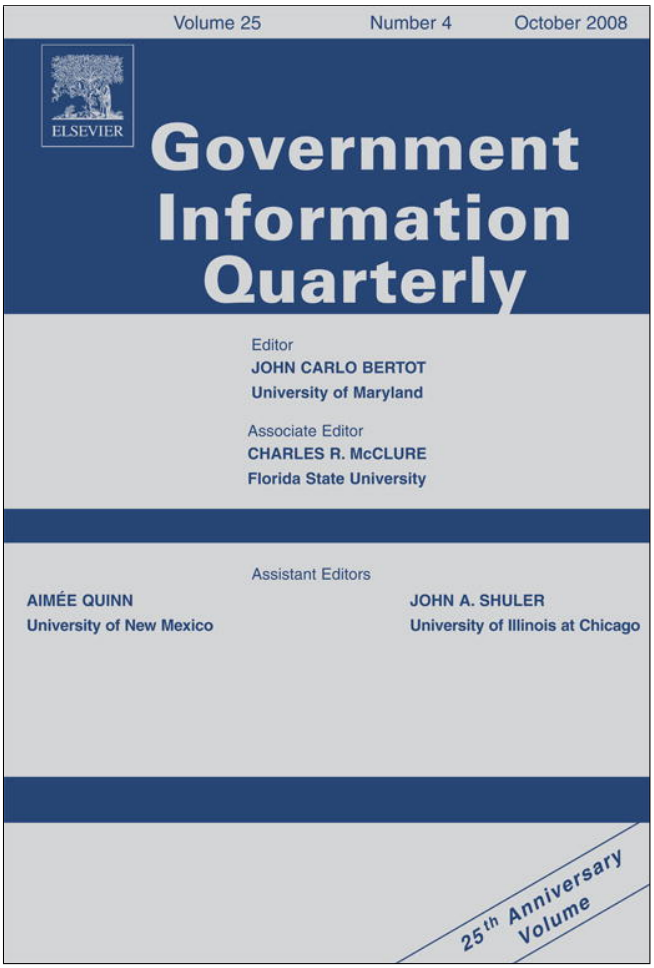

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Pennsylvania's transition to enterprise computing as a study in strategic alignment ☆

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Abstract

We theorize about the strategic alignment of computing with organizational mission, using the Commonwealth of Pennsylvania's efforts to pursue digital government initiatives as evidence. To do this we draw on a decade (1995–2004) of changes in Pennsylvania to characterize how a state government shifts from an organizational to an enterprise perspective regarding computing. We document and analyze the strategic and operational aspects of a series of information and communications technology (ICT) planning efforts to highlight the nature and roles of strategic alignment used to achieve this transition. Findings from this analysis mark the importance of combining several approaches to strategic planning regarding the adoption and application of ICT.

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In this paper we pursue the broad research question: *What does it take to become a digital government*? By 'digital government' we mean the combination of organizational processes, organizational structures, computing resources, digitization of data, as well as relevant information and technology policies, taken together, support the delivery of government services via digital means. To do this, we draw on the Commonwealth of Pennsylvania's[3] ongoing efforts to improve its information and communication technology (ICT) infrastructure from 1995 to 2004 as a revelatory case study.

Building from an analysis of this case study we make two contributions. First, we focus explicitly on the growth of digital government from an enterprise computing perspective, looking beyond particular computer applications, technology projects, and specific needs of sub-units, to focus on the growth of inter-organizational systems and an intra-unit perspective to computing (Bernard, 2004; Markus et. al., 2002). We do so to illustrate the complexity of pursuing comprehensive, coherent, and sustainable digital government initiatives. We characterize the Commonwealth of Pennsylvania's state-level government as an enterprise, and focus on their computing changes over the past decade to provide examples of the move from organizational to enterprise perspectives (e.g., Fountain, 2001).

Our second contribution is to theorize about the strategic role of computing, drawing on concepts from the literature of information technology strategy, and in particular, strategic alignment. As we detail below, strategic alignment is a conceptual model that highlights the relationships between strategy and operations from both business and technology perspectives (e.g., Henderson & Venkatraman, 1993). We focus on Pennsylvania's approach to strategic alignment in order to illustrate how their success both builds on, and extends, current thinking in this area.

The paper continues in five sections. In the next two sections, we develop the enterprise perspective on computing and review the strategic alignment model. In the section on our Research approach, we explain the research design, data collection and analysis. In Findings section, we present a summary of our findings (and provide more details in the Appendix), which we discuss in Pennsylvania and digital government section.

1. An enterprise perspective on computing

We begin by noting that organizations in both the public and private sector continue to seek increased administrative efficiencies and improved operational effectiveness via increased information sharing, and that public sector organizations differ from those of the private sector in their take up and uses of ICT (Hackler & Saxton, 2007; Boyne, 2002; Danziger, Dutton, Kling, & Kraemer, 1982; Bozeman & Bretschneider, 1986; Rainey & Bozeman, 2000). In particular, the concept of enterprise computing, and the arrangement of information and

[3] Pennsylvania is one of four commonwealths in the United States (the others being Massachusetts, Virginia, Kentucky). The differences in name reflect traditions rooted in colonial rule: there are no differences in governance or rights between states and commonwealths in the US.

computing assets in a rationalized form that provides a means to link strategic choice with physical implementation, has been taken up at the U.S. federal and state levels to some degree (see, for example, www.feams.gov). This is embodied in approaches such as enterprise architecture (see NASCIO, 2003; Bernard, 2004; Gregor, Hart, & Martin, 2007). In contrast, the take up and use of enterprise systems, such as those sold by SAP, Oracle, and others – often known as enterprise resource planning (or ERP) systems – has been a dominant computerization activity among Fortune 1000 companies over the past 15 years, and is now becoming a focal activity of many small-to-medium enterprises, as well as a trend in many U.S. federal agencies and state-level governments.

Enterprise computing brings together the selection, development, and deployment of ICT with information use, organizational structure, and work processes (Bernard, 2004). This is done via an orientation toward semi-automating key organizational processes; aggregating data and information; standardizing operating systems, application software, and physical devices; integrating workers using common systems; and demanding more standardized operational policies and procedures with more direct links to organizational strategy.

Enterprise systems are often depicted as a "stack" or "layered" model (Spewak, 1993). In these models, computing elements are arranged by functionality, with the lower levels focusing on transporting data and information, and the higher levels engaging issues of personal and organizational needs. For example, a six-layer enterprise computing model has the transportation media, protocols, and devices as the base. The particulars of computing hardware arrangements (e.g., centralized, distributed, and end-user/mobile) make up the next layer. Operating systems, systems and application software, and the ways in which they interact are the third layer. The data structures and relationships are depicted as a fourth level. While data structures and relationships are often intimately tied to software, they are depicted independently to emphasize both the need for coherent data architecture and for this to be independent of any particular software application. Building on these four levels are the work processes and procedures (the fifth layer), which in turn are both guided by and integrated into the enterprise policies, procedures, and strategies laid out in the sixth tier. In this way, enterprise computing provides interconnections between functionally-based computer applications and strategic planning. Taken together, this perspective provides an 'enterprise architecture' that serves as a set of abstractions to represent the integration of physical computing devices and high-level strategic aspirations via processes, data, and work organization.

There have been, in practice, several means to achieve this architectural vision of enterprise computing. Prior to the development of open computing platforms (such as the personal computer and the internet), most organizations pursued proprietary systems (e.g., having all IBM products). This model is no longer actively pursued by most organizations. Rather, the current dominant model selects compatible systems and focuses on inter-operability among multiple vendors' products. Often this leads a typical enterprise to have dozens, if not hundreds, of vendors providing networking, applications, hardware, and systems all of which must be integrated and supported in complex, evolving, and idiosyncratic webs of computing (e.g., Kling & Scacchi, 1982).

Three trends are currently helping to reshape computing at the enterprise level. First, the shift to computers viewed essentially as commodities has led to computing purchases that are driven more by software than by hardware decisions, and this software is more commonly purchased rather than developed in-house. Second, the rapid rise of inter-networking (most visibly, the internet) and third, the relative ease of interconnection among an organization's computing assets (via virtual private networks and other networking approaches), has shifted organizational attention towards software applications that allow for the sharing of data, engaging in common work practices, and providing computing functionality to workers independent of location.

2. Enterprise systems

One response to these trends is that several software vendors now offer integrated systems that support work groups, the most common of which is Microsoft's near ubiquitous Office Suite (which includes software applications such as word processing, calendaring etc). Beyond work groups, vendors like Oracle and SAP offer enterprise systems that work with databases and provide accounting, payroll, sales, ordering, customer service, and other organizational-level functionality in support of business and work processes. These 'enterprise systems' are large, complex, and demand extensive training to implement and maintain. In addition there are large and steadily growing academic and professional literatures on the technical aspects, implementation issues, and strategic decisions surrounding enterprise systems.

An enterprise system often has a number of integrated modules that share access to a common set of data. This data can be accessed via coherently-designed uniform screens. These screens are often web-based (i.e. someone using a personal computer can gain access using a simple browser such as Safari or Firefox). One difference between work group office suites and enterprise systems is scale. For example, SAP's R/3 ERP (one of the most common and comprehensive enterprise systems, and adopted by Pennsylvania) is based on 1980's programming and innovations in creating a client-and-server architecture. The SAP R/3 system has four major elements: an integrated database; a set of development tools (ABAP); a means to encode, apply and manage business and workflow rules guiding the operations; and the collection of business modules. These modules are typically grouped into four elements: finance, human resources, manufacturing (logistics), and sales. Within each of these elements are a range of modules (e.g., sales can include customer relationship management and distribution modules).[4]

Enterprise computing activities – be they the development of an enterprise architecture or the purchase of an enterprise system – are difficult to undertake successfully. In the Pennsylvania state government context, for example, engaging enterprise architecture demands that here-to-fore semi-independent agencies consider other agencies in their planning. Enterprise computing also relies on people to initiate, sustain, and support the

[4] For more information on enterprise systems, see www.cio.com/research/erp.

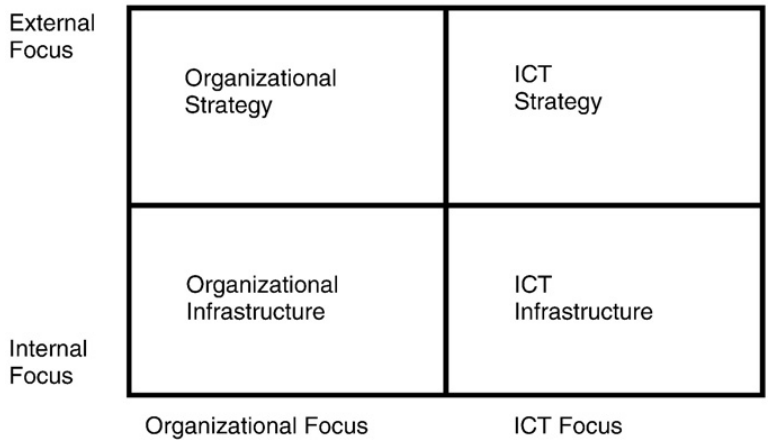

Fig. 1. Strategic alignment model.[5]

collaboration, information sharing, coordination, and communication these activities demand, all-the-while withstanding the strain on the treasuries of even well-funded units.

3. Strategic alignment

The strategic alignment model posits a set of relationships among the components of business strategy, functional operations, and the deployment and uses of computing (Henderson & Venkatraman, 1993). The strategic alignment model is developed as a two-by-two matrix, as shown in Fig. 1. One axis of the matrix is the internal (inward-looking and infrastructural) view of the organization, versus the external (outward-looking and strategic) view. The other axis is a business (organizational) versus ICT focus. Combining these two axes leads to a matrix of four elements: organizational strategy, ICT strategy, organizational infrastructure, and ICT infrastructure.

Drawing on Fig. 1: a common (if not the most common) approach to pursuing strategic alignment is to begin with an organization's strategic vision and make sure that the strategic vision for computing aligns with this. This alignment, in turn, should drive the selection and deployment of the computing infrastructure (e.g. Kefi & Kalika, 2005; Ness, 2005). This approach is known as *strategy execution* (see Table 3). Such an approach would lead to investing in ICT that supports the strategic goals of the organization — likely the implicit model for many governments who engage digital government activities. A second approach could be that ICT strategy can drive organizational strategy, leading to changes in organizational infrastructures in an attempt to align organizational operations and strategy to ICT strategy. Typically called *technology transformation*, this might be the approach taken by an enterprise which seeks to use new technologies to enable or guide organizational activities.

A third approach to pursuing strategic alignment, labeled *service-level alignment*, would be to have decisions about the computing infrastructure drive strategic ICT decisions. For

[5] See Henderson and Venkatraman (1993) for a more detailed presentation.

example, allowing each unit to select its own e-mail system is likely to lead to a situation where the enterprise is faced with a collection of potentially incompatible systems which limit the enterprise's ability to build a shared computing infrastructure. In this scenario, the unit's tactical decision can drive strategic choice. Moreover, this is a common situation faced by organizations with large legacy system investments.

A fourth approach to strategic alignment is to allow operational pressures of the organization to lead the making of operational choices in computing. In this situation, called *competitive potential*, organizational infrastructure pressures (such as fast-changing environments) may make strategic decisions difficult to pursue except as an outgrowth of operational activity. This is often an inertial (or slow change) approach and may not be seen as a strategic choice. In practice, such a situation has the look and feel of the strategic drift that Ciborra (1997, 2000) argues is too often the case in contemporary organizations.

Strategic alignment is often depicted as a static, top-down approach, where organizational leaders seek to match strategic intent with the proper development and deployment of IT infrastructure and processes. However, evidence from detailed fieldwork suggests that strategic alignment is often situated and ongoing (e.g., Grant, 2003; Avison, Jones, Powell, & Wilson, 2004). Others have found that IT infrastructure flexibility is more important than pursuing a singular or monolithic plan for strategic alignment (e.g., Ness, 2005). One goal of this research is to illustrate that strategic alignment is neither static nor inflexible.

4. Research approach

We chose a case study approach to this research for three reasons. First, the concept of strategic alignment is tied to the contexts of use, and case studies are most useful when the phenomenon is situated in its socio-political context (Yin, 1989). Second, case studies provide the means to collect detailed data and support the process of theory elaboration, which is our goal in this paper (e.g., Vaughan, 1992; Eisenhardt, 1989; Flyvberg, 2006). Third, the opportunity to study the strategic and operational engagement of a state, and its move towards digital government, makes this a revelatory case (e.g., Yin, 1989).

We focused on the Commonwealth of Pennsylvania's efforts to pursue digital government for two reasons. First, states are complex enterprises which provide a living laboratory for studying large-scale organizational change enabled by the increased uses of computing. Second, Pennsylvania was one of the last states to develop an internet presence (in the mid-1990s) but one of the first states to attempt an enterprise systems implementation (beginning in 1999). This movement (from laggard to leader) in pursuing digital government initiatives happened even as the other 49 states made similarly bold moves to engage more governmental services online. This magnifies the value of using Pennsylvania as a revelatory case study.

The study was designed to proceed in three stages. The initial stage, which ran from 1999 through 2002, focused on identifying the appropriate setting. The primary data collection phase, which included the interviews and observations, ran from 2003 through early 2004. During this stage, interim analysis of data was begun (as suggested by Miles & Huberman,

1994). During the final stage, from early to late 2004, data analysis became the focal activity, and we pursued additional fact-checking and follow-up interviews.

Like many field-based research projects, the research design evolved during our time in the field. For example, the development of the state-level implementation of an ERP system (a project called "Imagine PA" and discussed below) led us to expand the research scope to include more details on this work, since the ERP served both as a platform to pursue digital government initiatives as well as a means to rationalize computing resources and support increased information sharing. This meant doing additional interviews and document collection in 2004.

As is typical in case studies, we relied on key stakeholders to help us gain access to other players and units, to provide (or identify) relevant documents and sources, and to provide feedback on interim analyses. During the data collection period we had access to members of the CIO's office (known in Pennsylvania as the "Office of Information Technology," or "OIT") including the CIO and key staff. We also had access to key stakeholders outside the state government and were given copies of all key documents. In summary, the corpus of data includes more than 20 interviews, several hundred internal documents, and a number of documents from the professional, trade, and public presses. Whenever possible, we tape-recorded interviews (and transcribed them). For all interviews and observations, we took field notes.

We developed the analysis of the interviews and notes, observational material, documents and archival records in two stages. The first stage was to organize material to reflect particular projects and chronology. The result of this analytic activity is summarized in Table 1. In the second stage we used the enterprise computing and strategic alignment constructs as frameworks. To do this, we developed coding matrices, with the constructs as rows, data sources as columns, and cells representing when the data source provided evidence that reflected the construct of interest (Miles & Huberman, 1994). This data was used to assess the patterns of computing that unfolded through the period of study.

5. Findings

This section is developed in three parts. In the first, we provide a summary of the detailed case study (with more case study details provided in the Appendix). In the second part we summarize findings relative to the enterprise computing perspective. In the third part we summarize findings relative to the strategic alignment perspective.

6. Pennsylvania and digital government

Pennsylvania is the 12th most populous state in the United States and one of four commonwealths. It has 67 counties and the second most local governments (over 8000) of all states (there are more than 87,000 local governments in the U.S. [U.S. Census, 2005]). The capital is Harrisburg, southeast of the state's center. The commonwealth (or state) government has approximately 50 independent agencies, with 43 of them having chief technology or chief information officers. The CIO's office (officially known as the "Office of Information

Table 1
Pennsylvania's enterprise computing projects timeline (1995–2004)

1995
- January — Tom Ridge (R) sworn in as Governor of PA
- October — PA's first homepage was introduced (48th U.S. state to do so)

This became **PA PowerPort** (the state's portal site) in 2000

1996
- Spring — IMPACCT report published

1997
- July — **Data PowerHouse Project** (data center consolidation) announced
- August — **Commonwealth Connect** (desktop/office and e-mail standardization) discussions begun
- Fall — Telecommunications convergence discussions initiated

1998
- Summer — **Technology Incentive Plan** (TIP) fund created
- June — Contract with Microsoft finalized for Commonwealth Connect

1999
- Spring — Began processes to select vendors for ERP and systems integrators for **Imagine PA** (the enterprise system effort)
- October — **PA Open for Business** portal site launched

2000
- May — Bureau of Commonwealth Telecommunications Services (BCT) formed
- June — Contract with SAP finalized for **Imagine PA** software vendor
- August — Continuous enrollment begins in **Invitation to Qualify (ITQ**: a procurement and vendor registration program**)**
- October — Full transition to **Data PowerHouse** complete
- October — Official launch of the **PA PowerPort** website

2001
- Early — **Imagine PA** project team created
- March — Contract with KPMG Consulting (with IBM as partner) finalized as system integrator for **Imagine PA** (SAP implementation)
- July — All Pennsylvania agencies' PCs (40,000 total) standardized on **Commonwealth Connect** desktop software
- December — Lt. Gov. Mark Schweiker becomes PA Governor (Tom Ridge becomes first secretary of Homeland Security)

2002
- July — First wave of **Imagine PA** SAP software implementation begins (see note 1 below for details on waves)
- October — Second wave of Imagine PA SAP software implementation begins (see note 1 below for details on waves)
- November — Ed Rendell (D) elected to be Governor of PA.
- End of year — The majority of all agencies' PCs (60,000 (+)) standardized on **Commonwealth Connect** desktop software and e-mail network

2003
- January — Ed Rendell (D) sworn in as Governor of PA
- January — First part of third wave of **Imagine PA** SAP software implementation begins (see note 1 below for details on waves)
- March — Installation of **Imagine PA** SAP/human resource modules temporarily halted due to software customization, system integration testing and end-user training issues.
- April — Second part of third wave of **Imagine PA** SAP software implementation begins (see note 1 below for details on waves)
- August — OIT creates office of Enterprise Integration
- September — OIT gets oversight to agency IT budget/planning and direct input on hiring agency-level CIOs

Table 1 (*continued*)

2004

- July — Third part of third wave of Imagine PA SAP software implementation begins (see note 1 below for details on waves). Implementation completed by end of 2004.

Table 1 note 1: Details of Pennsylvania's enterprise systems project waves*

July 1, 2002 **Wave 1 Implementation**

Budget Prep — PHASE I for all agencies, Budget execution (Wave 1 agencies), Accounting, Procurement, Workflow, Business Warehouse, Travel planning, and Construction Project Administration (CPA) for:

- Executive Offices OA and OB
- Aging
- Agriculture
- Banking
- Emergency Management
- Health
- Human Relations
- General Services
- Insurance
- Military and Veterans' Affairs
- State
- State Police
- Public Utility
- Securities Commission
- Attorney General

Oct 1, 2002 **Wave 2 Implementation**

Budget execution (Wave 2 agencies), Accounting, Procurement, Workflow, Business Warehouse (BW), Travel Planning, and Construction Project Administration (CPA) for:

- Community and Economic Development
- Conservation and Natural Resources
- Corrections
- Education
- Revenue
- Municipal Retirement
- Public School Employee Retirement System
- State Employee Retirement System
- Civil Service
- Fish and Boat
- Game

Jan 2, 2003 **Wave 3A Implementation**

This includes Budget Execution (Wave 3 Agencies), Accounting, Procurement, Workflow, Business Warehouse (BW), Travel Planning, and Construction Project Administration (CPA) for:

- Public Welfare
- Pittsburgh Ports
- Liquor Control Board
- Probation and Parole
- Tax Equalization
- Historical and Museum

(continued on next page)

Table 1 (*continued*)

Table 1 note 1: Details of Pennsylvania's enterprise systems project waves*	
Apr 1, 2003	**Wave 3B Implementation** This includes Budget Execution (Wave 3 Agencies), Accounting, Procurement, Workflow, Business Warehouse (BW), Travel Planning, and Construction Project Administration (CPA) for: • Environmental Protection • Environmental Hearing Board • Labor and Industry • Liquor Control Board
July 1, 2004	**Wave 3C Implementation** This includes Budget Execution, Accounting, Procurement, Workflow,Business Warehouse (BW), Travel Planning, Travel Expense Reporting, and Construction Project Administration (CPA) for: • Transportation Imagine PA begins transition to Integrated Enterprise Systems (IES). Wave 3C represents the final installment of the of the originally envisioned 4 Wave implementation and completed the transition of the five major business processes – Finance, Budget, Procurement, HR/Payroll, and Travel – from the legacy systems into SAP.

* Source:http://www.ies.state.pa.us/imaginepa/cwp/view.asp?a=6&Q=49472&PM=1&imaginepaNav=|2022|.

Technology" and the formal title of the CIO is "Deputy Secretary of OIT") is part of the "Department of Administration" and located in the executive branch. The OIT was established in 1995 and there have been four CIOs since.

The mission of the OIT and the role of the CIO have been expanding over the past 10 years, with both gaining increased decision-making power regarding information technology. Five activities during this period reflect this expansion. As noted below, in the later 1990s, OIT began to exert strategic planning influence (via the 1996 IMPACCT report (IMPACCT, 1996)) and to support this plan with discretionary funding via the technology innovation program. In the early 2000's, OIT opened an *Enterprise Architecture Office*. This office was charged with developing a state-wide enterprise architecture for defining and promoting standards for development, operations and infrastructure, and engaging the various IT units in the commonwealth to participate and collaborate. In doing this, Pennsylvania became one of the first states to explicitly engage enterprise architecture and served as a 'beta' site for the National Association of State CIO's (NASCIO) enterprise architecture program. In 2003, the CIO was given the ability, by executive order, to *approve agency CIO selection*. As a result, the OIT/CIO now had a formal oversight role to the 43 agency CIOs in Pennsylvania state government. In the same executive order, OIT gained *oversight of agency IT budget and project planning*. This means that OIT had increased governance over IT spending for the commonwealth. These actions helped to move concepts of enterprise computing from a voluntary activity pursued through informal means to a more formalized activity across the agencies that comprise the commonwealth's state government. And these activities made OIT the formal convener of the commonwealth's strategic IT planning.

Between 1995 and 2004, more than 30 initiatives were undertaken (wholly or in part) by Pennsylvania's OIT. Many of these projects supported modernization of a particular agency's computing infrastructure or the extension of service (such as the state-wide radio network or

the integrated justice network that focused on police and public safety[6]). The 7 projects summarized below (depicted in Table 1 and discussed in more detail in the Appendix) reflect those that have substantial enterprise computing components. Our intent in highlighting these is to make two points:

(1) Technological development of Pennsylvania's enterprise computing is integrally related to, and embedded in, the organizational structures and policies developed to guide and support this work.
(2) Enterprise computing efforts made by Pennsylvania and the OIT over 10 years (1995 to 2004) represent a consistent planning focus that reflects strategic alignment principles.

These seven projects include:

1) *Commonwealth Connect:* an effort to consolidate across the nearly 80,000 personal computers (as of 2004) to common desktop software and e-mail standards (becoming the first state to partner with Microsoft in a state-wide licensing agreement).
2) *Commonwealth Data Center*
3) *Telecommunications Consolidation* brought together data centers and telecommunications.
4) *Invitation to Qualify (ITQ)* streamlined the ICT products and services procurement process.
5) Several government-to-business web portals including *PA Open for Business* and a state portal, PA Powerport, to provide a range of services focused on citizen-to-government interactions.
6) *Technology Investment Program (TIP)* that allowed the CIO to fund initiatives that embodied or enabled economic development or educational excellence. The money from TIP and the leadership by OIT staff made this (new) office a central node in e-government.
7) *Imagine PA*, the enterprise systems implementation effort, focusing on the enterprise resource package SAP R/3 as a state-wide administrative operational platform. This extensive project began during the Ridge administration and continued through the Schweiker administration into the Rendell administration. Imagine PA brought both increased information sharing, through the development of data architectures, and organizational process changes, through the implementation of the various SAP modules.

7. Enterprise computing

In Table 2 and below, we present and discuss these projects organized according to the enterprise computing perspective. The data makes clear that Pennsylvania's movement towards an increased level of digitally-enabled government has been guided by the efforts of the OIT. Each of the projects had both strategic intent and active participation (if not leadership) from OIT. Moreover, across these projects, both the OIT and the role of the CIO evolved from innovation to stewardship. It took ten years for OIT to solidify its roles as the

[6] See www.pajnet.state.pa.us for more on these efforts.

Table 2
Enterprise perspective

	OIT's roles	Imagine PA (ERP)	PA Comm. Connect	Powerport and Business Portals	Telcomm. consolidation.	PA Powerhouse	ITQ	TIP
Strategic intent	**X**	X	X	X	X	X	X	X
Process and work flow	**X**	X	X	X			X	
Applications/ software	**X**	X	X					X
Information architecture	**X**	X	X	X		X		X
Hardware	**X**		X			X		X
Telecom.	**X**				X	X		X

strategic leader for computing in the commonwealth and to exert this leadership across the entire ensemble of computing in Pennsylvania state government.

The projects reflect attention to both modernizing and marshalling the state's computing resources into a coherent enterprise architecture. The work of PA Powerhouse, the telecommunications consolidation, and the TIP shared a common focus: to improve the base technologies. This infrastructural work serves as an evolving platform for increasing information sharing, as well as making work processes more transparent and easier for constituents to engage. This focus is represented by the citizen-focused and business-focused portal efforts, and the immense efforts that are the "Imagine PA" and "Commonwealth Connect" projects. The ITQ and TIP served as vehicles to pursue these enterprise activities by helping to both distribute and focus resources on strategic targets.

8. Strategic alignment

In Table 3 and below, we present and discuss the commonwealth's computing projects from a strategic alignment perspective, noting that the OIT pursued all four approaches to strategic alignment. The ITQ and TIP activities reflect technology strategy following from organizational strategy in that these programs were designed to provide resources and guide activities that resulted in ICT purchases and decisions that reflected organizational goals. In

Table 3
Strategic alignment perspective

Strategic Alignment approach	Example from PA enterprise computing
Strategy Execution	ITQ
Business -> Organization -> IT Infra.	TIP
Technology Transformation	Imagine PA (information sharing)
Business -> IT -> IT Infra.	Commonwealth Connect
Competitive Potential	Imagine PA (organizational process changes)
IT -> Business -> Organization	PA Powerport
Service-level Alignment	Telecommunications consolidation
IT -> IT Infra. -> Organization	PA Powerhouse (data center consolidation)

contrast, two extensive projects: "Imagine PA" and "Commonwealth Connect" were engaged with the specific intent to achieve technology-enabled transformations. "Imagine PA" also was used to pursue a competitive potential alignment effort, bringing IT to support and improve work processes as well as reduce transactional and information-sharing costs. In the same way, "PA Powerport" and the portal activities helped improve the operations of Pennsylvania state government. As noted, the "PA Powerhouse" and telecommunications consolidation provided service-level alignment and operational stability.

9. Discussion: Pennsylvania enterprise's computing activities and strategic alignment

From 1994 through 2004, the Commonwealth of Pennsylvania's political and IT leadership made a series of decisions showcasing a pattern of enterprise thinking around the value and uses of computing to support strategic alignment. This progress happened at the same time other states were pursuing similar efforts to increase their level of digital government activity. The ability of Pennsylvania to shift from being a laggard to being a leader in digital government suggests that this attention to strategic alignment and enterprise computing creates a competitive advantage. The progress over this ten-year span transcends three governors, a change in the political affiliation of administrations, four CIOs, the rapid rise (and bursting) of the 'dot.com' boom, terrorist attacks on the U.S., and a host of less-visible but significant events.

Through the remainder of this paper, we explore this ten-year trajectory of decisions as evidence of an enterprise computing perspective, and as an example of ongoing strategic alignment. As we laid out at the beginning, enterprise computing is the most recent, and most visible, effort to engage the symbiotic relationships among an institution's structures and functions as well as the ensemble of computing and communications technologies (Bernard, 2004).

10. Planning: An enterprise computing perspective

As outlined above, the current literature suggests that public sector organizations continue to pursue computing differently than do private sector organizations. For example, relative to the private sector, public sector organizations are likely to focus on administrative, not strategic, elements, to pursue funding for computing in piecemeal ways, and reify – as opposed to streamlining – control of procedures (Bozeman & Bretschneider, 1986; Heintze & Bretschneider, 2000; Boyne, 2002). The level of red-tape, purposes for use, and funding models often make it more difficult for public sector organizations to realize the value of computing. And evidence suggests that managing public-sector IT efforts also differs from the private sector in that it is even more difficult to engage in process re-engineering (e.g., Cats-Baril & Thompson, 1995; Shalala, 1998).

The recent focus on enterprise computing blends the techno-centric approaches advocated by those engaged in building enterprise architecture from the bottom-up with strategic-institutional perspectives (Gregor et al., 2007; NASCIO; 2003; Fountain, 2001). Seen in this light, the combination of policy decisions to establish IT oversight with OIT, the rationalization

of the telecommunications, desktop, and data centers, and the move toward an enterprise system reflects steady progress in pursuit of a coherent enterprise computing architecture. The more recent efforts by the newly created OIT Office of Enterprise Architecture to establish standards for development environments, middleware applications, and information sharing indicate that these efforts are cohering.

From an enterprise computing perspective, Pennsylvania's efforts over the past ten years illustrate how public sector organizations can simultaneously engage the policy, operational, and technical elements. Their work provides interested observers with both an example of how to engage enterprise computing, and evidence on the types of decision, stakeholders, and projects that must be involved.

11. Planning: A strategic alignment perspective

The evidence from ten years of work by Pennsylvania and its OIT suggests that they have been able to move from operationally-led decision-making toward a strategic alignment model. The ability to see projects through, such as telecommunications infrastructure rationalization, common desktop standards, streamlined IT procurement, the TIP (to support strategic initiatives), and the recent oversight controls for agency CIO and IT planning, suggests steady progress toward increased alignment between the commonwealth's strategic vision and the ability of its computing investments to support these visions.

Given the range of initiatives, it is also worthy to note that Pennsylvania, and particularly the OIT and CIO, have engaged in several approaches to pursuing strategic alignment. They have often successfully pursued multiple alignment activities at the same time. This suggests that strategic alignment is both dynamic and flexible in action — that there are multiple models to choose from. With only one case study to draw from, prescription is not possible. However, we speculate that the Pennsylvania experience suggests that it is not possible (and may not be wise) to develop strategic alignment as a singular approach, or to conduct alignment activities by pursuing only one approach.

The evidence from Pennsylvania makes clear that the change of administrations led to changes in strategic focus. For example, the pro-business and economic development focus of the Ridge-Schweiker administration had been replaced with a more populist approach by the Rendell administration. Combined with economic changes (that is, the surpluses of the 1990s gave way to lean years in the early 21st century), the focus seems to have shifted towards operational issues.

Moreover, the lengthy and difficult implementation of the SAP ERP suggests that process-level changes across the commonwealth government may be slow to realize. This is not all that different from the findings from the private sector (e.g., Grant, 2003; Gregor et al., 2007). Given the differences in how computing is employed in public sector organizations, and some of the differences between private and public sector organizations, it may be that process changes will be the most difficult to realize (e.g., Rainey & Bozeman, 2000; Boyne, 2002; Hackler & Saxton, 2007).

Pennsylvania's two portal efforts provide mixed evidence of the state's ability to pursue sustained process changes. The construction of a website that allows some integration of activities (by the site's users) across agency boundaries suggests that some process change is

possible. The continued agency-level boundary protection that prevents further streamlining of business processes suggests further change may be slow.

The ten years of evidence makes clear that Pennsylvania's commonwealth-level government has been able to engage in strategic alignment. The effort is not without its struggles, and the timetable suggests that alignment change is neither quick nor direct. The evidence suggests that an enterprise's strategic intent can be mapped to the development, deployment, and uses of computing assets. Furthermore, this alignment can be carried on during substantial organizational and environmental change. The scale and scope of Pennsylvania's government makes clear that organizational size, while a considerable influence, is not a barrier to such change.

What also becomes clear is that infrastructural alignment is easier than information and process alignment. However, this is a relative comparison. The efforts to align the telecommunications, desktop standards, and procurement and funding approaches to computing are complex and expensive. As Pennsylvania's state government embarks on efforts to leverage their substantial investment in an ERP, the focus will be on business process change and information integration. From both the strategic alignment and enterprise perspectives, this focus is also the link between strategy and infrastructure. Given the steady progress made to develop a coherent enterprise computing architecture, and to engage in strategic alignment, Pennsylvania is well-positioned to engage this next stage in computing.

Returning to the false notion of strategic alignment as static and top-down, the evidence from this case study, and other empirical studies of strategic planning, make clear that these efforts reflect more bottom-up responsiveness and flexibility (Saaksjarvi, 1997; Ciborra, 1996, 2000). This finding is supported by the theorizing and empirical evidence on the adoption and uses of computing in organizations, indicating that too many new systems do not lead to the effects intended, and often lead to unintended consequences (Leonard-Barton, 1988; Sproull & Kiesler, 1991; Sproull & Goodman, 1989). For those who advocate bottom-up planning, the evidence from Pennsylvania suggests that organizations that pay attention to constituents (i.e., by creating forums and vehicles to engage people) can gain value. In Pennsylvania, OIT set a model example of innovation through strategic and tactical uses of ICT, focusing on gathering data and building a business case, and providing both financial support and internal expertise in project management and contracts.

For those who seek examples and evidence of how to engage enterprise computing, information integration, and strategic alignment of informational and computing resources with operational needs, Pennsylvania's efforts from 1995 to 2004 provide both a viable template and practical lessons. The evidence from Pennsylvania's efforts makes clear that strategic alignment is as much a bottom-up and opportunistic activity as it is a rational, top-down activity (see also Avison et al., 2004).

We further note that by 2004, Pennsylvania had increased the level of information sharing and information integration across government agencies. The effects were uneven across all agencies, and there is much more to do, but the ten years of platform building, the focus on developing a coherent information and ICT architecture, and the efforts to standardize desktop, server, and web-based systems showcases the ensemble of computing elements, informational components, governance decisions, and policy guidelines that require time to come together into a coherent strategic alignment.

Appendix A. The Pennsylvania enterprise computing efforts: 1995–2004

In this appendix we provide additional contextual, factual, and chronological data regarding Pennsylvania's enterprise computing efforts. In doing this we build on and supplement the material presented in the body of the text.

A.1. The Pennsylvania context

In the early 1990's Pennsylvania government was composed of approximately 152,000 full-time employees supporting an estimated population of 12 million citizens. State government revenues totaled approximately $36.7 billion (U.S. Census, 1992)[7]. Pennsylvania's economy was still dependent on traditional manufacturing-based industries and Pennsylvania was ranked 47th in job growth rate. Not surprisingly, even before January 1995, when Governor Tom Ridge and his administration took office, there was a widely perceived need to move the state economy and labor force toward new forms of economic development that were less likely to focus on traditional blue-collar manufacturing jobs.

While the state economy was continuing to transition away from traditional industries, state government was seemingly stuck within an outmoded technological paradigm. Pennsylvania's annual investment in electronic data processing and telecommunications was estimated to be $275 million (IMPACCT, 1966). Within Pennsylvania state government, the operational ICT infrastructure of most agencies had fallen behind industry standards. Moreover, leaders of most agencies believed that each should have control of both the information that it generated and used, and the hardware and software used in this effort. Thus, in 1995 Pennsylvania maintained 21 data centers, each operating relatively independently, with little redundancy or oversight. Moreover, systems were failing (e.g. many flooded when it rained), downtime was rising, service-levels were dropping, as was the morale of the commonwealth's information technology staff. Further, Pennsylvania lagged behind other states in the deployment and uses of computing. For example the state did not establish a government-wide presence on the internet until October of 1995 (only West Virginia and Mississippi trailed Pennsylvania online).

In 1995, after months of internal discussion, Governor Ridge commissioned the "Improve Management Performance and Cost Control Task Force" (IMPACCT). The authors of the report recommended that the commonwealth develop a long-range IT management strategy that would increase the cost effectiveness of IT investments, strengthen the competitiveness of the commonwealth, better serve citizens through IT use that is improved by regulatory agencies, and would enhance agency operations. The report suggested that initial investments in the state's IT and telecommunications infrastructure could ultimately yield a 5–10%

[7] The number of employees has not changed appreciably since: 2002 numbers show PA commonwealth government employing 154,000 FTE.

savings in the state's annual IT outlays. They specifically recommended seven strategic actions:

- Re-examine agency policies regarding the sharing of information
- Alter personnel policies in order to provide competitive compensation for high-level IT managers and technical staff
- Move toward off-the-shelf application procurement instead of in-house development
- Create an inventory for re-use of packages already developed by the Commonwealth
- Select a suite of software engineering tools for use by all agencies in developing new custom applications
- Move toward the development of relational databases
- Revise procurement standards to assure that they meet required standards, improve competition, and reduce vendor prices.

In early 1996, at about the same time the IMPACCT report was released, Governor Ridge created the Office for Information Technology (OIT) within the Commonwealth's Office of Administration (OA, the administrative arm of Pennsylvania state government). The Deputy Secretary of OIT became Pennsylvania's 'Chief Information Officer' (CIO). The CIO was charged with engaging the recommendations of the IMPACCT report, and a strategic plan was outlined in their 1997 plan, 'Breaking Through Barriers'.[8]

A.2. Computing in Pennsylvania state government

From this point forward innovating through IT became a strategic goal and the OIT staff was encouraged to innovate using ICT. They worked to pursue high-visibility and high-impact concepts, to learn from mistakes, and to pursue a range of projects tied to either economic development or educational excellences. The combination of clear and active issue advocacy from senior executives, the legitimization that access to budget and senior cabinet counsel provided, the combination of innovative ideas with an analytic approach to taking on ICT projects, and the willingness to take risks, all reflect both the administration's commitment to engaging ICT and the important role the OIT played in establishing computing vision and standards for the commonwealth. In doing this, OIT exemplified the enterprise computing perspective.

The OIT played a critical role in developing an enterprise perspective. Its very presence – rising from nothing to be a thriving organization housed in the Office of Administration and with direct access to the Governor – and willingness to engage in formal and informal actions to establish enterprise computing oversight across Pennsylvania state government, made it a central player.

The OIT's guiding principles were set out in a short (6 page) document. These principles depicted ICT as a lever to enable economic development, reflected private-sector sophistication in developing ICT combined with public-sector ideals of service delivery and access, and

[8] See www.oit.state.pa.us.

specified general principles for the ICT and computing architecture in Pennsylvania. This big-picture view provided a guiding frame, rather than a detailed specification, for how to approach ICT. These principles helped OIT to focus on leveraging interests of constituents while emphasizing negotiation and consensus. The OIT staff took an analytic orientation when engaging this work, focusing on compiling evidence and using it to make their points. Their ability to develop (and provide) evidence, and their pursuit of computing tied to the guiding principles, became a potent force pushing the enterprise computing agenda.

A.3. Commonwealth desktop standardization: Commonwealth connect

In 1994, agencies within the commonwealth were supporting between 3000 and 3500 personal computers (PCs). By early 1998, this number had grown to nearly 25,000 PCs, and by 2002 there were upwards of 65,000 desktop computers. As was typical in the mid-1990s, individual agencies had control over the software operating on their PC's. In 1997, the OIT began roundtable discussions with leading software companies to explore standardizing all agencies to a single software package for handling office productivity and e-mail functions. In 1998, OIT/PA selected Microsoft desktop and e-mail software, and over three years moved to a standardized desktop, work group, and e-mail package. In addition to the savings related to the standardization initiative, the commonwealth was able to obtain a commitment from Microsoft to invest $11.9 million for economic development and educational projects in Pennsylvania communities. Therefore, OIT was able to leverage its sizable purchasing and contracting power to gain additional value from the vendor in order to help important stake-holder groups.

A.4. Commonwealth data center (Data Powerhouse) and telecommunications consolidation

Two projects in near parallel helped Pennsylvania to rationalize and consolidate its computing infrastructure. One of OIT's initial projects was to first consolidate, then outsource to a vendor, the agency-run data centers identified as sources of inefficiency and redundancy. The intent was to make better use of commonwealth assets and to improve performance. By the mid 1990s, the commonwealth possessed 21 data centers which were run independently for 17 different agencies, only one of which was more than 8 miles from the capital of Harrisburg. These centers created redundancies in the costs associated with their management and maintenance, and made it difficult to either share information across agencies, or for the agencies to promote more efficient management of their ICT resources.

The Data Powerhouse project was a major step towards integrating the management of ICT across the commonwealth's government with an eye toward cost savings and improved efficiency. In 1999, after a competitive bidding process, a 7-year contract was awarded to a 10-company group led by Unisys. In doing this, the commonwealth not only consolidated their data centers, but became the first large state to outsource its management and maintenance.

At about the same time as data center were being consolidated, the OIT formed an office to oversee telecommunications policy for the commonwealth. By 2000, the Bureau of

Commonwealth Telecommunications Services (BCTS) was formed to oversee the consolidation of all state telecommunications efforts into an omnibus contract and, concurrently, the development of a shared metropolitan area network used by all state agencies.

A.5. Invitation to Qualify (ITQ)

Invitation to Qualify (ITQ) was implemented to improve the speed and reduce the cost of selecting vendors. In the ITQ, vendors are pre-qualified to provide services, and state agencies can select from this list of pre-approved companies to meet their procurement needs. The ITQ process was piloted on the procurement of LAN services in 1996, and has since been applied to the procurement of many services including IT consulting, computer training, computer programming, and computer systems analysis. Prior to the ITQ process, the RFP cycle could take 6 months or more to complete. Under the ITQ process, procurements have been completed in as little as three days. ITQ vendor lists are open for continuous enrollment and allows for pre-qualification of an unlimited number of vendors.

A.6. Portals: PA powerport and PA open for business

Two portals were developed by OIT in cooperation with a number of agencies. Both continue to serve Pennsylvania citizens and visitors. PA Powerport is the state's website and a nationally recognized portal for government-to-citizen interactions. The Pennsylvania Open for Business Website provides entrepreneurs with state government forms they need to do business in Pennsylvania. Both are architected using Dynamic Site Framework (DSF), a product that combines standard XML with proprietary structures. The DSF web standards and approach were presented as a rudimentary computing architecture. Any Pennsylvania government agency that engages DSF also receives access to all other content and design done in DSF. This leveraged consistency and rewarded the Pennsylvania technology company (Cimbrian) that developed and licensed the DSF framework.

A.7. The TIP program

The Technology Investment Program (TIP) came about to help Pennsylvania with the Y2K problem. Initially, a pool of money was set aside because agency funding needs were not yet determined. This money was a separate appropriation from the budget office, a line item in the budget that was part of the overall general fund. After Y2K, the TIP was continued for other technology uses because the 18-month budget cycle does not allow for quickly changing technological needs. This provided OIT with discretionary funds they could allocate to areas and agencies deemed in greatest need for software, hardware, or development.[9]

[9] However, in the early 2000's TIP was zero-funded due to budget constraints. It has not been funded since.

A.8. OIT oversight

Many of the projects initiated by OIT were innovations designed to encourage commonwealth agencies to engage in IT as a means of both taking an enterprise perspective and leveraging the technology to improve both internal operations and service delivery to constituents. These efforts reflected the 'boom times' of the 1990s, and by early 2000's state-level funds were squeezed. During this period, the OIT initiated more aggressively the implementation of organizational structures and policies to solidify their ability to leverage enterprise efforts for the commonwealth.

Three activities during this period reflect this goal. First, the OIT opened an *Enterprise Architecture Office*. This office was charged with developing a state-wide enterprise architecture, defining and promoting standards for development, operations and infrastructure, and engaging the various IT units in the commonwealth to participate and collaborate. In doing this, Pennsylvania became one of the first states to explicitly engage enterprise architecture, and served as a 'beta' site for the National Association of State CIO's (NASCIO) enterprise architecture program. Second, the deputy secretary of OIT was provided, by executive order, to *approve agency CIO selection*. By virtue the OIT/CIO had now a formal oversight role to the 43 agency CIOs in Pennsylvania state government. Third, in the same executive order OIT gained *oversight on agency IT budget and project planning*. This means that OIT had increased governance over IT spending for the commonwealth. These actions helped to move enterprise computing from a voluntary activity pursued through informal means to be a more formalized activity across the agencies comprising the commonwealth's government.

A.9. Enterprise systems implementation in Pennsylvania

The largest and most visible enterprise computing effort has been the SAP Implementation. Pennsylvania was one of the first states to embark on the multi-year effort to link governmental operations through the use of an enterprise resource planning system. The decision to purchase and implement SAP reflects a long-term view of this ICT as a platform or enabler of future government opportunities.

The decision to engage SAP in particular reflects an ongoing series of discussions involving the governor's office, key agency leaders, OIT, and the IT leaders of many agencies. The efforts to standardize the desktop, data center consolidation, and rationalization of the telecommunications infrastructure provided venues to reflect and discuss agency and commonwealth needs to upgrade software, systems, and processes used to support core business functions. Rather than address these requests individually, over the course of these and more focused meetings, it was determined that significant advantages could be gained by responding in a more coordinated fashion with long-range benefits. This idea became the Integrated Enterprise Systems (IES) (formerly known as, "ImaginePA") — the state's effort to streamline and standardize key business processes regarding accounting, budgeting, payroll, human resources, and procurement.

In two rounds of competitive bidding the software (SAP's R/3) and the system integrator (KPMG — now Bearing Point) were selected. From the SAP R/3 product suite, five SAP ERP

components were developed to integrate and serve each of these business processes and to advance the IES initiative (accounting, budgeting, payroll, human resources, and procurement).

The SAP implementation (using the MySAP implementation approach) concluded in June, 2004. As typical with most large-scale information systems, the effort was more complex than expected. The software required more customization than anticipated, and the organizational resistance to changes in the business process was more resolute. Thus, the implementation took a year longer than planned. The project spanned two project managers and two gubernatorial changes (i.e., Ridge/Schweiker to the Rendell administration).

A.10. Organizational context and work process issues

The SAP R/3 components were to be implemented uniformly across all agencies, allowing for very little customization. While the system helped to standardize administrative processes and information across users, the designed system failed to address some agency-specific needs. For example, in procurement, employees and agencies were forced to develop "quick-fix" or work-around responses for system misspecifications. One agency noted that the SAP Procurement system did not generate the type of reports needed for their transactions. As a result, in addition to using the new SAP system for documentation, they also had to replicate their traditional method for processing reports, which led to work redundancy and the application of a parallel work process.

A second set of issues involved training and human resources. About a year prior to transition to SAP, users attended mandatory SAP R/3 training sessions. Neither the state government nor SAP (the system manufacturer) designed the training courses for this implementation. Rather, the design and instruction of the formal training program was contracted to a third-party vendor. Consequently, the credibility of the training was challenged as this third-party vendor was perceived as being unfamiliar with both government procurement policies and the software for which it is was commissioned to develop training modules.

Moreover, while formal training was mandatory across agencies, the enforcement of training requirements varied from agency to agency. Some viewed training as a critical step to successful implementation, while others deemed it a waste of time. As a result, formal training rates varied largely across agencies, but were fairly stable within agencies (e.g., individuals within agencies enforcing training had higher rates of participation than those from agencies not enforcing training). This led to problems early in the take up of SAP R/3 modules.

Issues with process change continued. For example, the SAP Procurement module was to be implemented in all government agencies in central and field offices across the state. The magnitude of difference between the new system and the legacy system was reported to be substantial. To this point, 95% of all organizations participating in the implementation rated the new SAP Procurement system as being "very different" from their previous work methods, which did not allow for as detailed documentation of purchasing transactions or as great of access to records filed by other offices and agencies.

Prior to SAP Procurement, the methods of conducting purchases and requisitions in agencies across the state were diverse. Some agencies used traditional paper-based processing, many others used a state-designed system of antiquated electronic spreadsheets, and one

agency had an electronic procurement database that was relatively sophisticated, but it was not networked with other business components as SAP allows. For most agencies, the new SAP Procurement system introduced a medium for data entry, it required the storage of more detailed information than was previously recorded, and it provided greater access to procurement records and histories within and across agencies.

Not only did SAP Procurement introduce a speedier form of information processing and retrieval, it also changed the quality of the communicative interactions among agencies. Interfacing in a virtual work environment decreased the need for some personal interactions, and created a sense of work abstraction with the elimination of more-tangible paper process markers, such as documents, records, receipts, and communication logs.

Although the system was deemed a radical change for procurement processing, some aspects of procurement remained the same throughout the implementation, namely state procurement laws and the order with which work processes moved critical information from one part of the agency to another (i.e., chain of command). These things remained relatively constant, as did the intact agency networks existing prior to the implementation. Those agencies with a history of collaborative practices, shared services, and/or partnerships, continued to work together independent of the system used for executing procurement.

There were also political aspects of implementation. For instance, two reasons initially outlined by the state for implementing the SAP Procurement system were: (1) to increase the access to information within and across agencies in an efficient effective manner in order to share knowledge and crisis manage, and (2) to reduce expenses associated with vendor-shopping in order to facilitate better purchasing management. Several unintended side-effects grew out of the scale and ambitious nature of the SAP implementation. One is that, while communication was increasing across agencies, the content of communication often pertained to SAP system problems. This was not the valuable organizational knowledge-sharing the system was intended to inspire.

A second unintended result was changes to long-standing relationships among state agencies and local vendors. The incoming Rendell administration instituted new no-bargain contracts for up to five-years after the implementation. These contracts require that the state purchase certain goods (e.g., toilet paper, sheet metal, etc) through select vendors only. Some local vendors with historic business ties with the state were excluded from the SAP-approved vendor lists. Not only were relationships damaged by these mandates, these contracts eliminated the ability to "shop" for a best exchange rate, as the system was initially intended to support and as was outlined as a priority function by the former Ridge-Schweiker administration. As a result, many system users wondered why the ERP system was being implemented if state policies prohibited the attainment of the goals the system was designed to achieve.

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