaders meet weekly to resolve issues that arise.

In addition to this management structure in place, there was a strong project management team. The project has both business and technical project managers who are Department of Taxation employees. The two project managers are assigned to the project full-time and have a strong background in systems development. The business project manager, for example, had spent 16 years at the Department of Taxation working both in the IT division and as director of a business unit within Tax when he was appointed as the business project manager. As an IT professional at Tax he was one of the initial project managers for the STARS system, which was developed in the mid-1980s and is being replaced by the Advantage Revenue System.

Other strong elements of project management include a consistent project management methodology and formal change control process. The project

Presence of Elements that Contribute to Project Success Tax Partnership Project			
✔ Present	**✓ Partially Present**	**✗ Absent**	
Identification of Functional Needs and System Requirements	✔		
Proven Technical Feasibility		✓	
Adequate Organization and Business Process Analysis	✔		
Adequate Vendor/Product Evaluation and Selection	✔		
Strong Legal Contract	✔		
Effective Project Management	✔		
Involvement of End-Users	✔		
Effective Project Oversight and Control	✔		
Reliable Funding	✔		

management methodology being used is one developed by AMS that is not based on critical paths but instead on key triggers and dependencies. The project also has a change control board that must approve all technical changes before they can be implemented.

Involvement of End-Users. Another major strength of this project has been the involvement of the end-users in the process. Prior to the initiation of the RFP, a consultant was hired to conduct strategic planning for the agency. During that process more than 100 Tax employees were interviewed regarding issues facing Tax and possible solutions. Then, during the RFP process for this project, employees were given access to the vendors as they worked on-site to develop proposals in response to the RFP. Upon award of the RFP, end-users at Tax were heavily involved in developing the blueprint design for the project. A formalized structure for user input was developed to ensure that input would be provided from users in each focus area. As the project has been developed, Tax employees have been working alongside AMS employees throughout the process.

Effective Project Oversight and Control. Another significant strength of this project has been project oversight and control. Effective internal oversight has been exercised through what is termed the P-6 committee. This committee is comprised of the commissioner of the Department of Taxation, the two Tax project managers, the executive commissioner responsible for most of the operational areas impacted by the Partnership, and three senior staff from AMS. This committee serves as the internal executive oversight committee. This committee meets weekly

to address significant issues that cannot be resolved at the level of the group and team leaders working with the project managers.

In addition to this internal oversight committee, the project also has formal independent validation and verification. The independent validation and verification effort includes a team of on-site reviewers who continually monitor various aspects of the project, including the adherence to schedules, the quality of the deliverables, and potential risks that arise. The independent validation and verification consultants issue regular reports summarizing their work.

Strong Leadership. The partnership project appears to have also benefited from strong leadership. When the decision was made to replace the obsolete revenue accounting system, the agency was unable to secure funding for the project through general fund appropriations. Therefore, the Tax Commissioner began to explore other funding options, and the agency sought and received legislative authority to enter a partnership to conduct the project through use of a benefits funding model. This innovative approach has led to a development effort that has been successful thus far. The Tax Commissioner also demonstrated leadership through the assignment of several senior staff with extensive experience to the project.

A Business Case Analysis Was Completed Late. The only aspect of this project that could have been strengthened substantially was the presentation of the business case for the project. Despite the high cost of this system, there apparently was no business case prepared until two years into the project and within a month of signing the $123 million contract with AMS. The cost-benefit analysis showed net benefits of $185 million over ten years. However, it does not appear to have included a thorough analysis of benefits or costs and was not a comprehensive analysis of all options available to the department. Moreover, the projected revenue analysis was based on increased revenue of $391 million resulting from vendor software that would improve auditing and collection of delinquent taxes. However, the analysis did not disclose that the software, which has been responsible for producing the additional revenue, would only cost $11.8 million – a small percentage of the full project cost.

VCCS STUDENT INFORMATION SYSTEM

The student information system project at the Virginia Community College System (VCCS) is an ongoing effort to install a new software package to assist the community colleges with student admissions, course registrations, academic advising, financial aid, tuition payments, and academic progress monitoring. The new system will also integrate all community college student databases into one system-wide database, which will assist the VCCS with system-wide reporting efforts and simplify future software upgrades.

The project has been mostly successful to date, although the target implementation date has slipped by about 6 months. Most of the identified critical success elements have been present throughout the project, and the information system should be fully implemented at all 23 colleges by June 2003. Although full implementation has been delayed since the project's original December 2002 target date, the project should be completed within the original estimated project cost of $18 to $21 million. The exhibit on the following page provides a summary of the project.

Narrative Chronology of the SIS Project

Initial planning for the student information system (SIS) began in 1997. The project consists of four phases: (1) system requirements, (2) procurement, (3) construction of system prototype, and (4) college deployment. The project is currently in the deployment phase, and as of December 2, 2002, nine of the 23 community colleges have already successfully implemented the system.

Prior to initiating the SIS project, the VCCS reorganized its IT structure to facilitate the integrated SIS project. In 1997, the VCCS consolidated its five regional data processing centers and formed the VCC Utility, which provides customer support, applications support, and network operations to the 23 community colleges. The savings resulting from consolidation of these activities are deposited into the Technology Development Fund, which is used to pay for many of the one-time costs associated with the SIS project and for annual maintenance of the system. The VCC Utility is responsible for administering the integrated student database, converting student data to the new system, providing other technical support to the college SIS deployment teams, and serving as the contact between the community colleges and PeopleSoft, the software vendor.

Between July 1997 and January 1998, system requirements were defined in phase I by several end-user workgroups and a separate technology infrastructure committee. The workgroups consisted of college administrators and faculty in the areas of admissions, financial aid, student records, student financials, and academic advising. Each workgroup and the infrastructure committee submitted their recommendations to the SIS steering committee, which compiled the information into a set of comprehensive requirements for the new system. These requirements documents were then used to develop the RFP.

Student Information System Virginia Community College System	
Projected Cost	$21 million
Actual Cost	$18.5 million * (estimated cost as of November 2002)
Projected Timeframe	January 1998 – December 2002
Actual Timeframe	January 1998 – June 2003
Status	Ongoing – nine colleges have implemented systems
Purpose	To develop integrated student information system across 23 community colleges.
Rationale	Provide enhanced services to students and faculty; avoid administrative costs as enrollment increases.
Vendors and Products Used	PeopleSoft, IBM, CIBER, EPOS.
Problems/Successes	Implemented at nine colleges; delayed implementation at all colleges due to data conversion issues and cultural adjustment problems.

* Cost does not include VCCS and community college internal costs.

Source: JLARC staff analysis of agency project documentation.

The procurement phase began in February 1998 with the issuance of an RFP and ended in July 1998 with a contract award to PeopleSoft. The VCCS received four responses to its RFP. The selection committee reviewed the responses and narrowed the selection down to two vendors: PeopleSoft and SCT. Based on evaluation criteria, vendor presentation feedback, and an analysis of the companies and their products, the selection committee chose PeopleSoft. This choice was subsequently ratified by the Council of Presidents. The VCCS then purchased a software license from PeopleSoft and one year of maintenance for approximately $5.3 million. The software license allows the VCCS to deploy the software to an unlimited number of desktops throughout the VCCS.

After the SIS software was purchased, the third phase of the project began and included a fit-gap analysis, which compared existing business practices to the functionality offered by the software, and system prototype construction. A functional area workgroup performed the fit-gap analysis for each of the six applications within the SIS. The analysis determined that about 80 percent of the PeopleSoft software model fit with the VCCS business model. Business processes that would need to be addressed were also identified. The generic system prototype was then

constructed using a small sample of student data. The prototype was completed in August 2000, and the college deployment phase began.

The college deployment phase included the designation of college deployment chairs, staff training, and a master deployment strategy for system implementation at each of the community colleges. PeopleSoft and VCCS staff provided training to key staff members at each college between September 2000 and March 2001. These staff members were then responsible for training other staff members in the use of PeopleSoft software. A master deployment strategy was developed to implement the system at the colleges in stages, with each college being able to choose the stage in which they would complete implementation. Three colleges chose to implement first, followed by four successive groups of five colleges each.

College implementation tasks began in March 2001 and are expected to continue until the spring of 2003. To date, nine colleges have implemented the new system: Paul D. Camp, Dabney S. Lancaster, Rappahannock, Thomas Nelson, Blue Ridge, Central Virginia, Lord Fairfax, Tidewater, and Southside Virginia community colleges. The reported implementation date for all colleges is December 2002, but several of the colleges have indicated that they will not be ready to go live by that date. All 23 community colleges are expected to be using the new system to register students for the Summer 2003 semester.

Implementation delays have been due primarily to problems with data conversion and critical business processes that needed to be aligned with the new system functionality. One major delay was caused by the task of converting 35 years of historical data to the new system. The conversion was necessary to allow for web-based degree audits and student transcripts for all VCCS alumni and students. This problem has been solved by the VCC Utility with the help of an additional software tool from another vendor. Other delays were caused by difficulties experienced by the community colleges in making the necessary cultural adjustments and in reengineering their business processes to fit the new Peoplesoft system. According to one VCCS project leader, these problems are also being solved.

Presence of Critical Elements Has Contributed to Likely Project Success

Most of the critical elements that contribute to the successful development of information systems were present in the SIS project. The project benefited especially from effective identification of system requirements, strong organizational and business process analysis, effective vendor and product selection, effective project oversight, and reliable funding. Project management was effective in the central office but less effective at the colleges. The exhibit on the following page summarizes the presence or absence of key elements to project success.

Identification of Functional Needs and System Requirements Was Adequate. The VCCS used a structured process to develop both functional and technical system requirements. The VCCS used workgroups composed of community college administrators from each of the functional areas – admissions and records, financial aid, student finance, and academic advising. These workgroups met

Presence of Elements that Contribute to Project Success VCCS Student Information System			
✔ Present	**✓ Partially Present**	**✗ Absent**	
Identification of Functional Needs and System Requirements	✔		
Proven Technical Feasibility	✔		
Adequate Organizational and Business Process Analysis	✔		
Adequate Vendor/Product Evaluation and Selection	✔		
Strong Legal Contract	✔		
Effective Project Management		✓	
Involvement of End-Users	✔		
Effective Project Oversight and Control	✔		
Reliable Funding	✔		

on an ongoing basis for a period of six months to develop the functional requirements for the SIS. In addition, an infrastructure workgroup, which was assembled from IT staff both in the central office and at the colleges, met over the same time period to develop the technical requirements for the system.

Organizational and Business Process Preparation Was Adequate. Organizational and business process reengineering was accomplished prior to project initiation through the consolidation of five regional data centers into the VCC Utility, and through the use of functional area workgroups to conduct a fit-gap analysis of the software. The creation of the VCC Utility facilitated the integration of 23 college databases into one database for the entire VCCS system. Because of the consolidation of data centers, there is now one entity responsible for maintaining the database and providing technical support services to the colleges. Services provided by the VCC Utility were identified as critical to the success of the project by those colleges that have completed their SIS implementation. The Utility is the point of contact between the colleges and PeopleSoft, and it has acted as an implementation partner for the individual college deployment teams.

After the PeopleSoft software was purchased, the VCCS project management team created functional workgroups consisting of college administrators to map out the business processes and do a fit-gap analysis for the PeopleSoft software. The decision was made to not modify the software. A system prototype was developed for each of the functional areas that satisfied a majority of the existing business processes at the colleges. The colleges were then given the task of modifying

their own business processes during the deployment phase of the project to complete the reengineering and implementation of the new system.

While all of the colleges have struggled to some extent with the reengineering of their business processes, the independence given to the college deployment teams was necessary. The colleges have traditionally been given some level of independence from the system office in terms of how they conduct their daily business of registering and enrolling students, collecting tuition and fees, and disbursing financial aid. Therefore, in order to maintain support for the project from individual college presidents and administrators, there was a need to give each college some latitude to adjust their business processes to fit their internal needs.

Vendor Evaluation and Selection Was Adequate. The VCCS appears to have had an effective selection process for both the software and for the vendors selected to implement the system. In response to its RFP for a software vendor, VCCS received four responses. The selection committee narrowed the selection to two companies, PeopleSoft and SCT Banner. Each company was invited to a two-day conference to present their product to the selection committee and a host of college administrators and faculty. The selection committee gathered feedback from 150 community college conference attendees, two-thirds of whom preferred PeopleSoft. Telephone calls were also made to institutions that had already implemented the vendors' software to learn more about the functionality of the competing products and customer satisfaction with each product. Finally, the VCCS evaluated the organizational cultures of each vendor to determine whether the companies would be compatible with the organizational culture at the VCCS.

Instead of using one implementation partner for the project, the VCCS used a series of different vendors to assist the project team with discreet tasks. For each task that required a vendor, the VCCS used a formalized three-step process to procure the services of vendors: (1) development of the requirements specification, (2) request for statement of work from vendors, and (3) construction of the deliverable. Each vendor was chosen based on its demonstrated ability to complete the discrete task needed.

Internal Project Oversight Has Been Effective. Although the project has experienced some delays, oversight appears to have been effective in tracking progress and keeping the project within budget. The SIS project has two levels of internal oversight: oversight of the VCCS central office project management team and oversight of the college deployment teams. During the development of the SIS prototype, the Vice Chancellor for Information Technology and the VCCS Technology Council oversaw the development. The system office project manager reported directly to the Vice Chancellor for Information Technology, who chairs the Technology Council. The Technology Council consists of IT directors from all 23 colleges. Any required changes to the project during development were brought to the attention of the vice chancellor, who decided the course of direction and discussed the decision with the Technology Council.

After the software and SIS prototype were deployed to the colleges, the central office project management team and internal auditors became the primary over-

sight structures for the individual college deployment teams. Oversight of the college deployment teams is assisted by regular communication between the VCCS system office and the colleges. The system office project management team collects monthly progress reports from the college deployment teams and tracks the progress of each. In addition, internal auditors have been sent to each of the colleges to ensure that the colleges are progressing as reported. The system office also holds bi-weekly teleconferences with the college deployment chairs to discuss issues and concerns of the deployment teams.

Project Funding Has Been Reliable. The VCCS has been able obtain reliable funding for the project through a general fund appropriation, the Higher Education Equipment Trust Fund (HEETF), and VCCS and college budgets. The General Assembly appropriated $2.1 million to the project for seed money. The HEETF was used to purchase much of the infrastructure on which the applications are built. In order to raise the money from VCCS and college budgets, a Technology Development Fund was created from annual savings resulting from the consolidation of the five regional data centers into the VCC Utility. These three funding sources have provided adequate financial resources to successfully develop the project.

Effectiveness of Project Management Varies Across Colleges. While most of the critical elements for project success have been present throughout the SIS project, the effectiveness of project management has varied across colleges. Central office project management appears to have been effective through the first three phases of the project, but the deployment phase has relied upon part-time project managers at the individual colleges. The absence of a requirement for full-time, trained project managers may have caused implementation delays at several of the colleges.

The VCCS system office used a full-time, experienced project manager with two full-time assistants. The project management team received six months of PeopleSoft training and successfully guided the project through prototype development phase. Upon completion of the prototype phase, the project management team distanced itself from project management and shifted to an oversight role.

While the project management structure in the central VCCS office is strong, the adequacy of the project management teams within the individual colleges varies. Most of the community college deployment chairs have been assigned to their leadership roles on a part-time basis, and many do not have prior project management experience or formal training. The lack of experienced or trained project managers and their inability to function as project managers full-time may have contributed to implementation delays at several of the colleges.

The failure of colleges to adhere to the deployment schedule has negatively impacted the project. The deployment of the system to the colleges was designed to occur in stages, with three “pioneer” colleges and four successive waves of five colleges each. Each wave consisted of a mixture of small and large colleges so that successive waves could learn from the colleges that had already implemented the system. The plan was for colleges in the early waves to provide positive reinforcement to colleges in the later waves, and for colleges in the later waves to learn from col-

leges in the early waves. However, the staging of the SIS deployment became less useful as the colleges in the early waves failed to meet their implementation target dates.

VIRGINIA INFORMATION SYSTEMS INTEGRATED ONLINE NETWORK

The goal of the Virginia Information Systems Integrated Online Network (VISION) was to integrate the many different data systems operated by the Department of Health into a single online network. Potential benefits of the proposed system were more efficient use of resources, central collection of data for use by public health decision makers, and the means by which to achieve year 2000 compliance. While the project was successful in achieving Year 2000 compliance, it failed to meet most of the other goals of the project, and most of the elements critical for project success were absent. A summary of the project is provided on the following page.

Narrative Chronology of the VISION Project

The concept of VISION was first discussed in 1992, but serious planning for it does not appear to have begun until February 1996. The major goal of the project was to integrate 65 separate data systems that were being used to administer the Department of Health's (VDH) multiple programs. According to the department:

> ... the goal of the VISION project is to integrate all disparate information systems at VDH. This will ensure timely access to comprehensive information for decision support and avoid redundancy in data collection.

At the outset, user committees were established to develop user requirements and review business processes. In September 1996, the department entered into a contract with CMA Consulting Services to develop the key modules for the VISION initiative, which included immunization and vaccine and patient information, and billing/accounts receivable modules. The Department of Health selected the vendor based on a declaration of need for emergency procurement services without a competitive procurement process. VDH asserted that there was urgent need to integrate the immunization software with the Women, Infants, and Children (WIC) model, which was under development by CMA, and that CMA was the only consultant who could provide the needed integration within required time frames. After the contract was signed, the vendor undertook the development of the system without much involvement in the development process by the Department of Health.

CMA began development in the last quarter of 1996, and it extended through 1997. As deliverables were completed, they were provided to VDH. However, the contract did not require that the vendor be involved in acceptance testing or that acceptance of the modules be contingent on successful acceptance testing. In addition, end-users at Health were not involved in acceptance testing. It was subsequently discovered by VDH that some of the modules did not work. One of the problems was that the applications developed did not work with the database, and the various modules did not work well together.

With the year 2000 approaching, the decision was made to scale back the project substantially and focus on using the project to make the existing Patient

Virginia Information Systems Integrated Online Network
Department of Health

Projected Cost	Not documented
Actual Expenditure	$6.6 million
Projected Timeframe	February 1996 – undocumented
Actual Timeframe	February 1996 – June 1999
Status	Implemented but scheduled for replacement
Purpose	To integrate multiple data systems and replace existing Patient Care Management System.
Rationale	Need to improve access to and sharing of data on a statewide basis.
Vendors and Products Used	CMA Consulting Services.
Problems/Successes	System failed to achieve most goals.

Source: JLARC staff analysis of agency project documentation.

Care Management System year 2000 compliant. In June 1998, the Century Date Change Initiative project office was brought in to manage year 2000 compliance, and work on other aspects of VISION received less attention.

VISION was implemented in the spring of 1999. One of the biggest project challenges was the data conversion. Separate databases in each of the 35 health districts were being integrated to a single database. Given the time constraints and the challenges associated with data conversion, data constraints that had been developed earlier were disabled to speed up the process. With the data constraints disabled, there were no controls on the data input by the various VDH districts. This created a broad range of problems, the largest of which was that the system was operating too slowly. Given the problems with the integrated system, the decision was then made to redistribute the data to each of the districts. As a result, the system is operating, but there continue to be 35 separate databases instead of one integrated one. Shortly after VISION was implemented, the IT staff within the department determined that the system had not achieved its initial goals and needed to be replaced.

Lack of Key Critical Elements Contributed to VISION Failure

Most of the elements that appear to contribute to the successful implementation of an information systems project were absent from the VISION project. The absence of certain elements appears to have been particularly problematic. Among the elements missing that significantly impaired the project were adequate vendor

selection, effective project management, effective project oversight and control, and reliable funding. The exhibit on the next page summarizes the presence or absence of the key elements.

Inadequate Vendor and Product Evaluation and Selection. One of the major factors that contributed to the failure of the VISION system was the lack of adequate evaluation and selection of a vendor to develop the application. The selected vendor did not have the resources to adequately develop the VISION system. According to VDH officials, the skill levels of the vendor employees were not adequate to perform the work, and coding was poor and not well documented. One department official stated that the vendor "was more show than go. We did not lift up the hood and look under to see what the company was made of."

One of the factors contributing to the department's inadequate vendor evaluation was the absence of a competitive bidding process. The agency requested and received approval to retain the vendor on the basis that it needed emergency services. VDH asserted that the VISION system needed to be able to integrate with another Health program (WIC), and that only by retaining the vendor could VDH provide the needed services in the required time. As a result of the approval to forgo the normal procurement process, VDH was able to retain CMA Consulting without determining whether there were other qualified vendors, and without fully evaluating whether CMA was qualified to perform the work required.

Effective Project Management Was Absent. Another key element that was absent from this project was a strong project management structure. There were no agency project management standards in place, and VDH did not appear to follow a project development methodology. Effective project management was also limited because there was a high turnover rate among project managers for this project.

Another major problem with the project management was that there was no interaction between the VDH development team and CMA Consulting during the development of the VISION system. Instead, the system was developed off-site by CMA staff without any opportunity for input or involvement of IT staff or end-users at VDH. Problems were discovered with the various modules only after they were delivered to the department, and then CMA was not required to participate in acceptance testing.

Another major problem was the lack of a project plan, project budget or other key documentation. There is no documentation of a project plan. Additionally, according to an Auditor of Public Accounts report, there was never a budget prepared for the project. Also, the modules developed by CMA were accepted without any source code, data dictionary, or other documentation. Other project management deficiencies included the lack of change control or quality assurance processes.

Project Lacked Oversight and Control. Another element that was completely lacking was effective project oversight and control. There was no internal oversight steering committee or other entity to oversee the development of the

Presence of Elements that Contribute to Project Success Virginia Information Systems Integrated Online Network			
✔ Present	**✓ Partially Present**	**✗ Absent**	
Identification of Functional Needs and System Requirements		✓	
Proven Technical Feasibility		✓	
Adequate Organizational and Business Process Analysis		✓	
Adequate Vendor/Product Evaluation and Selection			✗
Strong Legal Contract		✓	
Effective Project Management			✗
Involvement of End-Users			✗
Effective Project Oversight and Control			✗
Reliable Funding			✗

project for most of the period of development. In addition, there was no external oversight for most of the project. The only external review came late in the project when the Century Date Change Initiative project office became involved in overseeing the project to ensure that the system being developed was year 2000 compliant.

Funding Was Unreliable. A final major element absent was sufficient funding. There was no appropriation for the project, and therefore the project had to be partially funded through dollars directed from other Department of Health programs. Another source of money for the project was federal immunization funds. One of the consequences of the lack of an appropriation was that no Department of Health employees could be assigned to the project full-time. In addition, according to one VDH official, when you do not have an appropriation for a project like this, "you tend to cut corners." One example of this was that only limited resources were devoted to the initial study of the project.

Web VISION Will Replace VISION

The Department of Health realized shortly after the implementation of VISION that it is not an acceptable system long term. The department subsequently contracted with a vendor for an analysis to determine whether to modify VISION or replace it entirely. The analysis indicated that it would be more cost-effective to replace the existing VISION system rather than try to modify it. The Department of Health began work on the new system in January 2000, which is called Web VISION. Web VISION will provide for centralized immunization tracking, a central pharmacy system, an automated accounts receivable system, and a system for billing Medicaid services.

In contrast to VISION, it appears that Web VISION is a successful development effort thus far. In November, a pilot was initiated in the Richmond district and after three weeks is going well according to Health officials. The reason for the success of Web VISION, which is being developed in-house, appears to be that the department has made significant improvements in its information systems project development process. These improvements incorporate many of the elements for success that are discussed in this report.

For example, there appears to have been better planning at the outset. The department formed user groups, and meetings were held to develop requirements for the project. In addition, the user groups examined business practices and business flow, and were able to establish a standard data and business flow to be used across all of the districts.

In addition, the Department of Health has established a strong project management team. It is led by a project manager with extensive private sector project management experience. The project manager has established a formal structure for communication with user groups. Quality assurance and change management teams have been established to evaluate the software as it is developed.

Development of Web VISION has also emphasized end-user involvement. User groups were established when the project was initiated and have stayed active throughout the software development. Development of the project has been an iterative process. The development team provides three releases of each module for user feedback.

Web VISION has also had strong internal oversight. An executive steering committee was established to oversee the development of the project. This committee includes the agency CIO and the project manager, a deputy commissioner, and an associate commissioner who meet bi-weekly to consider any issues that arise involving the project. Major project changes must be approved by this committee.

VIRGINIA VOTER REGISTRATION SYSTEM

The current Virginia Voter Registration System (VVRS) is a statewide automated system for maintaining voter information and records that was first developed in 1970 and is hosted on a mainframe at the Department of Information Technology's data center. Although this system met all State and federal elections reporting requirements, when the project began several studies had concluded that VVRS should be fully redesigned. Funding for the initial planning of a replacement system was appropriated by the 1998 General Assembly, and initial planning activities began in September of that year. Formal application development work on the new Virginia Voter Registration System (VVRS2) began in July 1999 and, following several delays in the scheduled completion date, was ultimately halted in December 2001. While the initial planning activities for the replacement project were strong, the absence of several key elements such as effective project management, effective oversight, and adequate funding contributed to the ultimate failure of the project. The exhibit on the following page provides a summary of the project.

Narrative Chronology of the VVRS2 Project

A 1998 JLARC review of the State Board of Elections (SBE) found that the existing VVRS needed to be upgraded due to the age of the technology, increasing maintenance costs, and an outdated programming language which made it increasingly difficult to produce reports or quickly modify the existing system to meet new voting requirements. The report also found that the development of a new system would reduce annual service charges being paid to the Department of Information Technology. Following the release of the JLARC report, the General Assembly allocated $150,000 to SBE in FY1998 to begin initial planning for the VVRS2.

The Secretary of Administration established a study committee in September 1998 to oversee the planning and development of the VVRS2. The committee was comprised of State and local election officials, a representative from each of the two major political parties, a citizen representative, and a consultant. The Secretary of Administration appointed the General Registrar for Chesterfield County as chair of the study committee. The study committee completed its initial research in December 1998 and then presented a final report to the Secretaries of Administration and Finance.

The December 1998 report concluded that the new system should have the same functionality as the current VVRS, offer the capability for ad hoc reporting, and allow for downloading and printing of data at local registrar offices. The new system would also need to provide interfaces with other State systems from which SBE receives data, including the Departments of Health, State Police, and Motor Vehicles. The study further noted many supplemental functions that the new system could provide, and envisioned that the new system would generate better statistical data and offer general registrars and the SBE greater online capabilities. Additionally, the 1998 study recommended that a second committee be formed to address technical issues involved in replacing the existing system. Accordingly, the

Virginia Voter Registration System
State Board Of Elections

Projected Cost	$4.75 million
Actual Expenditure	$2.9 million *
Projected Timeframe	September 1998 – January 2001
Actual Timeframe	September 1998 – December 2001
Status	Shut Down
Purpose	Replace existing Virginia Voter Registration System.
Rationale	To address identified deficiencies in the existing system.
Vendors and Products Used	N/A
Problems/Successes	Development of the system has been shut down.

* Does not include agency costs.

Source: JLARC staff analysis of agency project documentation.

Secretary of Administration formed such a committee in the spring of 1999. This second committee was comprised mostly of persons on the initial committee as well as some additional technical experts from State and local government, including the Director of the Department of Technology Planning.

In December 1999, the new committee completed a second study and presented a final report to the Secretaries of Administration, Technology, and Finance outlining the technical and functional requirements for the VVRS2. The second committee explored numerous options, including: a new mainframe system built and hosted by DIT; a stand-alone VVRS system built by the State Board of Elections; a commercial off-the-shelf product; and outsourcing the function entirely. The committee determined that in order to maintain the functionality of the existing system, including real-time connectivity, the system would need to be built in-house.

Four key components were envisioned for VVRS2: voter registration, petition tracking, election administration, and absentee certification. Based on this vision, the primary recommendations of the second committee report were to migrate the existing VVRS functionality into a relational database hosted by DIT, and to develop the project in two phases that would be managed by a dedicated project manager. The first phase would address the system's current functionality, establish necessary interfaces, and provide localities with the ability to generate and print ad hoc reports. The second phase of this project would be to provide the enhanced functionality identified in the 1998 study. Additionally, the 1999 study recommended

that the software be developed through an existing "body shop" contract for temporary personnel. The committee established an aggressive time frame for completion, estimating that VVRS2 would be ready for deployment in January 2001.

Following the release of the December 1999 report, SBE requested a total of $4.75 million in the 2000 biennium budget for the development of the VVRS2. In 2000, the General Assembly approved $2.3 million in funding for fiscal year 2001 to support the first phase of the project, but there was no funding assigned for fiscal year 2002. Instead, the General Assembly requested that SBE provide a status report on the project, including timelines for completion, project costs by fiscal year, and staffing needs. In early 2000 the Secretary of Administration made the decision to transition the 1999 study committee to a technical oversight committee to guide the VVRS2 application development. The oversight committee was responsible for overseeing the implementation of the VVRS2 and, subsequently hired a project manager and development staff from a State body shop contract.

Development work for the first phase began in July 2000, four months behind the scheduled start date. Originally designed to be implemented in an incremental fashion from January to July 2001, detailed design work indicated that the system could not be implemented incrementally. The implementation schedule was changed accordingly, but the scheduled implementation date of July 2001 was not changed. During the fall of 2000, it became apparent that substantial problems were present in the management and oversight structures of the VVRS2 development effort. Because of space limitations within the offices of SBE, the application development team was initially located in the Chesterfield County Registrar's Office, while the project manager remained located in the SBE central office in Richmond. During this time period, the project manager had only limited contact with the development team, and the chair of the steering committee began to expressly direct the day-to-day activities of the development team.

As a result of this split development effort, numerous technical changes were made to the registration component without the knowledge of the project manager, and the implementation date was moved from July to September 2001. However, during this period SBE continued to report that phase one development was near completion, and a status report was prepared for the General Assembly in October 2000 requesting additional funding for fiscal year 2001 and the appropriation of funds for continued development in fiscal year 2002. The General Assembly, however, recessed the 2001 session without amending the biennial budget or authorizing any additional funds to SBE. In order to keep the contract employees in place, SBE, in collaboration with the Secretaries of Administration and Technology, authorized the project team to continue its activities without additional funding by having the SBE absorb project expenses from its operating budget.

In January 2001, the Virginia Electronic Government Implementation Division (E-Gov) was requested to perform an analysis of the feasibility of successfully implementing the VVRS2 in time for the November 2001 election. The E-Gov division conducted a thorough review of the project's development to date and identified 21 existing or potential risks to the planned schedule, cost, and performance of the VVRS2 in their report "Risk Review of the VVRS-II Project: Supplemental Report."

Following the release of the E-Gov report, the Secretary of Administration replaced the original project committee structure with a three-committee structure, consisting of a project delivery committee, a project management committee, and an end-user committee. Furthermore, a new project delivery committee chair was appointed, as well as a new project manager with responsibility for providing direction to the project.

The new project delivery committee chair and project manager worked with the project delivery, technical, and end user committees to develop a detailed project plan and systems requirements documents with approval milestones for the uncompleted petition services, election services, and administration services components. However, development of these documents did not begin until February 2001.

Even with these changes, the project continued to miss major milestone dates. However, the project manager continued to report that phase one was near completion. Between July 2001 and September 2001, the project encountered several performance issues, including database malfunctions and poor response times. Because of these issues, the project oversight committee determined that the system would not be ready for the November 2001 elections and delayed the implementation date to December of that year. Further testing of the system continued to reveal technical deficiencies within the system, and in December 2001, development work on the VVRS2 was stopped altogether.

Lack of Critical Elements Contributed to Project Failure

Most of the elements that appear to contribute to a successful information systems development project were either limited or not present during the development of the VVRS2 project. It appears that there was some initial success at establishing the business case, functional needs, and systems requirements for the VVRS2. However, several key elements for successful project development were missing, such as effective project management, adequate project oversight, and a reliable funding mechanism. The exhibit on the next page provides a summary of the presence or absence of the key elements for project success for the VVRS2.

Lack of Effective Project Management Structures Affected Development. One of the most critical elements absent from this project was effective project management. The designated project manager was not an employee of the State Board of Elections and was not familiar with the business needs of the agency. Instead, he was an individual hired on contract from a private sector vendor. In addition, as the project progressed, the Chesterfield county registrar, who was chairing the oversight committee, began acting as the project manager for the voter registration component of the system. The registrar began directing the programmers in the day-to-day development of the registration component without any coordination or collaboration with the official project manager. As a result of this process, changes were made to the registration component that created integration problems with other components of the VVRS2 system.

Presence of Elements that Contribute to Project Success Virginia Voter Registration System			
✔ Present	**✓ Partially Present**	**✗ Absent**	
Identification of Functional Needs and System Requirements	✔		
Proven Technical Feasibility	✔		
Adequate Organizational and Business Process Analysis			✗
Adequate Vendor/Product Evaluation and Selection		✓	
Strong Legal Contract	N/A		
Effective Project Management			✗
Involvement of End-Users		✓	
Effective Project Oversight and Control			✗
Reliable Funding			✗

Additionally, there does not appear to have been an adequate project plan that outlined the development tasks, measures of success, risk factors, and a schedule for completion of the project. There was also nothing that clearly defined and assigned roles and responsibilities to those on the project development team. In addition to the lack of a project plan, a design document was never completed to guide the programmers in developing the code for the new system. Finally, there was no successful effort to document the programming that was performed.

Ineffective Project Oversight Impaired Delivery. The project also lacked adequate internal and external oversight. There was no internal committee within the State Board of Elections to oversee the project. In addition, the external oversight committee established for the project did not function effectively. The chair of the oversight committee had taken on the role of project manager for the development of the registration component of the project. Therefore, he was serving in the dual role of project manager and chair of the oversight committee. This precluded the committee from exercising effective oversight. Finally, it does not appear that any ongoing independent review, by either the technology secretariat or a private consultant, was provided for this project until significant concern was raised regarding the project's technical development.

Funding Structure was Inadequate. Another element absent from this project was a reliable source of funding. While funding for the planning and development of the VVRS2 was provided through direct appropriations to SBE by the 1998 and 1999 General Assemblies, the project was dependent on the biennial appropriations to continue system development. Direct allocations for this project to-

taled more than $2.9 million, and an additional $900,000 was allocated for a network improvement project required by DIT regardless of the implementation of VVRS2. While the funding for the project was consistent through FY 1999, allocations in the FY 2000 budget provided only funding for the first year of the biennium, with funding for FY 2001 to be provided in the caboose legislation. Because the budget impasse in FY 2001 froze allocations at the FY 2000 levels, no additional funding was approved for the year, and SBE was required to cover project costs from the agency's operating budget. Ultimately, the lack of available funding was the final factor in the decision to terminate the development effort.

Involvement of End-Users Was Mixed. While an extensive survey of the local registrars and SBE elections officials was conducted when developing the initial technical and functional requirements, the involvement of the end-users was strictly limited upon completion of the functional requirements document. As directed in the Appropriations Act language, the study committee consisted of business representatives from the SBE, local registrars, and the general public. However, it does not appear that input from the end-users was appropriately utilized during the development phase.

In order to address the different needs of the end-users during the development phase, two functionality subcommittees were established. One of these subcommittees was intended to provide a mechanism for State Board of Elections employees to provide input as the project was developed. The other was to provide a mechanism for external users of the system to provide input. While there was some informal involvement of local registrars during the development and testing phases, there appears to have been only limited formal involvement of the end users. Neither the external user's subcommittee nor the SBE user subcommittee met on a regular basis. While the SBE subcommittee was provided the opportunity to provide comment on some components of the project the recommendations of the committee were never seriously considered, according to one board employee. Moreover, the subcommittee was never given the opportunity to provide input on the registration component of the project.

Identification of Functional Needs and System Requirements Was Adequate. The primary strength of the VVRS2 project was the initial planning for the project. The project was given a $150,000 appropriation for the planning phase. Two study committees were established that addressed both the need for the system and the system requirements. The first study committee, focused on the functional needs for a new system and development of the business case for the project. A second committee was established that continued to focus on the functional needs but also the system requirements as well. This committee also considered what the appropriate solution was to meet the State's needs. The primary way in which the committee explored both issues was through an evaluation of available commercial products and systems operating in other states. The evaluation process included attendance of system demonstrations.

APPENDIX B

AGENCY RESPONSES

As part of an extensive data validation process, the major entities involved in a JLARC assessment effort are given an opportunity to comment on an exposure draft of the report. Appropriate technical corrections resulting from the exposure review have been made in this final report. This appendix contains the written responses from the Secretary of Technology, the Department of Taxation, and the Department of General Services.

DEC 09 2002

COMMONWEALTH of VIRGINIA

Office of the Governor

Mark R. Warner
Governor

December 9, 2002

Mr. Phillip A. Leone
Director
Joint Legislative Audit and Review Commission
Suite 1100 General Assembly Building
Capitol Square
Richmond, Virginia 23219

Dear Mr. Leone:

We appreciate very much the opportunity to comment on the exposure draft for JLARC's report, Review of Information Technology Systems Development. Let me compliment you and your staff for a comprehensive and insightful report dealing with an important but also complex subject.

We share with you the same concerns and interests in the topics and issues covered in this report. It is my intent, and the intent of Governor Warner, to apply industry best practices in addressing these topics and issues, and we were very pleased to see the JLARC staff take a similar approach in producing this report. As you note in the draft, there is much consistency between the report's recommendations and the directions in the Governor's Strategic IT Plan that we are charged with implementing. As the Governor's specific legislative and budgetary proposals to the upcoming General Assembly session are presented over the next two weeks, I believe you will see that the details continue to support that confluence.

I look forward to the opportunity to provide remarks on and my support of the exposure draft to the Commission at its December 16 meeting. In the meantime, if you have any questions about our response to the exposure draft, please feel free to contact me or my deputy, Eugene Huang.

Sincerely,

George C. Newstrom
Secretary of Technology

COMMONWEALTH of VIRGINIA

Department of Taxation

December 6, 2002

Mr. Philip A. Leone, Director
Joint Legislative Audit Review Commission
Suite 1100, General Assembly Building
Capitol Square
Richmond, Virginia 23219

Dear Mr. Leone:

Thank you for the opportunity to review the exposure draft of the JLARC case study on TAX's Partnership Project. We view the report as complimentary of TAX's efforts to improve agency operations and update the technologies that we rely on. With respect to factual corrections, we have noted very few and have transmitted those to your staff by phone.

With respect to written comments, I offer the following observations and ask that they be appended to the report.

Business Case Analysis

As you indicated, the formal Economic Analysis required by the Council on Information Management was completed and approved in June 1998, prior to initiation of the contract in July 1998, but after the release of the Request for Proposal and subsequent contract negotiations.

TAX believed at the time, and continues to believe, that the business case for the Partnership Project was self-evident. JLARC had previously recommended that TAX replace its aging systems, as they were becoming obsolete, but TAX was unable to obtain a General Fund appropriation for even the planning phase of the project. Under the benefits-funded scenario, two large private firms believed that they could introduce improvements that would generate sufficient additional revenue to fund all of the desired improvements, without a General Fund Appropriation. These vendors both conducted a careful analysis and were willing to put significant capital at risk, a decision neither vendor took lightly. Both vendors also understood that they could not be

compensated for their work unless the systems implemented were adopted and used effectively by TAX.

Your report indicates that the cost-benefit analysis did "not appear to have included a thorough analysis of benefits or costs, and was not a comprehensive analysis of all options available to the department." We understand your point as to the timing of the analysis, but we believe that the contrary is actually true and a superior result was achieved because of the timing, still before the contract was signed. The fact that the Economic Analysis was not completed until June 1998 allowed Tax to base the analysis on AMS's actual proposal, including the actual contract costs being contemplated. Had the analysis been completed earlier, TAX would have been forced to rely on projections of costs that were unsubstantiated and would likely have been less accurate. In addition, TAX was able to rely on the expertise of AMS in projecting the revenue to be derived from new tools that TAX had no experience with, again yielding more accurate projections of benefits than would have been possible prior to proposal development and contract negotiations. In fact, revenue to date has exceeded expectations.

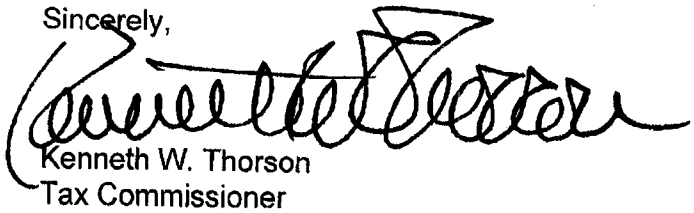
In terms of other options available to the department, there were none. TAX was faced with major systems and hardware that were obsolete and could no longer be supported, and the inability to secure funding for essentially any improvements. Benefits-funding, as described in the Economic Analysis, allowed for TAX to fund essential improvements using revenue that would not otherwise have been collected by the Commonwealth. TAX's statutory authority was limited to utilizing new revenue generated by a private partner to fund improvements provided by that partner. In other words, TAX did not have the option of utilizing a revenue stream generated by AMS to fund improvements under separate contracts.

Finally, you indicate that TAX failed to disclose that the software which has been responsible for producing the additional revenue would only cost a small percentage of the full project cost. The very foundation of the approach presented by AMS was to utilize quick and temporary improvements to existing processes to generate revenue to pay for the remainder of the improvements, most of which are not compliance-related. This approach was unique to AMS, but we believe was well understood.

Conclusion

I wish to thank the JLARC staff for their professional courtesies and their considerate examination of the Partnership Project. We are proud of what the Partnership between TAX and AMS has accomplished. The citizens of the Commonwealth and our own employees are already reaping the benefits of significantly improved service and compliance tools.

Sincerely,



Kenneth W. Thorson
Tax Commissioner

C: The Honorable John M. Bennett
Secretary of Finance

COMMONWEALTH of VIRGINIA

DEC 10 2002

Department of General Services

D. B. Smit
Director

December 6, 2002

202 North Ninth Street
Suite 209
Richmond, Virginia 23219-3402
Voice/TDD (804) 786-6152
FAX (804) 371-8305

Mr. Philip Leone, Director
Joint Legislative Audit and Review Commission
General Assembly Building
Suite 1100
Richmond, Virginia 23219

Dear Phil:

This is in response to the "eVA Electronic Procurement System" exposure draft. A more detailed (25 page) response has been shared with your staff. My hope is that JLARC staff has already corrected the exposure draft, making this letter moot. If not, please accept these comments as my official response to your eVA case study.

eVA, the Commonwealth's electronic procurement solution, is a state-wide enterprise resource planning (ERP) system. It is working. It is successful. It is saving the Commonwealth money.

The Auditor of Public Accounts estimated that Commonwealth agencies spent in excess of one half of one billion dollars on ERP's over the past five years. These ERP's are expensive, have achieved varying degrees of success and serve only the individual agency that paid for the system. A senior manager for one of Virginia's technology firms once told me "I'd love to be selling software to the Commonwealth. You (the Commonwealth) keep paying for the same systems over and over again". eVA, on the other hand, provides a single procurement ERP solution available to all agencies and eliminates the need for buying the individual ERP's for procurement.

eVA is being developed on schedule and within budget. We committed to deliver complete eVA functionality by December 31, 2002 and a team of DGS employees along with our private sector partner are working to make sure the schedule is met. We are on track to complete our work on December 31.

The decision to implement eVA made by Governor Gilmore and the decision to continue and enhance eVA made by Governor Warner were the product of cost-benefit-risk analyses. Perhaps not the "ROI" analysis your report suggests, however the decision makers were fully briefed on the costs and the benefits of electronic procurement.

This project was developed and has been monitored by a host of State agency and private sector stakeholders. Project development benefited from user involvement. Bi-weekly "vanguard agency" meetings were held to expose system problems. A team of State agency IT staff met regularly to discuss and resolve technical issues. A high level executive team composed of me, the Secretary of Administration, the Director of Purchases and Supply and senior officials from our private sector partner

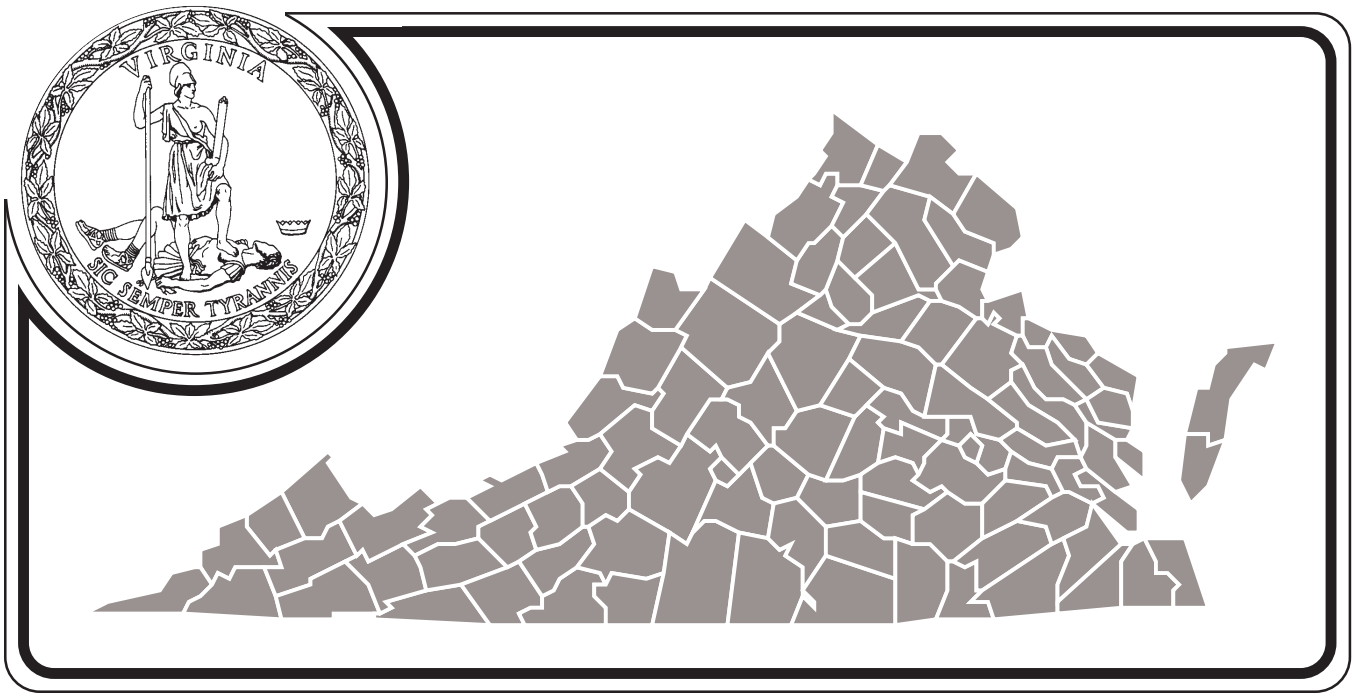
have met monthly to discuss progress, problems, budget and the schedule. To imply a lack of user involvement is simply not accurate.

Finally, and most importantly, eVA works. Over $316 million has been spent through eVA over the past 12 months. This represents over 54,000 transactions. We now have six major state agencies which are fully integrated into eVA, 4,700 users in 169 agencies and 142 local entities, and 7,265 registered vendors. We have over three million items available for purchase in 635 catalogues. The project is nationally recognized and Virginia is leading the nation. Your report is silent on this and I think fairness begs some mention of eVA's success.

While aspects of the JLARC report had merit, the majority of the issues raised in the report have been addressed. The results of careful project planning, project monitoring and oversight, and listening to and acting on user feedback has resulted in the most successful implementation of e-procurement by any state in the nation. This is an ongoing process and we will keep JLARC updated on the continued progress and success.

Sincerely,

D. B. Smit

Cc: The Honorable Sandra D. Bowen
Mr. Ron Bell
Ms. Caroline Rapking

JLARC
Suite 1100
General Assembly Building
Capitol Square
Richmond, Virginia 23219
(804) 786-1258 Fax: 371-0101
http://jlarc.state.va.us