PRIVATE AND PUBLIC SECTOR ENTERPRISE RESOURCE PLANNING SYSTEM POST-IMPLEMENTATION PRACTICES: A COMPARATIVE MIXED METHOD INVESTIGATION

by

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Abstract

While private sector organizations have implemented enterprise resource planning (ERP) systems since the mid 1990s, ERP implementations within the public sector lagged by several years. This research conducted a mixed method, comparative assessment of post "go-live" ERP implementations between public and private sector organization. Based on a survey of 194 ERP adopting organizations and supported by four interviews of senior IT executives/leaders within the public and private sector, the research identifies that differences exist in governance design, timeline to accept and timeline to extend baseline ERP implementations between public and provide, but differences do not exist in how public and private sector organizations design sustainment structures, in the importance of governance and sustainment structures within public and private sector organizations and in the relative importance of governance, sustainment and extension to driving organizational transformation. Continued engagement with senior leaders and effective training focused on business processes are critical components following ERP implementation that aid continuing organizational transformation.

Dedication

To my wife, Gail, for her love, patience and continual support to help me achieve this lifelong goal,

and

To my father, Benjamin Ernest, and my mother, Sadie Marjorie, for their life-long steadfastness, practicality, clarity of thought, generous love and constant reminders to seek happiness and God's will in daily living.

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CHAPTER 1. INTRODUCTION

Introduction to the Problem

During the 1990s, enterprise resource planning (ERP) systems were viewed as a key innovative technology for private sector organizations that would optimize use of resources, support globalization, streamline business processes through delivery of best practices, and reduce operating costs through elimination of custom built business applications. Despite difficulties due to cost overruns, delays, scarcity of skilled consultants/in-house IT staff and even project failures, private sector organizations continued to implement ERP systems at break-neck speed (Davenport, 1998). So much so that by the end of the 1990s more than 80% of large private sector organizations had invested in ERP to manage financials, manufacturing operations, and human resources back-office functions (Sullivan, 2005). Within the private sector, the popularity and success of ERP has continued into the 21st century while at a slower rate through implementation of software upgrades, extensions of functionality and adoption of web-based services. In less than 20 years the ERP market (including software licenses, consulting, IT hardware and support) is quite large, and projected to increase worldwide from almost $33 billion in 2004 to almost $49 billion by 2010, an annual rate of 6.8% (Eschinger, Pang & Dharmasthira, 2006). The United States alone represents 45% of ERP market at $15 billion.

Public sector organizations have been less quick to implement ERP, despite regulations such as the Klinger-Cohen Act of 1996. In addition to requiring public organizations to develop and document an enterprise architecture, Klinger-Cohen established a preference for acquisition and implementation of Commercial-off-the-Shelf (COTS) software (Chen, 2005). Some

researchers and writers have suggested that this delay to implement ERP is due to fundamental differences in the nature and business processes of public and private sectors. While private sectors tracks the value of assets, public sectors tracks "…obligations and authority" (Holcomb, as cited in Makulowich, 1999). The nature of public sector organizations in the United States is based on "the sharing of power and the separation of power, working together but against one another" (Watson, Vaught, Gutierrez & Rinks, 2003). Public sector organizations are increasingly challenged to improve constituency services while eliminating bureaucratic inefficiencies in a period of declining revenue (Miranda, 1999, Watson, et al., 2003). ERP systems offer the promise of "automat[ing] and integrat[ing] business processes and provid[ing] the data stream business analysis" (Makulowich, 1999). As a result, public sector organizations are now in the process of implementing enterprise-wide ERP systems (Blick, Gulledge & Sommer, 2000; Miranda, 2005).

Recent public sector ERP implementations have ranged from the large to the enormous. The State of Arkansas implemented SAP financials and human resources systems at the cost of $30 million. The State of Florida implemented a PeopleSoft ERP financial system at a program cost of $68 million while the City of San Antonio spent $88 million (Welsh, 2004). The Commonwealth of Pennsylvania reportedly implemented an SAP system over the period 2000 to 2003 at a program cost of over $130 million (Wagner & Antonucci, 2004). In 1998, the U.S. Navy authorized implementation of four separate non-integrated pilots at the aggregated cost of $1 billion and is now combining these four pilots into a single integrated ERP system for an additional estimated budget of $800 million for the period 2004 through 2011 (Gulledge & Sommer, 2003; Gulledge & Simon, 2004; Government Accounting Office [GAO], 2005b).

Federal civilian agencies such as Department of Treasury, the Department of Interior, the Internal Revenue Service (IRS) as well as all branches of service within the Department of Defense (e.g., Army, Navy, Air Force, Marine Corps) are currently implementing ERP projects. One of the leading information technology research and advisory consultants, Gartner Inc., forecasts that federal spending of $5.8 billion annually would increase 33% increase to $7.7 billion by 2010 (Yasin, 2005). Even larger than the federal sector, state and local public sector spending on ERP is forecast to increase from $9 billion in 2005 to over $11 billion by 2008 at an annual rate of 7.8% (Sood, 2005).

Yet the progression of ERP technology continues to adapt and evolve. Business application software vendors such as SAP, Oracle (following its acquisition of PeopleSoft) and Microsoft are continually adapting their offerings to provide greater agility and flexibility. ERP vendors are continually re-inventing themselves to move beyond core ERP applications of back-office financials, and human resources to front-office functionality including Customer Resource Management (CRM) as well as extending to business analytics and web based services. As new functionality is incorporated, ERP is evolving through Enterprise Resource Management (ERM) and Enterprise Systems (ES) to incorporate web-based Services Oriented Architecture (SOA) capabilities (Berinato, 2005; Sullivan, 2005).

Statement of the Problem

In light of the importance of ERP as an enabling software tool set, significant volumes of research exist that identify the critical success factors (CSFs) required for a successful ERP implementation (Holland & Light, 2001a; Allen, Kern & Havenhand, 2002; Hong & Kim, 2002; Parr & Shanks, 2004; King, 2005). In addition, significant studies exist that examine the ERP life cycle from initiation to implementation through adoption (Brehm & Marcus, 2000; Somers & Nelson, 2004). Little research, however, exists that focuses solely on the post "go-live" period following an ERP implementation, a perspective that according to Somers and Nelson (2004, p. 270) is "…particularly important for ERP systems." Further, given the emergence of public sector ERP implementations, little if any research exists that compares public and private sector and the structures each have put in place to govern, sustain and extend their ERP systems.

Purpose of the Study

The purpose of this study is to compare how private and public sector organizations that have implemented ERP systems continue to support transformation through creation of governance and sustainment structures as well as identify differences in rationale and timeframe for extending or upgrading their ERP systems following initial implementation. Based on these findings, the research will then be reviewed to identify whether a distinctive operational model for public sector governance and sustainment organizations exists. Further, the research continues the recommendation of Somers and Nelson (2004) to further research on post-implementation organizational behavior and increase knowledge on how public sector organizations are using ERP systems to drive transformation of government.

Rationale

Somers and Nelson (2004) used the Kwon and Zmud (1987) technology acceptance life cycle - Initiation, Adoption, Adaptation, Acceptance, Routinization and Infusion - and identified levels of importance for 25 key players and activities for ERP technology implementations. According to Somers and Nelson (2004), Initiation is the initial stage wherein the internal and external factors that drive the organization to implement an ERP system are considered. Adoption is the second phase when the organization considers its business case and cost-benefit analysis that result in selection of an ERP system and associated implementation partners. Adaptation is the third phase when the organization actually configures and implements the ERP system within the organization. Acceptance follows Adaptation, when during the period following implementation the system is gradually accepted over time and is improved. Routinization occurs when use of the system becomes routine and the integration capabilities are realized. The last phase, Infusion is the period when the system is used to enhance the performance of the organization.

Somers and Nelson's 25 factors listed in Table 1 below are comprised of eight players (P) and 17 activities (A). Somers and Nelson (2004) describe players (P) as human participants associated with various aspects of the ERP implementation and activities (A) as tasks that occur across the ERP implementation technology acceptance life cycle. Somer and Nelson identified the relative level of importance for the 25 factors across the six stages as High (H), Medium (M) or Low (L).

Table 1: Expected importance of players & activities across implementation stages.

		ERP Implementation Stages					
Players and activities		**Initiation**	**Adoption**	**Adaptation**	**Acceptance**	**Routinization**	**Infusion**
P	Top management	H	H	H	H	H	H
P	The project champion	H	H	H	H	M	M
P	The steering committee	H	H	H	H	L	L
P	Implementation consultants	H	H	H	M	L	L
P	The project team	H	H	H	H	L	L
P	Vendor–customer partnership	H	H	H	H	M	L
P	Vendors' customization tools	L	H	H	L	L	L
P	Vendor support	L	L	L	M	H	H
A	User training and education	H	H	H	H	M	L
A	Management of expectations	H	H	H	H	M	L
A	Careful package selection	H	H	L	L	L	L
A	Project management	H	H	H	H	M	L
A	Customization	H	H	H	L	L	L
A	Data analysis and conversion	H	H	H	H	L	L
A	Business process reengineering	H	H	H	H	L	L
A	Architecture choices	H	H	M	L	L	L
A	Dedicating resources	H	H	H	H	M	L
A	Change management	H	H	H	H	M	L
A	Clear goals and objectives	H	H	H	H	H	H
A	Education on new business processes	H	H	H	H	M	L
A	Interdepartmental communication	H	H	H	H	M	L
A	Interdepartmental cooperation	H	H	H	H	M	L

Legend: H = High
M = Medium
L = Low

Note: From *A taxonomy of players and activities across the ERP life cycle*, Somers & Nelson, 2004, Information & Management, p. 262. Copyright 2003 by Elsevier. Reprinted with permission.

Somers & Nelson surveyed 116 organizations, of which only 5 were federal, state or local public sector organizations while the remaining 111 organizations were private sector. Somers and Nelson (2004) found a significant level of entropy occurs following actual implementation

of the ERP system (e.g., after the Adaptation stage and through the Acceptance, Routinization and Infusion stages).

Technology continues to evolve and organizations continue to adapt and compete to meet either shareholder or constituent demands. Given the initial importance, expected benefits and long timeframes of ERP systems, it is important to understand whether the post-implementation phases (e.g., Acceptance, Routinization and Infusion) of ERP technology is a continuous-improvement process or whether it is cyclical, moving through successive ramp-ups and corresponding reductions in urgency, staffing sponsorship and system support. Governance, Sustainment and Extension are conceived as the critical support structures that continue to define ownership and move the organization through Acceptance, Routinization and ultimately to Infusion. It is from this perspective that understanding the inter-related aspects of Governance, Sustainment and Extension is approached.

Research Questions

The primary and overarching question guiding this study is how public sector organizations continue driving their ERP implementations after "go live" from the perspective of Governance, Sustainment and Extension to achieve transformation. Seven subordinate questions are offered that support the primary question. These are:

Question 1: Are there differences in how public and private sector organizations design and perform governance following ERP implementation?

Question 2: Is the level of importance for governance after implementation similar between public and private sector organizations?

Question 3: Are there differences in how public and private sector organizations design and manage sustainment structures following implementation?

Question 4: Is the level of importance for sustainment after implementation similar between public and private sector organizations?

Question 5: Are there differences between public and private sector organizations in time frames to achieve acceptance and routinization of the initial ERP implementation?

Question 6: Are there differences between public and private sector organizations in time frames when to extend or upgrade the initial ERP implementation?

Question 7: What are the relative levels of importance for Governance, Sustainment and Extension capabilities relative to each other to achieve transformation objectives across public and private sector organizations?

Stated as propositions of hypothesis, the research questions in the null and alternative forms become:

H_O1 (null): There is no significant difference in how public sector organizations design and perform ERP governance compared to private sector organizations.

H_A1 (alternate): There are significant differences on how public sector organizations design and perform ERP governance compared to private sector organizations.

H_O2 (null): There is no significant difference in importance for public sector governance of ERP technologies compared to private sector organizations.

H_A2 (alternate): There are significant differences in importance for public sector governance of ERP technologies compared to private sector organizations.

H_O3 (null): There is no significant difference in how public sector organizations design and manage sustainment structures for ERP technologies compared to private sector organizations.

H_A3 (alternate): There are significant differences in how public sector organizations design and manage sustainment structures for ERP technologies compared to private sector organizations.

H_O4 (null): There is no significant difference in importance for public sector sustainment of ERP technologies compared to private sector organizations.

H_A4 (alternate): There are significant differences in importance for public sector sustainment of ERP technologies compared to private sector organizations.

H_O5 (null): There is no significant difference in time frame within public sector organizations to accept, and achieve routinization of ERP technology following the initial implementation as compared to private sector organizations.

H_A5 (alternate): There are significant differences in time frame within public sector organizations to accept, and achieve routinization of ERP technology following the initial implementation as compared to private sector organizations.

H_O6 (null): There is no significant difference in time frame for public sector organizations to extend or upgrade the baseline ERP implementation compared to private sector organizations.

H_A6 (alternate): There are significant differences in time frame for public sector organizations to extend or upgrade the baseline ERP implementation compared to private sector organizations.

H_O7 (null): There is no significant difference in relative importance between ERP Governance, Sustainment and Extension capabilities to achieve transformation objectives across public and private sector organizations.

H_A7 (alternate): There are significant differences in relative importance between ERP Governance, Sustainment and Extension capabilities to achieve transformation objectives across public and private sector organizations.

Significance of the Study

Recent case studies of public sector ERP implementations (Watson, et al, 2003; Wagner & Antonucci, 2004; Solis, Putnam, Gemoets, Almonte & Montoya, 2005) describe the experiences and critical success factors through the initial three phases of the Kwon and Zmud (1987) technology acceptance life cycle of Initiation, Adoption and Adaptation. Little insight is provided into the remaining three phases of Acceptance, Routinization and Infusion. Given the high level of public funding required to implement ERP within public sector organizations, it is important to continue research into the structures and methods used to drive the ERP technology deeper into the organization as it moves from initial Adoption through the remaining three

phases of Acceptance, Routinization and Infusion – thereby increasing usefulness of the investment and reducing risk of failure. Obtaining greater insight into the successes (both short-term and longer-term) of public sector ERP implementations is valuable from an academic perspective as well as from a business practitioner perspective because the phenomenon of ERP within the public sector is at the initial adopter phase (Rodgers, 2003) and ERP implementations will likely continue through the remainder of this and into the next decade. Given the urgency and desire to transform government coupled with high expectations associated with ERP systems, it is important to understand what functionality has been implemented, what types of organizations have been constructed to sustain the system implementation, what governance structures have been instituted and how and when organizations are extending the ERP system following the implementation. Lastly, it is important to understand how governance and sustainment organizations continue to contribute to government transformation agendas.

Definition of Terms

The following terms are important to establish the context and frame of the research proposal:

Back-office: Systems that [automate] "the workmanlike business transactions that customers never saw or cared about" (Davenport, 2000, p. 2). These include general ledger, accounts payable, accounts receivables, human resources, payroll and information technology.

Commercial, Off-The Shelf (COTS): A system this is manufactured commercially, and then may be tailored for specific uses. This is most often used in military, computer and robotic systems. COTS systems are in contrast to systems that are produced entirely and uniquely for the specific application.

Enterprise Resource Planning (ERP): "…[A] single comprehensive database … [which] collects data from and feeds data into modular applications supporting virtually all of a company's business activities across functions, across business units, across the world" (Davenport, 1998, p. 123).

Enterprise Systems (ES): A system that includes…"every bit of computer-based information used for running a company's operations" (Davenport, 2000, p.2).

Extension: The act of upgrading the COTS software to a more current release or when additional functionality is added to the baseline ERP implementation.

Front-office: Systems that [support] "supply chain optimization, sales force automation and customer service. These new functions have been achieved either by installing more

comprehensive packages from ES vendors or by installing complimentary, or bolt-on, software applications" (Davenport, 2000, p. 3).

Governance: The act of affecting government and monitoring (through policy) the long-term strategy and direction of an organization. In general, governance comprises the traditions, institutions and processes that determine how power is exercised, how citizens are given a voice, and how decisions are made on issues of public concern. (Partnership with the Voluntary Sector, n.d., http://www.phac-aspc.gc.ca/vs-sb/voluntarysector/glossary.html).

Implementation: "The installation of an increment of …. [a] solution that is complete, tested, operational, and ready. An implementation includes all necessary software, hardware, documentation, and all required data".

Information Technology: "A term that encompasses all forms of technology used to create, store, exchange and utilize information in its various forms including business data, conversations, still images, motion pictures and multimedia presentations" (Science Coalition, n.d., http://www.sciencecoalition.org/glossary/glossary_main.htm).

Legacy Systems: An older computer system, often centered around a mainframe, which has been in place for a long time. Since rather old technology is difficult to upgrade, owners of legacy systems often are faced with weighing the cost of replacing a system that technically "still works" with a faster, less bulky, fully integrated system. (The EBusiness Site, n.d., http://www.thebusinesssite.com/IT%20Terms/Health%20Terms.htm).

Maturity: A description of the stages through which software organizations evolve as they define, implement, measure, control and improve their software processes. The model is a guide for selecting the process improvement strategies by facilitating the determination of

current process capabilities and identification of the issues most critical to software quality and process improvement. [SEI/CMU-93-TR-25]

Methodology: Proven processes followed in planning, defining, analyzing, designing, building, testing, and implementing a system.

Private sector: "A business that is engaged in private enterprise and that is free from government ownership" (CvTips, http://www.cvtips.com/g_private_sector.html).

Public sector: "Comprises the sub-sectors of general government (mainly central, state and local government units together with social security funds imposed and controlled by those units) as well as public corporations, i.e. corporations that are subject to control by government units (usually defined by the government owning the majority of shares)" (UNECE, n.d., http://www.unece.org/stats/gender/welcome1.htm).

Shared Services: Refers to the consolidation and sharing of services by different units within an organization. Shared Services are usually consolidated in a Shared Service Center (SSC), which is sometimes located in a low-cost location, near-shore or off-shore, such as in a low-wage country such as India or the emerging economies of Central Europe. Services common to different branches, locations, or units of a company are consolidated centrally at this SSC. (ASUG, 2006).

Sustainment: Those activities associated with keeping fielded products operational and maintained.

Service Oriented Architecture (SOA): "An application architecture within which all functions are defined as independent services with well-defined invokable interfaces which can

be called in defined sequences to form business processes" (Channabasaivaiah, Holley & Tuggle, 2003).

Transformation: A complete change, usually into something with an improved appearance or usefulness.

Assumptions and Limitations

This study is based on the assumption that the targeted survey population has personal knowledge and experience in the implementation of their organization's ERP implementation and is a fair and valid representation of public and private sector organizations within the United States. The study also assumes that the survey instrument developed by the author was carefully constructed and pilot tested sufficiently to ensure that responses given by the respondents would result in statistically testing the presented hypotheses. Further, the study assumes that all respondents to the survey have responded honestly and accurately.

This study will be limited by the selected sample set of public and private organizations who ultimately respond to the survey. The study will also be limited to public sector organizations identified as federal, state and local governments and agencies and will exclude higher education and health care organizations. The study will also be limited to private and public sector organizations within the United States, and excludes private and public sector organizations external to the United States.

Conceptual Framework

The proposed conceptual framework for this study is illustrated in Figure 1 below.

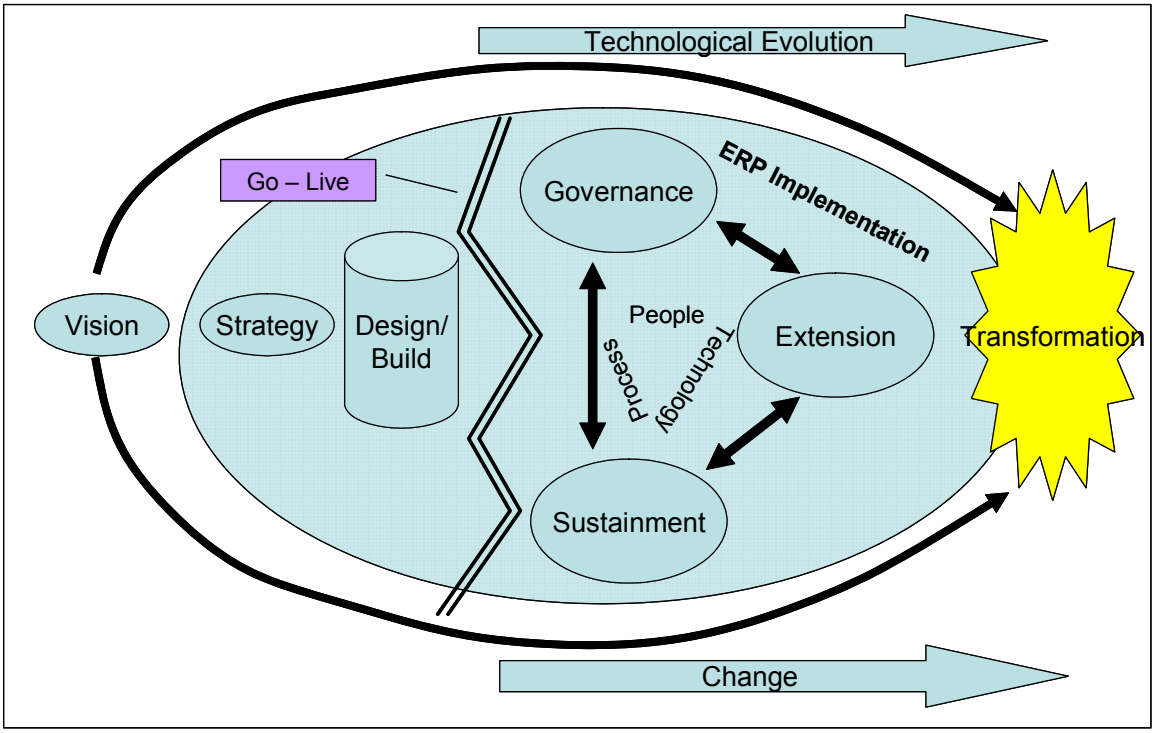

Figure 1: Bachman, C. A. (2007): Conceptual Framework.

Following the "go-live" ERP implementation, formal IT methodologies require establishment of ongoing governance and sustainment structure that seek to leverage people, process and technology to ensure continuous improvement. Technology continues to evolve as well as internal organizational and external macro changes are occurring. Decisions to extend the ERP application must be considered but must be kept aligned with overarching organizational strategic goals as well as sustainment capacity capabilities. It is through the interaction of these three components (governance, sustainment and extension) along with reference to the

organization's initial ERP vision statement that the organization moves toward its desired transformation.

Organization of the Remainder of the Study

Chapter 2 focuses on the theoretical framework of the study and a review of relevant literature across the knowledge domains of ERP, governance, sustainment, extension, and transformation. Chapter 3 presents the research methods and procedures through which the study will proceed. Chapter 4 reveals the collected data, the statistical analysis of data, associated tests of hypothesis as identified in Chapter 1 as well as qualitative data collected through interview. Finally, Chapter 5 presents the study conclusions, recommendations and identified opportunities for additional research.

CHAPTER 2. LITERATURE REVIEW

The conceptual framework displayed in Chapter 1 identifies five domains of knowledge that shape and influence the proposed study. These are Enterprise Resource Planning (ERP), Governance, Sustainment, Extension and Transformation.

Literature within each of these knowledge domains is briefly discussed to determine historical and current states, identify emerging or future trends and define the key characteristics within each domain. The research hypotheses are then aligned with the associated section of the literature review.

Evolution of ERP

Enterprise Resource Planning (ERP) systems are a dynamic and continually evolving suite of business applications that carry wide and deep organizational impact throughout the enterprise. Figure 2 below illustrates the evolution of ERP from its initial form as a Materials Requirements Planning (MRP) application to Manufacturing Resource Planning (MRP II) through ERP and on through current and future evolutions as Enterprise Architecture Integration (EAI), Service Oriented Architecture (SOA) and Search. In addition, Table 2 below provides additional comment on the evolution of business applications through a similar timeframe (Bond, Genovese, Miklovic, Wood, Zrimsek & Rayner, 2000). The dimensions examined by Bond, et al. (2000) were value-added roles, industry domain, business and organizational functional areas, business processes, information technology architecture and data ownership and usage.

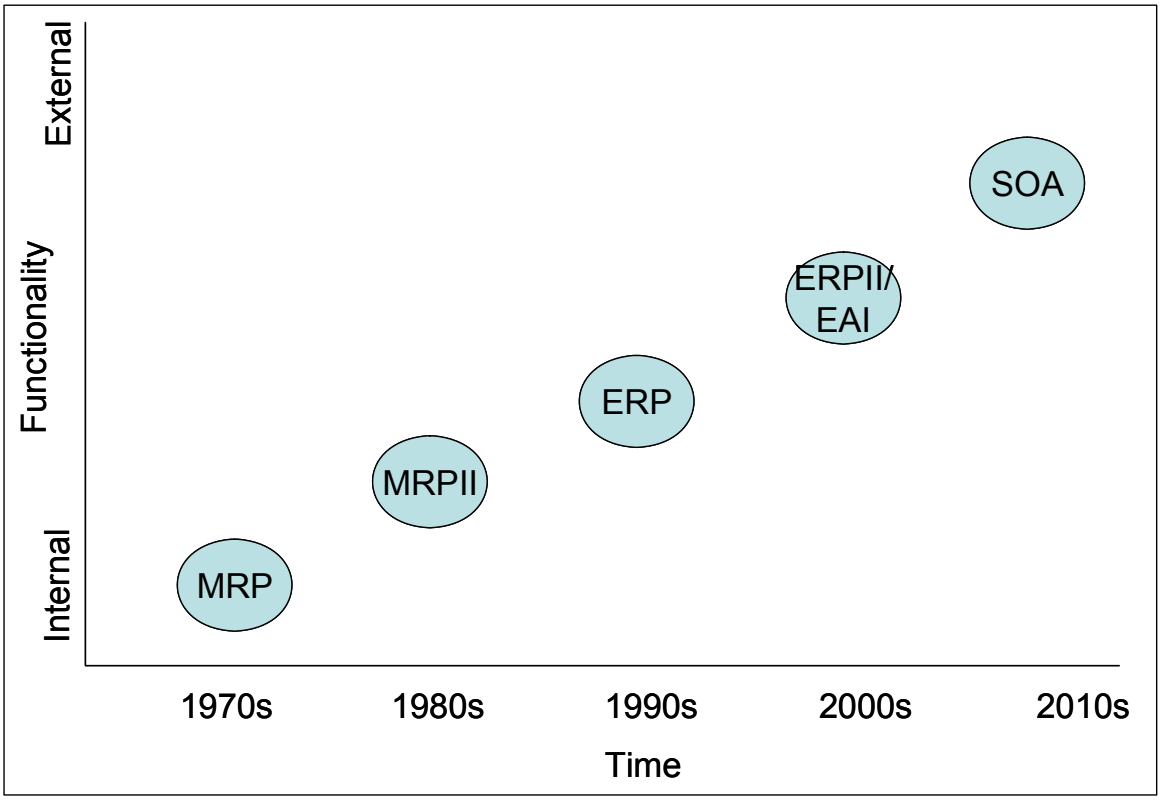

Figure 2: Bachman, C. A. (2007): Changing Nature of ERP.

ERP business applications have their beginnings in the 1970s when manufacturing companies were seeking to apply operational research theory and linear programming to optimize use of materials and resources (Sheldon, 2003). Known then as Materials Requirements Planning (MRP), these applications attempted to link the manufacturing planning and execution processes in order to improve inventory balances against forecasted vendor supply and customer demand. The focus of MRP was on the Bill of Materials (BOM) that combined together resulted in a manufactured product. By evaluating current quantities of on-hand materials against the

planned manufacturing requirements, potential shortages in materials were identified that resulted in creation of purchase orders.

Table 2: Evolution of Business Application Software.

	MRP	*MRPII*	*ERP*	*ERPII/EAI*	*SOA*
Time Period	1970s	1980s	1990s	Early 2000s	Current
Role	Materials optimization	Manufacturing optimization	Enterprise Optimization	Value-chain participation/ e-commerce	Value-chain participation/ e-commerce
Domain	Materials and inventory	Manufacturing & distribution	Manufacturing & distribution	All sectors/ segments	All sectors/ Segments
Function	Manufacturing	Manufacturing	Manufacturing, sales and distribution, and finance processes	Cross-industry, industry sector and specific industry processes	Cross-industry, industry sector and specific industry processes
Process	Internal, hidden	Internal, hidden	Internal, hidden, best practices	Externally connected	Plug & play
Architecture	Closed	Closed	Web-aware, closed, monolithic	Web-based, message brokering between partners	Web-based, open, componentized
Data	Internally generated and consumed	Internally generated and consumed	Internally generated and consumed	Internally and externally published and subscribed	Internally and externally published and subscribed

Note: Data in the table are from *ERP is Dead – Long Live ERP II,* by Bond, Genovese, Miklovic, Wood, Zrimsek, & Rayner, Oct. 4, 2000, Gartner Research.

In the 1980s, MRP evolved beyond a materials focus to incorporate manufacturing optimization. Known as manufacturing resource planning, or MRP II, these applications and processes extended the focus beyond inventory and materials to incorporate plant production capacity and personnel/human resource scheduling. Another result of MRP II was generation of a plant-wide Master Process Schedule, or MPS (Sheldon, 2005).

MRP II evolved as well as organizations sought to tie together separate and distinct manufacturing plants into interconnected enterprise-wide global networks that could support

24x7 operations and support improved executive level decision making. Organizations were increasingly challenged to maintain many different computer systems that led to enormous costs by needing to store, analyze and rationalize redundant data; update and maintain software code; and maintain communications links. A phrase coined in the early 1990s, ERP described packaged business software systems that provided a total, integrated solution for managing resources – including materials, human, financial, etc. (Klaus, Rosemann & Gable, 2000; General Center for Internet Services, 2001). Initially focused on back-office business processes, ERP systems were composed mainly of business software applications that affected and involved all levels of an organization and enabled organizations to link customers, employees and top-management decision-making from shop-floor execution and supply chain functions directly with financial management to strategic planning (Davenport, 1998; Sheldon, 2005). Davenport (1998) theorized that implementation of an ERP could contribute to a flatter, more flexible and open organization because information was made available to everyone. ERP introduces an infrastructure requirement for a client server-based infrastructure (Dibbern, Brehm & Heinzl, 2002), creating the need for more centralized information technology (IT) support and control. ERP had evolved to become "the spinal cord and information flow that link top-management thinking and planning with marketing, sales, capacity, planning, procurement and customer services" (Sheldon, 2005).

Despite introduction of industry-specific software add-ons (pharmaceutical, oil and gas, aerospace and defense, retail, public sector, etc.), Hamerman (2005) found that business continued to face ongoing ERP challenges, including a perpetual gap between package functionality and business need, unwillingness to change business processes, expense of

implementation and the complexity of systems integration. Functionality gaps can be addressed by customization, building custom functions or integrating the ERP with bolt-on, specialized packages, but at significant cost to the organization (Millman, 2004). Organizational resistance to change business processes to fit to the ERP software results in software modifications that are costly and unsupported by the software vendor that further reduce business flexibility (Davenport, 1998; Light, Holland & Wills, 2001; Hamerman, 2005). These also increase implementation costs (Brehm, Heinzl & Markus, 2001).

While the cost and expense of implementing ERP systems is high, ERP systems have been found to be a solid base from which other specific applications and processes that drive innovation can be attached (Markus & Tanis, 2001; Light, et al., 2001; Sullivan, 2003, Kavanaugh & Miranda, 2005). Top-down organizational pressures from CEOs to obtain value from the ERP investment pushed implementers to extend beyond core financial applications and incorporate modules including human resources, supply chain management and business intelligence (Beatty & Williams, 2003; Simonsen, Nielsen & Kraemmergard, 2006). To support customer demands for easier connectivity, ERP vendors began adapting their software to provide more open systems and allow external partners to execute transactions via interface. As a result, Enterprise Systems (ES) or ERP II emerged as the next stage of ERP evolution (Bond, et al. 2000; Davenport, 2000; Markus & Tanis, 2003).

Brynolfsson and Hitt (2003) found organizations increasingly driving toward simplification and standardization of IT processes to reduce cost and improve performance. Enterprise architectures emerged with an agenda to simplify and standardize organizational complexity while achieving increased openness and connectivity (Weill & Ross, 2004). Other

discussions reviewing enterprise architecture identified enterprise architecture as the core organizational imperative to achieve seamless integration with customers, agility and enable the ability to adapt to change (Hoogervorst, 2003; Di Maio & Koost, 2004). For over a decade, the Government Accounting Office (GAO) has stressed the importance of enterprise architecture as a method to optimally define organizational business and technology environments (GAO, 2003). Software vendors responded by offering enterprise architecture integration (EAI) that more closely incorporated software protocol standards such as CORBA and XML. EAI is touted to open previously internal ERP systems to customers and suppliers via message brokering (Themistocleous & Irani, 2003). Through use of software protocol standards, EAI enables information flows toward a pull-oriented technical environment compared to the tight push-oriented nature of ERP (Corbitt, Themistocleous & Irani, 2004).

Service oriented architecture (SOA) brings ERP to its current and most open capability. (Marks & Bell, 2006). Natis & Schulte (2004) defines SOA as a client/service design approach is which an application consists of a software service as well as software service consumer (also known as clients and service requesters). SOA emphasizes loose coupling between software components to achieve agile run time (Channabasavaiah, Holley & Tuggle, 2003: Sprott, 2005)

SOA promises a capability to pick and choose business and technology services, and encourages a trade out of services based on organizational re-design, new strategic intent, legislative requirements, or business process modifications (Sweden, 2006). SOA incorporates a "black box" nature where all input data, all response data and all exception conditions are listed in the interface. Also, critical to SOA is that sufficient metadata exist to identify the purpose and

function of the service (Natis & Schulte, 2004). According to the State of Utah's Chief Information Officer (CIO) Stephen Fletcher:

> SOA promises to bring significant business value out of existing IT assets through increased operational efficiencies, optimized business processes, and the ability to adapt and change quickly. Providing flexible access to information across platforms and languages can be complex and resource intensive. Service Oriented Architecture simplifies this through standard protocols which treat all platforms equally. This allows us to offer data services to a wide variety of business partners with requests that can originate from anywhere (Natis, 2006).

ERP vendors such as SAP, Oracle and Microsoft have introduced their latest business application suites as being SOA-compliant through introduction of new technological frameworks, such as SAP's Net Weaver®, Oracle's Fusion® and Microsoft's .Net ® (Berinato, 2005; Whiting, 2006). ERP vendors are also incorporating enterprise search technologies to extend further openness and interoperability (McKendrick, 2007).

In summary, this section briefly traces the beginnings of ERP back to the 1970s up to current date – from silo-oriented, internally focused MRP software that integrated with finance for improved inventory and materials usage up through its current manifestation that is multi/cross-industry capable. This latest incarnation of systems incorporate SOA capabilities to support transparency, openness and collaboration between both internal and external partners and constituents. With business process applications continuing as its core, ERP software is expanding its technological capabilities to support evermore interoperable exchange of transactions across an organization's entire (e.g., internal and external) value-chain.

Governance of ERP

As stated in Chapter 1, ERP implementations can require a huge investment – ranging from $10s of millions to $100s of millions. Given such investment, executive oversight and

governance are critical. This section will review forms of governance that may be pertinent to IT in general and ERP in specific.

IT is pervasive in the 21st century and some suggest is a critical component to achieve sustainable competitive advantage to thrive in the global and knowledge based economy (Porter & Millar, 1985; Drucker, 1988; Patel, 2003). Conversely, Nicolas Carr (2003) offers a counterpoint that information technology has become a commodity and no longer matters as a differentiator for sustainable competitive advantage. These differing perspectives suggest that organizations must continue to align IT strategy with business strategy and sharpen decision-making regarding what IT functions, knowledge and skill-sets can and should be closely held within the organization and what functions, knowledge and skill-set can and should be outsourced (Loh, 1994; Clark, Zmud & McCray, 1995; Nelson, Richmond & Seidmann, 1996; Poppo & Zenger, 1996; and Fowler & Jeffs, 1998). Adding to the mix, external regulatory mandates such as Sarbanes-Oxley (legislated to prevent future Enron's, WorldCom's or Tyco's) are forcing greater financial transparency and increased executive accountability for decision-making and actions across the enterprise (Damianides, 2005). As a result, organizations must adapt forms of governance across business practices as well as across information technology operations and services (Peterson, 2004a). Resistance to change was noted as a significant technology implementation barrier in the public sector in a U.S. government report that suggested, "To succeed will require an effective governance structure to overcome the barriers and implement the changes necessary" (U.S. Office of Management and Budget, 2002, p. 20).

A traditional definition of governance is focused on the "locus of IT control, or where IT decision-making authority is allocated" in the organization (Brown & Magill, 1994). During the

1970s and 1980s, firms "…alternated between centralized models where authority for the majority of IT decisions was located in the corporate IT group, and decentralized models where authority for most IT decisions was located in the divisional or functional IT units" (Argarwal & Sambamurthy, 2002). Moving beyond the centralized versus decentralized IT organizational debate, various researchers have suggested that governance is less about where and more about who makes and how strategic IT decisions are made. As a result, federal governance structures emerged during the 1990s (Sambamurthy & Zmud, 1999; Peterson, O'Callaghan & Ribbers, 2000; Peterson, 2004b; Williams, 2004).

In their study of 256 organizations, Weill & Ross (2004) used political system archetypes of monarchy, feudal, federal, duopoly and anarchy to understand how decisions were made across five components: IT principles, IT architecture, IT infrastructure strategies, business application needs and IT investment. Weill & Ross (2004) found three primary patterns of governance in use for top performing organizations (based on cost-effective use of IT, effective use of IT for asset utilization, effective use of IT for growth and effective use of IT for business flexibility as illustrated in the Figure 3 below. The Weill & Ross study found that decisions on IT principles, architecture, strategies and investment are tightly held, while business application needs are somewhat less centralized.

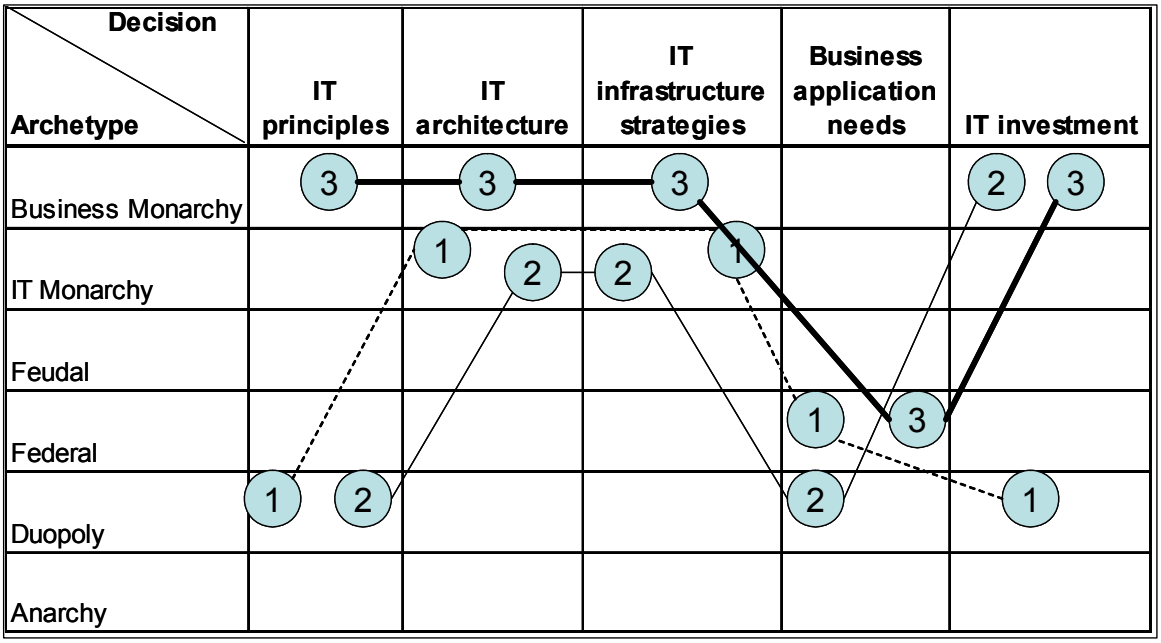

Figure 3: Top three governance performers.

Note: From *IT Governance*, p. 133, by Weill & Ross, 2004, Harvard Business School Press. Copyright 2003 by MIT Sloan School Center for Information Systems Research. Reprinted with permission.

With the advent of ERP, CRM and supply chain management, combined with increasing scarcity of human capital resources and greater reliance on external IT partners/suppliers, IT organizational models are trending back toward hybrid models that incorporate stronger, centralized structures (Peterson, et al., 2000; Anderson, Bikson, Lewis, Moini & Straus, 2003; Hvalshagen, 2004).

Each of these models calls for increased focus on strategic alignment and organizational coordination across the enterprise. Peterson (2004b) uses the Indian fable of 6 blind men describing an elephant – each believing their own perspective is correct, but each having a completely different description as they lack the ability to perceive the whole. As a metaphor, Peterson makes the case that a holistic governance architecture incorporating structural, process

and relational organizational capabilities is critical. Alternatively, Hamaker (2003) describes governance using an umbrella analogy where the "umbrella" of governance overarches the organization to establish strategic plans, allocate financial resources, and generate control frameworks that influence and shape enterprise operations.

Empirical evidence has emerged that effective IT governance leads to achievement of superior corporate/organizational performance (Weill & Woodham, 2002; Hamaker, 2003). Some researchers define governance as "specifying the decision rights and accountability framework to encourage behavior in the use of IT" and must incorporate four critical domains: principles, infrastructure, architecture and investment prioritization (Weill & Woodham, 2002). Others define governance as a design that incorporates leadership, organizational structures and processes that ensure the organization sustains and extends its IT investments to satisfy strategy and objectives (Van Grembergen, De Haes & Guldentops, 2004).

A practitioner's view presented by the IT Governance Institute (ITGI) is less theoretical, but perhaps equally as complex to execute. According to the ITGI, IT governance "is concerned about two responsibilities: IT must deliver value and enable the business, and IT-related risks must be mitigated" (IT Governance Institute, 1998). Given the complexity, cost and potentially business crippling risk associated with failed IT projects, the ITGI declares that "IT governance is the responsibility of the Board and Executive Management and should be an integral part of enterprise governance" (ITGI, 2003). This approach introduces complexities, however, because board members and executive management, other than those directly responsible for the information technology function, do not necessarily have direct knowledge of and expertise in information technology. Recent regulations, such as Sarbanes-Oxley 2002, however, clarify that

ignorance is no longer an acceptable defense and executive management is increasingly held accountable for the action of their subordinates (Damianides, 2005).

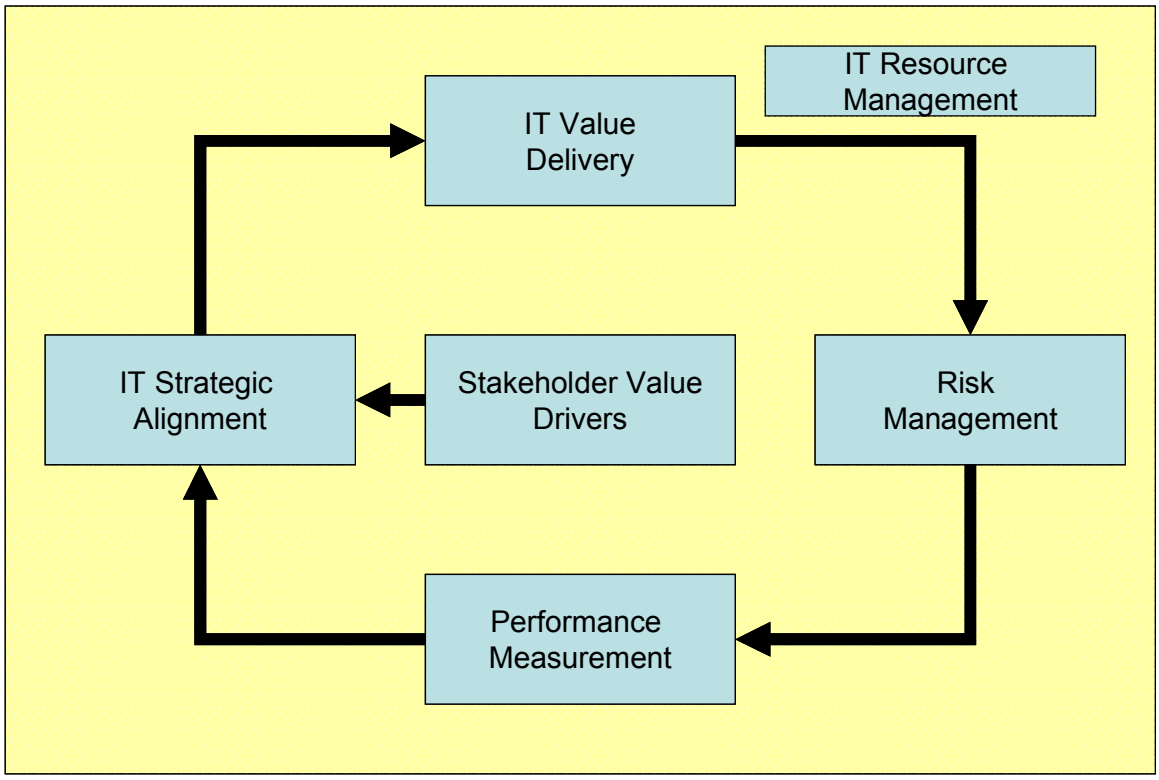

Figure 4: Focus areas of IT Governance.

Note: From *Board briefing on IT governance (2nd ed.)* by IT Governance Institute, 2003. Copyright 2003 by the IT Governance Institute. Reprinted with Permission.

The ITGI model for governance (illustrated in Figure 4,above) illustrates a continuous life-cycle that incorporates five main IT focus areas – each driven by continuing awareness and understanding of stakeholder value drivers (ITGI, 2003). The five main IT focus areas for governance are IT strategic alignment, IT value delivery, IT resource management, risk management and performance management.

IT strategic alignment involves working to ensure that enterprise IT investments are in harmony with organizational strategic objectives. By doing so, IT investments are focused

toward building capabilities necessary to develop business value. IT value delivery provides an oversight function to ensure that IT is delivered on-time, within-budget and of appropriate quality. Also IT value delivery provides review and feedback that the expected benefits are achieved as promised. IT resource management focuses on optimizing investment use and allocation of IT resources.

Table 3: IT Governance Life Cycle – Static View.

IT Governance Domains	***Objectives***	***CObIT Components to Assist***	***Implementation Tool Kit***
Alignment	**Direct**	• Business and IT key goal indicators	Documentation and reporting tools IT governance implementation tools Information and presentation tools
Value Delivery	**Create** Ability to build the capabilities necessary to deliver business value	• Key performance indicators • CObIT process framework • Critical success factors • Control objectives • Control practices	
Risk Management	**Protect** Successful delivery of business value		
Resource Management	**Act** Establishment and deployment of IT capabilities for business needs	• Maturity model • Critical success factors • Control objectives • Control practices	
Performance Management	**Monitor** Closing the feedback loop to redirect alignment if needed	• IT balanced scorecard • CObIT benchmark • Maturity Model • Audit guidelines	

Note: From *IT Governance Implementation Guide*, p. 19, by IT Governance Institute, 2003. Copyright 2003 by IT Governance Institute. Reprinted with Permission.

IT resources include internal and external physical and human capital resources, including people, applications, technology, facilities, data, partners and suppliers) sufficient to achieve optimal performance. Risk Management seeks to ensure IT risk management policies and practices are sufficient to safeguard enterprise IT assets, including information security and operational and technology risks, including disaster recovery. Lastly, Performance Measurement determines whether policies, procedures and project management capabilities as well as

performance metrics are in place that when executed ensure achievement of desired IT goals and objectives.

The ITGI advocates use of the Control Objectives for Information and related Technology (CObIT) methodology to establish and support each of the five IT governance main focus areas. In citing the IT Governance Institute (2003b), Kordel (2004) describes a static view of the IT governance life cycle that aligns CObIT components and suggests a potential implementation "tool-kit" to aid in documenting, measuring and reporting requirements across each of the five main focus areas (see Table 3, above). Kordel goes on to suggest that effective IT governance is not a single solution, and requires a consistent and evolving method and approach.

Clearly, private sector organizations are driven by strategy to achieve sustainable competitive advantage and their capability to achieve that strategy as measured through bottom-line results. Successful private sector firms generate value for their owners as measured in financial statements (Weill & Ross, 2004). Alignment of IT within a private sector framework can be more straightforward when compared to additional special characteristics that are manifest within public sector organizations. These include separation of powers and the need for oversight across executive, legislative, and judicial branches, limited terms of service for publicly elected or appointed officials, influence of discrete and divergent political agendas and appropriation of funds (Anderson, et al., 2003; Hvalshagen, 2004). Further, public sector organizations support provision of "…goods and services that all citizens receive, even if they don't directly pay for them…" (Weill & Ross, 2004) while also ensuring equity of consumption and benefit by correcting market failures or by prosecuting abusers.

Since the 1980s, IT governance services have been provided by the accounting and audit profession, including such large firms as Ernst & Young, KPMG, Deloitte and PriceWaterhouseCoopers. More recently, large software vendors, including the large ERP software vendors such as SAP and Oracle, are now offering software tools and services that support creation and monitoring of IT governance (Kaarst-Brown & Kelly, 2005). Oracle presented its Oracle SOA Suite 10g Release 3 as featuring governance (Krill, 2006). SAP has even created a separate business unit specifically dedicated to assisting organizations improve their governance, risk and compliance capabilities (SAP, 2006).

Introduction of new regulatory compliance requirements with stronger enforcement mechanisms, such as SOX 2002 may have heightened Board and executive management urgency. Ultimately, IT governance is less about control and more about complementary relationships between business and IT that result in generation of value (Peterson, 2004a). Understanding how organizations are continuing to adapt and evolve their IT governance processes and structures is an important area for continued study.

In summary, this section described various forms, responsibilities and techniques to establish and maintain ERP governance structures. Despite differences in organizational objectives between public and private sector organizations, Hypotheses 1 and 2 seek to determine whether differences in governance exist between public and private sector organizations, as follows:

H_O1: There is no significant difference in how public sector organizations design, perform ERP technology governance compared to private sector organizations, and

H_O2: There is no significant difference in importance for public sector governance of ERP technologies compared to private sector organizations.

Sustainment of ERP

Much of the ERP literature has focused on the implementation phase due in some part to complexity of implementation, the associated implementation costs and unfortunately documentation of several spectacular failures. More recently, increased interest has emerged on the post-implementation phase (Esteves-Souza & Pastor-Collado, 2001; Al-Mashari, 2003).

One area of research is how ERP implementations are maintained, or sustained following implementation. The term, sustainment, comes from the Department of Defense (DoD) and speaks to the continuing maintenance of a deployed system. Following the DoD 5000 acquisition methodology, sustainment elements include supply, maintenance, transportation, engineering, data management, configuration management, manpower, personnel, training, habitability, survivability, safety, occupational health, protection of Critical Program Information (CPI), anti-tamper provisions, IT supportability/interoperability, and environmental management (Dayton Aerospace, 2003). Additional elements of sustainment, according to the Defense Acquisition University (DAU), are conducting upgrades to hardware and software and measuring customer confidence (DAU, 2003). As such, sustainment operations require a holistic perspective and require creation of IT organizational structures that can maintain and continue to improve an ERP system.

A principle hallmark of ERP systems is that they integrate and streamline enterprise business processes. As such, a sustainment operation must be constructed that enables end users of the system to perform the business processes efficiently and continuously throughout the

system's life cycle (Hirt & Swanson, 2001; Park & Kusiak, 2005). Typical functions within a sustainment organization (Prior, 2000; Mirchandani, 2004) are business process management, deployment management, application software support, technical operations, data management, security and quality assurance/test.

Business process management is responsible for continuing definition, enhancement and support of functionality delivered by the ERP system. This function must be knowledgeable and continually aligned with the organization's business process requirements and must be able to identify and define new business requirements.

Deployment management is responsible for continued rollout of the ERP system, providing communications, end-user training, end-user support via help desk, organizational change management support and customer satisfaction via survey support. New technologies such as ERP result in changes in how work will be performed following implementation. As a result, the deployment function must understand and identify areas of organizational and end-user resistance that may impede acceptance and routinization of the ERP technology and provide techniques that will mitigate or minimize that resistance within the deployed sites.

Application software support is responsible for software contractual maintenance, installation, maintenance, troubleshooting and future upgrades. Staffing considerations take into consideration "make or buy" decisions whether to hire and maintain internal staff or leverage consultants for correcting software defects, developing additional functionality and deploying new software releases.

Technical operations are responsible for maintenance of software and hardware for development, test and production landscapes, and data storage and archival of data. This function

keeps the computer systems running and available for transactional processing, schedules job processing/interfaces at optimal timeframes, ensures timely back-ups and in the event of a catastrophic failure, provides for system recovery.

Data management is responsible for definition and maintenance of ERP system application master data, ensuring common understanding and use by end-users and eliminating potential redundancies.

Security operations are responsible for managing end-user access as well as performing security audits to ensure proper security controls. Lastly, quality assurance and test operations are responsible for continued maintenance of quality by establishing repeatable and comprehensive testing requirements.

Because ERP integrates business processes, Zrimsek & Prior (2003) contend that support organizations must transition functional application support to a business process orientation. Further, application development must broaden to include integration (e.g., support external, standardized interfaces), while operations must expand to include architecture that defines middleware, standards and support IA and security.

Mirchandani (2004) identified three forms of sustainment organizational models (see Figure 4) – the traditional IS model, a partnership model and the competency model. In the traditional IS model, business units maintain responsibility for business process support while the IT organization maintains responsibilities for supporting all other functional areas (user interface support, application functional support, application development support, applications operational support and infrastructure support). In the partnership model, the business unit maintains responsibilities for business processes, user interfaces and application functional

support, while the IT organization is responsible for application development and operations and infrastructure support.

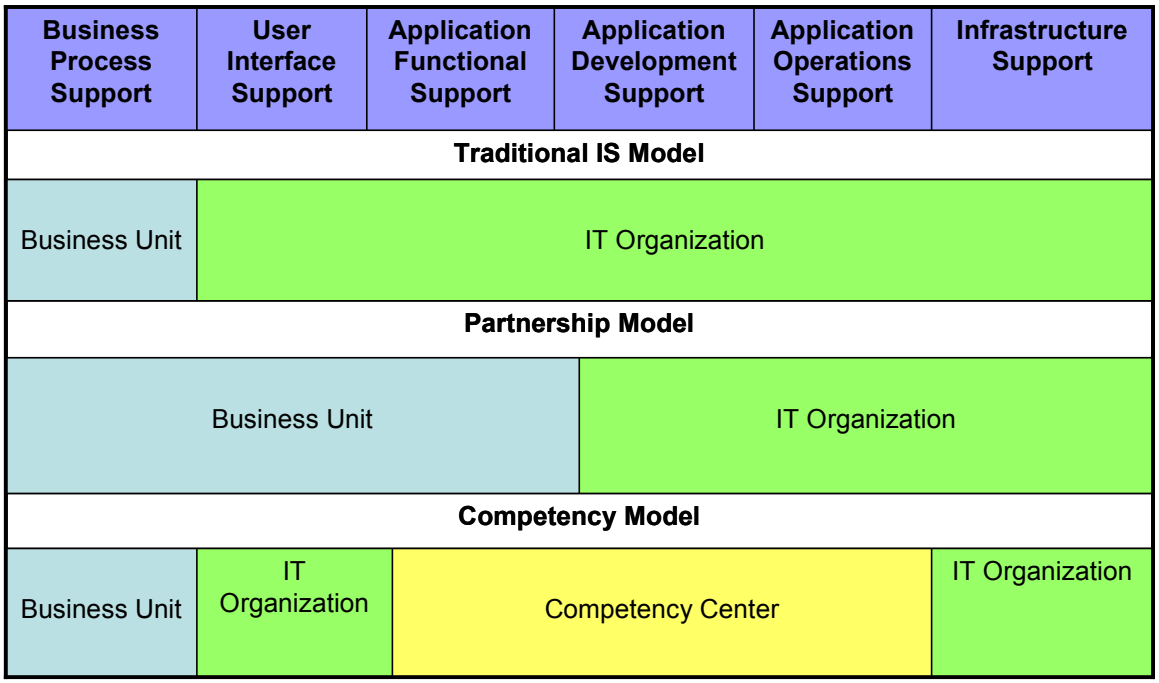

Figure 5: Post implementation package support: Organizational models.

Note: From *Post implementation package support: Organization models*, by Mirchandani (2004), Gartner Research. Copyright Feb. 10, 2004 by Gartner. Reprinted with permission.

In the Competency Model, a new, centralized organization is created with responsibility for application functional, development and operations support with business units maintaining responsibility for business processes and the IT organization keeping responsibility for user interface and infrastructure.

Formalized frameworks have emerged that assist organizations to continuously improve the capability and effectiveness. One such framework is the IT Infrastructure Library (ITIL), developed by the UK government's Office of Government Commerce in the 1980s. ITIL identifies management practices that support delivery of high quality information technology

services. ITIL decomposes sustainment activities into twelve components (Fry, 2005). Incident management focuses on the monitoring and measuring of key performance indicators (KPIs), or identifying clearly defined objectives with measurable targets that enable managers to understand the effectiveness of the process in review. Problem management focuses on minimizing the adverse impact of incidents and problems on the business that are caused by errors in the IT infrastructure. Change management focuses on maintaining a standardized methodology for handling all changes promptly and efficiently, to minimize the impact of changes on service quality while improving day-to-day operations. Release management focuses on managing a collection of authorized changes to an IT service, including problem fixes and enhancements of the targeted service. Configuration management focuses on current maintenance and documentation of all configurations (e.g., setup) to deliver the existing software and hardware into productive use. Availability management focuses on measuring and monitoring IT system accessibility and reliability as compared to identified or agreed targets. Service desk management focuses on providing a communications channel to report incidents and problems that might impede business operations. In addition, service desk management supports managing end-user expectations by collecting and maintaining a database of frequently asked questions (FAQs) and providing a consistent and factual response to end-user inquiries. Capacity management focuses on the measuring and monitoring of all resources (hardware, networks, peripherals, software and human) when outage or reduction of resources could delay business processing. Service level management focuses on monitoring and measuring the levels of service delivered by the IT organizations and their external suppliers/partners. Security management focuses on management and auditing of system related security concerns, including

user access and accessibility of data. Financial management focuses on overall financial IT policy, including use of IT chargeback and outsourcing methods while maintaining reasonable costs of service for the enterprise.

Maturity models are another method to measure capability and strength of an organization to achieve its mission (Holland & Light, 2001b; Cooke-Davies, 2004). ITIL methodology incorporates use of the Control Objectives for Information related Technology (CObIT) maturity model to determine that capability of the IT organization to deliver needed services. The CObIT model aggregates level of maturity using a range from zero (0) to five (5) where 0 is non-existent, 1 is initial/ad-hoc, 2 is repeatable and intuitive, 3 is defined process, 4 is managed and measurable while 5 is fully optimized level of maturity.

ERP implementing organizations, however, continue to face internal challenges despite creation of a centralized sustainment organization structure. Chang (2004) identified that post go-live implementation organizations have difficulty dealing with governance resulting from dissenting business unit perspectives, knowledge retention and management, and data conversion and maintenance. Ko, Kirsch & King (2005) identified the difficulty that sustainment organizations have in transitioning from reliance on external consultants to internal staff while Solis, et al. (2006) discusses the shortage of qualified IT professionals with sufficient skills to support ERP. Hawking & Stein (2002) describes the critical gap in resources & skills with the latest ERP/ES e-business and e-commerce functions/capabilities, while Scott (2005) identifies the difficulty in maintaining the usability of ERP training materials following initial implementation.

Beyond these, Ross & Vitale (2000) identified four obstacles that challenge ERP sustainment organizations following implementation. The first obstacle is that during the initial implementation, ERP projects did not establish performance metrics. The second obstacle was that organizations did not resource the post-implementation sustainment organization adequately. The third obstacle was that insufficient resources were committed to management reporting. The fourth obstacle was that too often ERP projects were slow or did not address organizational resistance.

In summary, this section describes various forms, responsibilities and techniques to establish and maintain ERP sustainment structures. Similar to the governance section, despite differences in organizational objectives between public and private sector organizations, Hypotheses 3 and 4 (in the null form) seek to determine whether differences exist in sustainment between public and private sector, as follows:

H3: There is significant difference in how public sector organizations design, position and operate sustainment structures for ERP technologies compared to private sector organizations, and

H4: There is significant difference in importance for public sector sustainment of ERP technologies compared to private sector organizations.

Extension of ERP

ERP vendors are continually adapting and evolving ERP software as summarized in the Evolution of ERP. As a result, the decision to invest and implement in ERP is in itself a life

cycle that begin the investigation that ERP can improve business operations, until ultimately, the ERP system is retired.

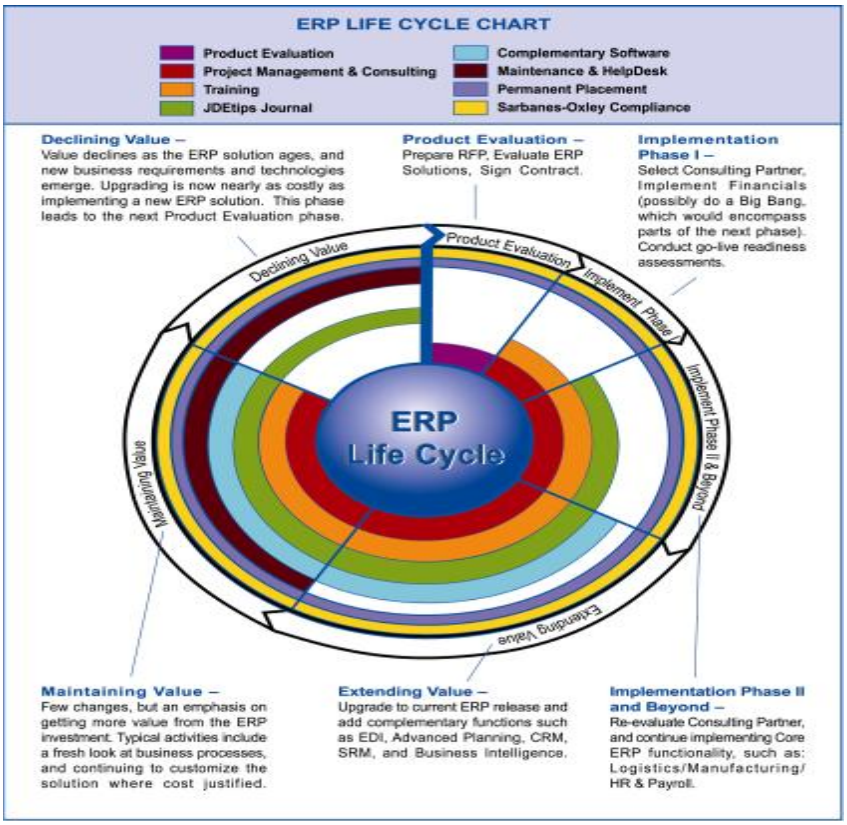

Figure 6: ERP Life Cycle Chart.

Note: From *The ERP Life Cycle* by Klee, 2005, The Four Hundred. Copyright May 31, 2005 by Andy Klee. Reprinted with permission.

Andy Klee (2005) envisions the ERP life cycle as a continuous journey that initiates at the Product Evaluation through one or more Implementation phases where the core ERP modules are implemented, to an Extending Value phase, a Maintaining Value phase and ultimately, to a Declining Value phase (see Figure 6 above). As Klee (2005) states, the Extending Value phase is when key sponsors and end users expect to gain the technological innovation initially promised at the start of the ERP journey. This phase typically includes software upgrades as well as adding

in analytic and decision-making capabilities such as Customer Relationship Management (CRM), and Business Intelligence capabilities.

Emergence of the Internet along with the need to support collaborative, virtual organizations via portals is another method where the ERP system has been extended (Mowshowitz, 2002; Rose, 2003). An enterprise portal enables customers, employees and vendors access the information they need anywhere and anytime. Portals allow users to push and pull information from internal and external sources. More often than not, a software upgrade is required to acquire the enabling portal and internet technologies.

Table 4: Reasons for migrating to a new version.

Category	Reason	Key Reason	Mentioned
Business	Added functionality	29%	57%
Technical	Compliance with new standards	19%	38%
	Expiration of support for installed version	14%	24%
	Keeping the system up-to-date	14%	14%
	Dissatisfaction with technical performance	10%	24%
Organizational	Organizational Issues	10%	14%
Environmental	Pressure from the value chain	5%	5%

Note: From *ERP system migrations* by Kremers & Van Dissel, 2000, Communications of the ACM, 43(4). Copyright 2000 by Communications of the ACM. Reprinted with permission.

A study conducted by Kremers & Van Dissel (2000) identified the leading reasons for extending or upgrading the ERP system was the desire to add business functionality, followed by several technical reasons including new standards compliance, expiration of software support agreements and keeping the system up-to-date (see Table 4, above).

The same study also identified problems when extending the ERP system (see Table 5, below), where time needed to implement the new version was mentioned most frequently.

Table 5: Problems encountered with migrations of ERP systems.

Problems encountered	Mentioned
Time needed for implementing the new version	50%
Technical problems with the new version	31%
Bad estimates by migration partner(s)	25%
Costs involved	25%
Strain on the organization	25%
Quality of the migration support tools	25%

Note: From *ERP system migrations* by Kremers & Van Dissel, 2000, Communications of the ACM, 43(4). Copyright 2000 by Communications of the ACM. Reprinted with permission.

Ng, Gable & Chan (2002) provide additional comment that extending and ERP system is not a decision taken lightly. Ng, et al. (2002) found the cost of an ERP upgrade ranges from 25% to over 35% of the initial implementation costs dependent on the degree of "out-of-the-box" or customization incorporated by the implementing organization (Brehm, Heinzel & Markus, 2001). Ng, et al. (2002) identified the continued scarcity of available skilled resources, whether internal or external, thereby adding to the risk and complexity of extending an ERP system.

Given the cost and continuing organizational impact of upgrades and migrations, extension of an ERP system must be carefully planned. Rose (2003) suggests six steps should be considered to be successful: select a business function that provides real benefits and that is not mission- critical; evaluate requirements and plan the implementation; create a proof of concept prototype; ensure evaluation, planning, and concept creation meet reality; test, and implement without shutting off current systems or business functions.

As a summary, this section identified a life cycle approach that is requisite to organizations implementing ERP. While there are various reasons for upgrading to a new version, there are also associated difficulties. Extension is similarly complex based on the scope or stretch of functionality that is sought between the initial implementation, the level of acceptance and the level of inter-connectivity the organization seeks to achieve across its internal

and external value-chain. To that end, Hypotheses 5 and 6 (in the null form) are offered as follows:

H_O5: There is no significant difference in time frame within public sector organizations to achieve acceptance and routinization of ERP technology following the initial implementation as compared to private sector organizations, and

H_O6: There is no significant difference in time frame for public sector organizations to extend or upgrade the baseline ERP implementation compared to private sector organizations.

ERP as platform for Transformation

A successful ERP implementation does not always guarantee its successful use nor does it guarantee transformation (Boudreau, 2002). Further, definition of success is not an immediate occurrence. According to Schein (2003), "all organizations attempt to maintain equilibrium and to maximize their autonomy vis-à-vis their environment." Moving an organization from its current state of equilibrium to a transformed, next state, therefore, is difficult and complex work.

Everett Rodgers' Diffusion of Innovations theory (2003) speaks to the process of how an innovation is communicated over time through a social system and it is through the communication of perceived attributes of the innovation. Rodger's described five attributes that influence whether the innovation can/will be adopted. The first attribute is the *relative advantage* of the innovation and whether the innovation is perceived as better than existing practice. The second attribute is *compatibility* to existing values, past experiences and needs of potential adopters within the social system. The third attribute is *complexity* or whether the innovation is difficult to understand and use. The fourth attribute is *trialability* – can the innovation be used on

a limited basis, while the fifth attribute is *observability* – are the results of the innovation visible to others. Rodgers found also that the pace of adoption of an innovation within a social system varies across five adopter categories: innovators; early adopters; early majority; late majority; and laggards. That is, there are organizational members that will accept innovation quickly while the majority of members accept the innovation over time. Shein (2003) speaks of "unfreezing, restructuring and re-freezing" as important aspects of organizational transformation. Communications messages and channels, both formal and informal, will influence the pace of adoption. But fundamentally, there are those members who resist and do not accept organizational change readily regardless. Organizations will adopt an innovation at varying rates of diffusion based on its structure, norms and leadership, both formal and informal.

To describe the life-cycle of organizational transformation through implementation of an ERP system, Rajagopal (2002), prior to Somers and Nelson (2004), adopted the Kwon and Zmud (1987) six stage model (Initiation, Adoption, Adaptation, Acceptance, Routinization, and Infusion). The fundamental finding in this research confirms Rodgers (2003) that transformation and adoption of innovation requires time and continuous attention. As Yates & Van Maanen (2001, p. xii) state, transformation occurs when "…a shift in the way that work is done within a chartered collective" is achieved.

Davenport (2000) argues that one of the greatest values of ERP/ES systems is its ability to support transformation from the context of turning data into knowledge and results (see Figure 6 below). Davenport suggests that improved information exchange through an ERP/ES system supports an improved analytic process. This in turn leads to improved decision-making which lead to behavioral changes, initiatives, process changes and improved financial impacts.

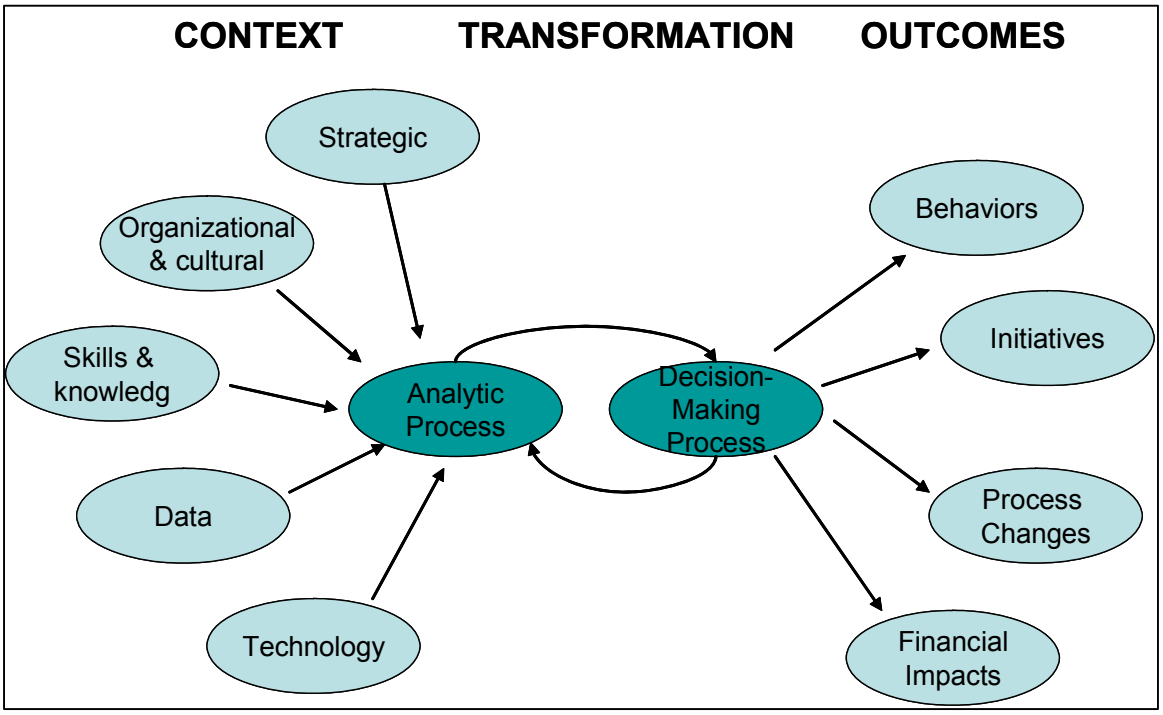

Figure 7: How ES Data is Transformed into Knowledge and Results.

Note: From *Mission critical: Realizing the promise of enterprise systems*, p. 229, by Davenport, 2000, Harvard Business School Press. Copyright 2000 by President and Fellows of Harvard College. Reprinted with permission.

Baldwin and Steck (2005) argue that after stabilizing and synchronizing the initial ERP implementation, mature organizations recognize that an ERP system is only a backbone that can support technologically the transformation into open and connected organizations. Concurring with Willis & Willis-Brown (2002), Baldwin and Steck (2005) argue that these organizations recognize that ERP is not solely about technology, but is "above all a human and process transformation" (Baldwin & Steck, 2005, p. 316). Baldwin and Steck contend that mature organizations engaged in ERP will focus on the benefits of ERP, align the organization and transition roles to a new way of doing business, build and leverage process expertise, assign real ownership of benefits and lastly, define metrics and manage to them. Chang, Gable, Smythe & Timbrell (2003) offer that knowledge management to enable use of the ERP system is most

problematic while Oliver & Romm (2002) raise questions whether organizations have sufficiently weighed the trade-offs provided from ERP systems (e.g., integration, standardization, improved data) against aspects individual or departmental restrictions and job satisfaction and empowerment.

Transformation, however, does not occur overnight. Or as Yates & Van Maanen (2001, p. xiii) state:

> Contrary to the conventional (and expensive) wisdom of many futurists, technology gurus, and strategy consultants, organizational transformations – at least those tied to IT (sic ERP) – seem not to be carefully orchestrated events, quick and sure leaps into a glorious future, or even terrible jarring disruptions.

Rather, organizational transformation occurs through a process of gradualism – where change is "slow, halting, incremental, and often ironic" (Yates & Van Maanen, 2001, p. xiii).

This section briefly examined transformation as an event that moves gradually over time. Both public and private sector organizations require time to move from acceptance to routinization to infusion transformation but perhaps at varying rates. For both public and private sector organizations, governance and sustainment structures manage and support movement toward transformation along with their ability to extend their ERP implementation. As such, Hypothesis 7 is offered as follows:

> H7: There is significant difference in relative importance between ERP Governance, Sustainment and Extension capabilities to achieve transformation objectives across public and private sector organizations.

Chapter 2 reviewed current literature across the evolution of ERP, its governance, sustainment and extension, and the ability of ERP to serve as a platform for transformation. The next chapter, Chapter 3 presents the proposed research methodology, methods and data to be collected that will be used for completion of the proposed research.

CHAPTER 3. METHODOLOGY

This chapter identified the methodology and procedures proposed to be used to conduct the research study. The proposed methodology was conceived as a sequential, explanatory mixed method study based on business research designs as outlined by Arbnor & Bjerke (1997), Robson (2002), Cooper & Schindler (2003), and Creswell (2003). The proposed mixed method methodology consisted of two phases: Phase A - a quantitative first phase using survey and statistical analysis techniques, and Phase B - a qualitative second phase using interview and content analysis techniques. Phase A included the identification of a suitable sample group, creation of a survey instrument, conducting a pilot of the survey, collection of data and analysis of the survey data using formal statistical techniques to answer the seven research hypotheses. Phase B included selection of the interview group, creation of the interview instrument, collection and analysis of the interview data and how the resultant data explains and extends the research hypotheses.

This chapter is divided into twelve sections. The first section is a restatement of the research problem. The second section identified the survey sample to be used for the first phase of the study (Phase A) and how it will be generated. The third section identified the seven research null and alternative hypotheses that will be researched in the first phase, or Phase A. The fourth described how the survey instrument for Phase A was generated. The fifth section described how the survey instrument for Phase A was piloted. The sixth section described the research variables that were considered during Phase A. The seventh section discusses the data collection procedures to be used within Phase A. The eighth section identified proposed statistical analysis tools and techniques that would be used to test and answer the seven research

hypotheses with Phase A of the study. The ninth section identified the interview group to be used for the second phase (Phase B) of the study. The tenth section identified how the interview instrument and interview data for Phase B would be collected. The eleventh section described how the interview data from Phase B would be analyzed and used to support conclusions found in the Phase A of the study. The final twelfth section identified the issues of bias, validity and reliability facing the research study and how they would be resolved.

Re-statement of the Research Problem

The purpose of this study was to understand how the internal governance and sustainment structures for private and public organizations that have implemented ERP systems compare and how the ability for these organizations to extend their ERP implementation via upgrade, continued roll-out and/or continued modular implementation have enabled these organizations to achieve their transformation goal. The conceptual framework identified in Chapter 1 theorized that the initial implementation of an ERP system is "not the end...[b]ut it is, perhaps, the end of the beginning" (W. Churchill, 1942). As a result, understanding the inter-relationships between governance, sustainment and extension and comparing these inter-relationships across private and public organizations that have achieved a degree of transformation would provide further insight for organizations that may implement ERP in the future.

Phase A: Design of the Sample

The theoretical population was any public or private sector organization within the United States that has implemented an ERP system. According to Gartner (Sood, 2005), the public sector consists of the US federal government, its 15 departments, numerous agencies and sub-agencies, state and local government consisting of 50 states, 3,200 counties and over 19,000 cities. In the same article, Gartner contends that the majority of these organizations are now in the process of completing an ERP financial implementation. The public sector also includes higher education, charitable organizations and health care institutions – these organizations, however are excluded from the research study.

The 2006 U.S. census identified almost 6,000,000 private sector organizations within the United States, however there were only 18,000 firms with more than 500 employees and achieved sales greater than $1,000,000 (U.S. Census, 2006). Microsoft Corporation and Oracle Corporation lists over 2,000 and 4,000 ERP customers respectively while SAP lists almost 60,000 customers globally. Assuming 25% are within the United States, the potential number of potential SAP private sectors organizations is approximately 15,000 and the total estimated number of ERP customers range between 19,000 to 21,000.

Based on a total potential population of 21,000, achieving a statistically valid sample (95% confidence level +/- 5%) requires obtaining 377 total responses. This number of responses can be achieved assuming approximately a 10% response rate from 2,000 private sector and 2,000 public sectors organizations that will be randomly selected to participate in the research. Both private and public sector executives were defined through use of a database of 4,000 IT

executives provided by CIO Magazine, a leading trade journal serving chief information officers and other IT leaders in the United States. This resource is considered a reliable source as the magazine has been in existence since 1987, has won numerous journalistic awards, sponsors trade conferences and executive programs and conducts its own research and analysis of trends affecting the IT marketplace. The data was also supplemented with mailing lists provided by Applied Computer Research, Inc. and SAP Customer List, LLC.

Phase A: Research Hypotheses

The following seven research questions within five major domains (e.g., Evolution of ERP, Evolution of Governance, Sustainment and Extension were been identified that guided the study.

Question 1: Are there differences in how public and private sector organizations design, and perform ERP governance following implementation?

Question 2: Is the level of importance for governance after implementation similar between public and private sector organizations?

Question 3: Are there differences in how public and private sector organizations design, and manage ERP sustainment structures following implementation?

Question 4: Is the level of importance for sustainment after implementation similar between public and private sector organizations?

Question 5: Are there differences between public and private sector organizations in time frames to achieve acceptance and routinization of the initial ERP implementation?

Question 6: Are there differences between public and private sector organizations in time frames when to extend or upgrade the initial ERP implementation?

Question 7: What are the relative levels of importance for Governance, Sustainment and Extension capabilities relative to each other to achieve transformation objectives across public and private sector organizations?

The seven research hypotheses stated in the null and alternative forms are:

Hypothesis H_O1 (null): There is no significant difference in how public sector organizations design and perform ERP governance compared to private sector organizations.

Hypothesis H_A1 (alternate): There is a significant difference in how public sector organizations design and perform ERP governance compared to private sector organizations.

Hypothesis H_O2 (null): There is no significant difference in importance for public sector governance of ERP technologies compared to private sector organizations.

Hypothesis H_A2 (alternate): There is a significant difference in importance for public sector governance of ERP technologies compared to private sector organizations.

Hypothesis H_O3 (null): There is no significant difference in how public sector organizations design and manage sustainment structures for ERP technologies compared to private sector organizations. .

Hypothesis H_A3 (alternate): There is a significant difference in how public sector organizations design and manage sustainment structures for ERP technologies compared to private sector organizations.

Hypothesis H_O4 (null): There is no significant difference in importance for public sector sustainment of ERP technologies compared to private sector organizations

Hypothesis H_A4 (alternate): There is a significant difference in importance for public sector sustainment of ERP technologies compared to private sector organizations

Hypothesis H_O5 (null): There is no significant difference in time frame within public sector organizations to accept, and achieve routinization of ERP technology following the initial implementation as compared to private sector organizations.

Hypothesis H_A5 (alternate): There is a significant difference in time frame within public sector organizations to accept, and achieve routinization of ERP technology following the initial implementation as compared to private sector organizations.

Hypothesis H_O6 (null): There is no significant difference in time frame for public sector organizations to extend or upgrade the baseline ERP implementation compared to private sector organizations.

Hypothesis H_A6 (alternate): There is a significant difference in time frame for public sector organizations to extend or upgrade the baseline ERP implementation compared to private sector organizations.

Hypothesis H_O7 (null): There is no significant difference in relative importance between ERP Governance, Sustainment and Extension capabilities to achieve transformation objectives across public and private sector organizations.

Hypothesis H_A7 (alternate): There is a significant difference in relative importance between ERP Governance, Sustainment and Extension capabilities to achieve transformation objectives across public and private sector organizations.

Phase A: Survey Instrumentation

The data for this study was gathered through a survey developed by the researcher. A review of the literature found several surveys within the America's SAP User Group (2006) that have been developed to understand and identify best practices for competency centers, implementation critical success factors and upgrade considerations. However, due to the length and depth of detail for each of these surveys, replication would not be advantageous to the proposed study. As a result, the researcher developed a survey that consisted of key factors within the domains of Governance, Sustainment and Extension based on the ERP literature review. The draft survey was piloted with ten information technology/ERP subject matter experts and will be modified based on their collective input. Suggestions on content, clarity and appearance of the instrument from these ten subject matter experts will also be incorporated into the survey instrument. The section "Phase A – Pilot Survey" below described the activities that were performed during this phase.

In addition to demographic information, the planned survey was comprised of five sections: Governance design and performance, Sustainment design and management, Timeframe for Acceptance and Routinization, Timeframe for Extension following initial implementation, and Inter-relationship of Governance, Sustainment and Extension capabilities to support organizational transformation objectives.

Phase A: Research Variables

Based on the literature review presented in Chapter 2, the following research variables were identified to assist in testing the seven hypotheses stated above.

Variables associated with Hypothesis 1 (H_O1: There is no significant difference in how public sector organizations design and perform ERP technology governance compared to private sector organizations) are identified in Table 6 below:

Table 6: Independent and dependent variables for Hypotheses 1

Hypothesis #	Independent Variable	Dependent Variables
1	Type of Organization (Private vs. Public sector)	Governance vision/strategy alignment (undefined, defined, evolving) Governance scope of oversight (Enterprise vice business unit & front office versus back office) Governance form (monarchy, feudal, federal, anarchy) Governance maturity Governance measurement (Alignment, Value, Risk, Resources)

Variables associated with Hypothesis 2 (H_O2: There is no significant difference in importance for public sector governance of ERP technologies compared to private sector organizations are identified in Table 7 below:

Table 7: Independent and dependent variables for Hypothesis 2

Hypothesis #	Independent Variable	Dependent Variables
2	Type of organization (Private vs. Public sector)	Governance responsibilities (Function vice process) Governance process ownership Governance representation (Position with organization; frequency, voice) Governance budgetary control (Contributes, receives, approves)

Variables associated with Hypothesis 3 (H_O3: There is no significant difference in how public sector organizations design, position and operate sustainment structures for ERP technologies compared to private sector organizations) are identified in Table 8 below:

Table 8: Independent and dependent variables for Hypothesis 3

Hypothesis #	*Independent Variable*	*Dependent Variables*
3	Type of organization (Private vs. Public sector)	Sustainment cost pressures Sustainment form (centralized, decentralized, shared, external) for process, user interface, functional application, application development, application operations, infrastructure) Sustainment maturity Sustainment measurement

Variables associated with Hypothesis 4 (H_O4: There is no significant difference in importance for public sector sustainment of ERP technologies compared to private sector organizations) are identified in Table 9 below:

Table 9: Independent and dependent Variables for Hypothesis 4

Hypothesis #	**Independent Variable**	**Dependent Variables**
4	Type of organization (Private vs. Public sector)	Sustainment sponsorship Sustainment staffing & training Sustainment partnerships Budgetary Control (Recommends, contributes, receives)

Variables associated with Hypothesis 5 (H_O5: There is no significant difference in time frame between public and private sector organizations to achieve acceptance and routinization of ERP technology following the initial implementation) are listed in Table 10 below:

Table 10: Independent and dependent variables for Hypothesis 5

Hypothesis #	**Independent Variable**	**Dependent Variables**
5	Type of organization (Private vs. Public sector)	Clarity of ERP objectives Implementation approach (wave vs. Big Bang) Scope of functionality Management/labor relations & forms of compensation Organizational flexibility Leadership

Variables associated with Hypothesis 6 (H_O6: There is no significant difference in time frame for public sector organizations to extend or upgrade the baseline ERP implementation compared to private sector organizations) are listed in Table 11 below:

Table 11: Independent and dependent variables for Hypothesis 6

Hypothesis #	Independent Variable	Dependent Variables
6	Type of organization (Private vs. Public sector)	Added functionality Regulatory compliance Technology obsolescence avoidance Technology performance Value-chain collaboration & inter-operability(internal vice external) Leadership

Variables associated with Hypothesis 7 (H_O7: There is no significant difference in relative importance between ERP Governance, Sustainment and Extension capabilities to achieve transformation objectives across public and private sector organizations) are listed in Table 12 below

Table 12: Independent and dependent variables for Hypothesis 7

Hypothesis #	Independent Variable	Dependent Variables
7	Type of organization (Private vs. Public sector)	Governance design Governance importance Sustainment design Sustainment importance ERP acceptance and routinization Extension timeframe Organizational imperative for transformation

A graphical representation of the seven hypotheses and their associated variables is shown in Figure 8 below:

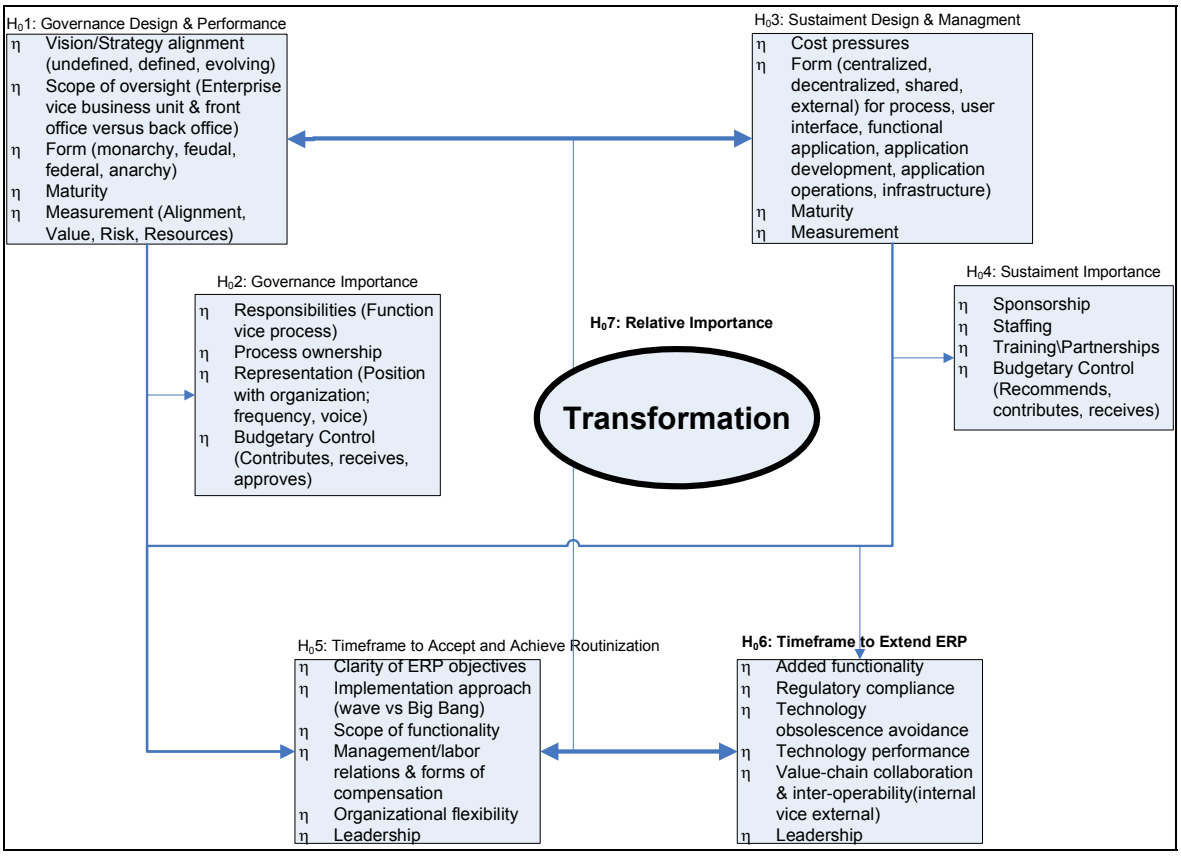

Figure 8: Bachman, C.A. (2007): Research hypotheses and associated variables.

Phase A: Pilot Survey

Robson (2002, p. 383) states "that the first stage of any data gathering should, if at all possible, be a 'dummy run' – a pilot study. This helps to throw up some of the inevitable problems of converting your design into reality". Pilot testing is also useful, according to Cooper & Schindler (2003, p. 431) in revealing "errors in the design and improper control of extraneous or environmental conditions". The researcher developed the survey based on an investigation of the literature and followed methodology described in Groves, R.M., Fowler, F.J., Couper, M.P.,

Lepkowski, J.M., Singer, E. & Tourangeau, R. (2004). The researcher then conducted a pilot survey to ensure clarity of the survey questions prior to distributing the final survey to the entire sample population. In addition, the researcher used information collected from the pilot survey to determine whether research factors should be incorporated or removed as questions in the survey, and whether the survey can be completed in the anticipated 10 to 15 minute estimate.

The pilot survey was submitted to a group of ten subject matter experts (SMEs) within the field of information technology and enterprise research planning software implementations. The group of ten SMEs consisted of five SMEs who had extensive knowledge of ERP implementations within the private sector and five SMEs who had extensive knowledge of ERP implementations within the public sector. The ten SMEs were invited to participate using a Web-based invitation and the SMEs were requested to complete the pilot survey in the same manner as the full sample population. The pilot survey also included an additional free text question that enabled the SMEs to offer suggestions for improving clarity and applicability of the survey.

Data from the pilot survey was analyzed using Statistical Package for the Social Sciences (SPSS 17.0 for Windows) to develop descriptive statistical analysis, including computation of means, standard deviations, frequency distributions and Pearson chi square analysis (Coopers & Schindler, 2003, Pallant, 2007, Takahashi, 2009). The data from the pilot survey was not be subjected to multivariate analysis of variance testing (MANOVA) due to the limited sample set. Lessons learned from the pilot study were incorporated into the full survey prior to submission to the full sample population. The survey created by the researcher is attached as Appendix A.

Phase A: Field Survey Data Collection

The survey data for Phase A were collected using a web-hosted survey approach. An initial introductory email was submitted to top level computer executives and/or CIOs for the sample private and public sector organizations. The introductory email explained the purpose and the importance of the study, provided a declaration of informed consent and provided a Uniform Resource Locator (URL) link to the hosted survey instrument. It was disclosed that all survey information would be held privately and that anonymity would be protected through use of the hosted site. The introductory email identified the timeframe for completion and also offered the respondents a URL where the combined survey results were available following completion on the survey. A reminder email was submitted two weeks after the introductory email, again inviting the targeted list to access the URL and complete the survey. A 2nd and final follow-up email was performed dependent on survey participation results of the first two mailings.

Phase A: Data Analysis

The data for the study was analyzed using the SPSS 17.0 for Windows. Respondent data from survey results was tabulated and descriptive statistical information was developed for private and public sector groupings. Conclusions were drawn using statistical tests of significance from the coalesced survey results to identify differences between public and private sustainment operations. The following provides additional details for the statistical techniques planned to test each hypothesis:

Hypothesis 1 sought to confirm there is no difference in how public and private sector organizations govern ERP technologies in terms of design and performance structures. The

survey questions for Hypothesis 1 generated data across five identified independent variables - vision/strategy alignment; scope of oversight; form; maturity; measurement – to help define the dependent variable of governance structure. Modest data transformation was required to better understand and discover patterns or relationships, resulting in generation of Z scoring (Cooper & Schindler, 2003, p. 496). Multivariate analysis of variance, or MANOVA, was then used to perform the test of the null hypothesis. According to Cooper and Schindler (2003), MANOVA is a commonly used technique that "assesses the relationships between two or more dependent variables." If the null hypothesis was rejected additional tests would be performed such as multiple discriminant analysis to better understand the data.

Hypothesis 2 sought to confirm there is no difference in level of importance between public and private sector governance structures. The survey questions for Hypothesis 2 generated data across four identified independent variables - responsibilities, process ownership, representation; budgetary control/volatility. MANOVA was used to perform the test of the null hypothesis. Similar to Hypothesis 1, if the null hypothesis was rejected additional tests would be performed such as multiple discriminant analysis to better understand the data .

Hypothesis 3 sought to confirm there is no difference in how public and private sector organizations design and manage ERP sustainment structures. The survey questions for Hypothesis 3 generated data across four identified variables - cost pressures; form for process, user interface, functional application, application development, application operations, infrastructure; maturity and measurement. MANOVA was performed to the test the null hypothesis. Similar to Hypothesis 1, if the null hypothesis was rejected additional tests would be performed such as multiple discriminant analysis to better understand the data.

Hypothesis 4 sought to confirm there is no difference in ERP sustainment organization level of importance across public and private sector organizations. The survey questions for Hypothesis 4 generated data across four identified variables – sponsorship, staffing & training, partnerships and budgetary control/volatility. MANOVA was performed to test the null hypothesis. If the null hypothesis was rejected additional tests would be performed such as multiple discriminant analysis to better understand the data.

Hypothesis 5 sought to confirm there is no difference in timeframe between public and private sector organizations in accepting and achieving routinization of the ERP technology. The survey questions for Hypothesis 5 generated data across six identified, independent variables - clarity of ERP objectives, implementation approach, scope of functionality, management/labor relations and forms of compensation, organizational flexibility and leadership - to determine the influence these variables have on the dependent variable of timeframe to accept and achieve routinization of ERP technology. MANOVA was performed to test the null hypothesis. If the null hypothesis was rejected additional tests would be performed such as multiple discriminant analysis, to better understand the data.

Hypothesis 6 sought to confirm there is no difference in timeframe to extend or upgrade ERP between private and public sector organizations. The survey questions for Hypothesis 6 generated data across six identified, independent variables - added functionality, regulatory compliance, technology obsolescence avoidance, technology performance, value-chain collaboration & inter-operability and leadership. MANOVA was performed to test the null hypothesis. If the null hypothesis was rejected additional tests such as multiple discriminant analysis would be performed to better understand the data.

Hypothesis 7 sought to confirm that there is no difference in the inter-relationships of Governance, Sustainment and Extension capabilities within private and public sector organizations to achieve envisioned transformation. The survey questions for Hypothesis 7 generated data across seven variables, six of which are determined from Hypothesis 1 through 6 - governance design and performance, governance importance, sustainment design and management, sustainment importance, ERP acceptance and routinization and extension timeframe. The seventh variable was organizational imperative for transformation. According to Cooper and Schindler (2003), factor analysis is a method to "reduce to a manageable number many variables that belong together" (Cooper & Schindler, 2003, p. 635). The identified inter-relationships used factor analysis to explain which variables have significant influence on achieving transformation.

Phase B: Interview Group Selection

Respondents to the first phase survey had the opportunity to self-identify interest to participate in a 45 to 60 minute deeper discussion on the topic of governance, sustainment and extension of ERP following implementation. From those respondents expressing interest to participate in the second phase interview, four senior IT executives/leaders were selected – two from the private sector and two from the public sector and interview meetings were scheduled.

Phase B: Interview Instrumentation and Data Collection

The interview instrument used a semi-structured interview technique (Robson, 2002) that allowed for explanation as well as exploration of the inter-relationships of Governance, Sustainment and Extension following an ERP implementation. The semi-structured interview

included a short synopsis of the findings generated in the first phase followed by a set of open-ended list of questions targeting governance, sustainment and extension models and their significance to achieving transformation. The interviewees were asked to respond to the findings and assess the relevance of the findings to his/her own organization and to his/her professional experience. The researcher sought to conduct face-to-face interviews with each participant. However, due to significant distance between the interviewees and the researcher was encountered, and the researcher resorted to use of interview via telephone. Interview notes were taken and the interviews were digitally recorded, following receipt of the interviewee's permission.

Phase B: Interview Data Analysis

The interview notes and digital recordings for the four interviewees were transcribed and subjected to content analysis using QSR International's qualitative analysis software, NVivo 7. The interview data was coded to find themes, supported by quotations that either confirm or offset the survey findings from the first phase. The interview data was also be used to enhance interpretation of the survey findings from the first phase to provide more robust models for governing, sustaining and extending ERP programs.

Research Bias, Validity and Reliability

Sadler (1981) identifies 3 types of potential bias: (1) ethical compromise, (2) value inertias and (3) cognitive limitations. Ethical compromises may occur due to conflicts of interests, reactivity between informant and evaluator due to some purposeful activity and sloppiness. Value inertias may occur from the researcher's personal preferences, background and

perspectives. Both ethical compromise and value inertia may be constrained through solid methodology, full disclosure of the researcher's interests, and openness with research participants in accordance with Collaborative IRB Training Initiative (CITI) guidelines (Braunschweiger & Hansen, 2007), including the CITI module: Internet Research - SBR. The third type of potential bias, cognitive limitation, may occur by failing to effectively deal with large amounts of information at once. Sadler suggests that cognitive limitation can be constrained through simplification/reduction, integration and the building of a careful research conceptual framework and methodology. These components are described within earlier sections of this chapter.

Achieving validity and reliability is critical to development of the research survey instrument and determining whether the results collected and analyzed are representative of the subject population (Cooper & Schindler, 2003). Because the researcher has several years of professional experience implementing ERP, personal bias may have emerged that could diminish validity of the research. To offset bias and strengthen both internal and external validity, the researcher conducted a pilot review of the survey instrument with ten subject matter experts/practitioners within the field of ERP implementations to determine whether the questions, language and evaluation scales were appropriate and could achieve the desired survey results. Further, reliability was developed through pilot testing of the survey instrument in advance of the general survey submission. The population targeted to participate in the pilot testing was ten subject matter experts/practitioners that have implemented ERP within the private sector arena and ten subject matter experts/practitioners that have implemented ERP within the

public sector arena. Further, reliability will be tested for internal consistency using the Cronbach's alpha technique.

Participant bias could also occur through the responses of the research participants themselves. A random sampling of targeted research population as described in the section "Design of the Sample" assisted in reducing participant bias. Further, the researcher relied on honest and truthful responses by the research participants.

To offset the risk of limited survey response and further strengthen external validity, the survey results in the first phase were exposed to four interviewees (two from the private sector and two from the public sector) in the second phase for comment and deeper interpretation. Through the use of differing data collection techniques in two sequential phases (e.g., Phase A uses survey, while Phase B uses interview), triangulation that reveals converging lines of thinking within the complex framework of Governance, Sustainment and Extension of ERP were developed (Robson, 2002; Creswell, 2003; Dubé & Paré, 2003).

CHAPTER 4. DATA COLLECTION AND ANALYSIS

Introduction

This chapter describes the methods used to collect data resulting from Phase A and Phase B of the study and the analysis of the collected data. The chapter is divided into sixteen sections: Introduction, Description of the Phase A Population, Phase A: Research Question 1, Phase A: Research Question 2, Phase A: Research Question 3, Phase A: Research Question 4, Phase A: Research Question 5, Phase A: Research Question 6, Phase A: Research Question 7, Phase B: Selection of Interview Population, Phase B: Interview Case 1, Phase B: Interview Case 2, Phase B: Interview Case 3, Phase B: Interview Case 4, Phase B Interview Comparison and Summary.

The purpose of this study is to compare how private and public sector organizations that have implemented ERP systems continue to support transformation through creation of governance and sustainment structures as well as identify differences in rationale and timeframe for extending or upgrading their ERP systems following initial implementation.

Description of the Phase A Population

The data for this study were collected from July 2008 through April 2009 through two separate mailings each incorporating two invitations. In the first mailing, 2,000 randomly-selected senior managers within the Information Technology function (from Director up to Chief Information Officer (CIO) or Chief Technology Officer CTO) from North American public and private sector organizations were asked to respond to a survey submitted to them via email. A total of 29 (1.45%) usable surveys were returned. In the second mailing, 2,556 randomly-selected managers (from Manager up through CIO or CTO) within the Information Technology

function were asked to respond to the same survey submitted to them via email. The second email submission returned 204 (8.0%). In total, 233 (5.1%) survey submissions from the two separate mailings were received with 163 identified as private sector submission and 70 identified as public sector submissions.

Table 13 presents the breakdown of respondents by invitation and across public and private-sector organizations based on question 1 in the survey (see Appendix). Responses to Public Sector (federal) and Public Sector (state and local) were aggregated to form a single Public Sector grouping.

Table 13: Survey Population & Respondents across Public & Private Sector Organizations

Mailing / Sector	*Population =4,556*		*Respondents (N = 233)*	
Mailing 1	N	%	N	%
Private	1,000	50	8	0.8
Public	1,000	50	21	2.1
Sub-total 1	2,000	100	29	1.45
Mailing 2				
Private	2,348	91.9	155	6.6
Public	208	8.1	49	23.56
Sub-total 2	2,556	100	204	8.0
Private	3,348	73.5	163	70.0
Public	1,208	26.5	70	30.0
Total	4,556	100	233	5.1

Question 3 requested respondents to identify whether their organization had implemented an ERP system with a 'No' response generating an automated termination of the survey. Thirty-nine (39) respondents (21 Private and 18 Public sector) indicated that they had not implemented an ERP system, thus reducing the useable survey population to 194 respondents (142, 73.2%, Private and 52, 26.8%, Public sector) where an ERP implementation had occurred. The reduced population of 194 respondents grouped as whether private or public sector as the independent variable was used to perform all descriptive statistics and MANOVA tests of hypothesis for Research Questions 1, 2, 3, 4, 5 and 6. The reduced population of 194 respondents grouped as

whether private or public sector as the independent variable was used to perform all descriptive statistics, MANOVA tests of Hypothesis and Factor Analysis Testing.

Question 4 requested the date of initial ERP implementation. Survey responses for ERP implementations ranged from prior to 1995 through 2008 revealing an even spread of implementations across the time horizon. The greatest number of ERP implementations (21, 10.8%) occurred prior to 1995 with the second greatest number (20, 10.3%) occurring in 2006. The statistical mode occurred in year 2001 (57.2%). Table 14 displays the frequency of responses for ERP implementation dates.

Table 14: ERP Implementation dates by Year

	Frequency	*%*	*Cumulative Percent*
Before 1995	21	10.8	10.8
1995	2	1.0	11.9
1996	6	3.1	14.9
1997	12	6.2	21.1
1998	19	9.8	30.9
1999	18	9.3	40.2
2000	16	8.2	48.5
2001	17	8.8	57.2
2002	17	8.8	66.0
2003	8	4.1	70.1
2004	6	3.1	73.2
2005	12	6.2	79.4
2006	20	10.3	89.7
2007	5	2.6	92.3
2008	15	7.7	100.0
Total	194	100.0	

Phase A: Research Question 1

Are there differences in how public and private sector organizations design, and perform ERP governance following implementation?

To answer Research Question 1, survey participants were requested to respond to 5 questions: Questions 6,7, 8, 9 and 14 in the Survey. (see Appendix A). These five questions generated 9 variables as identified in Table 15, below:

Table 15: Research Question 1 - Variables for Governance Design and Performance

Question	*Variable*	*Variable Description*
6	GOV1DesStrucVision	Overall state of IT alignment with your organization's business strategy & vision:
7a	GOV3DesForm_ITStratGoalsObjs	Decision-making responsibilities for IT strategic goals & objectives
7b	GOV3DesForm_ITArch	Decision-making responsibilities for IT architecture
7c	GOV3DesForm_ITInfraStrat	Decision-making responsibilities for IT infrastructure strategies
7d	GOV3DesForm_BusAppReqs	Decision-making responsibilities for Business application requirements definition
7e	GOV3DesForm_ITInvest	Decision-making responsibilities for IT investment prioritization
14	GOV4DesMaturity_Count	Framework used as a template to define and build your ERP Governance organization:
9	GOV2DesScope_Count	IT domains where your ERP Governance org maintains oversight & control
8	GOV2DesStructure	Formal ERP Governance organization in place

Descriptive statistics for the nine variables included in Research Question 1 are listed in Table 16 below.

Table 16: Research Question 1 - Descriptive Statistics

Question	*Variable*	*Type of Org (Priv_PS)*	*Mean*	*Std. Deviation*	*N*
6	GOV1DesStrucVision	Private Sector	3.11	.980	142
		Public Sector	2.87	1.121	52
		Total	3.04	1.025	194
7a	GOV3DesForm_ITStratGoalsObjs	Private Sector	2.63	.821	142
		Public Sector	2.52	.641	52
		Total	2.60	.777	194
7b	GOV3DesForm_ITArch	Private Sector	2.70	.960	142
		Public Sector	2.56	1.110	52
		Total	2.66	1.004	194
7c	GOV3DesForm_ITInfraStrat	Private Sector	2.90	.468	141
		Public Sector	2.88	.379	52
		Total	2.90	.444	193
7d	GOV3DesForm_BusAppReqs	Private Sector	2.43	1.048	142
		Public Sector	2.58	1.144	52
		Total	2.47	1.073	194
7e	GOV3DesForm_ITInvest	Private Sector	2.55	.847	142
		Public Sector	2.46	.670	52
		Total	2.53	.803	194
14	GOV4DesMaturity_Count	Private Sector	.98	.767	142
		Public Sector	1.02	1.129	52
		Total	.99	.876	194
9	GOV2DesScope_Count	Private Sector	2.87	1.846	142
		Public Sector	2.60	1.624	52
		Total	2.79	1.789	194
8	GOV2DesStructure	Private Sector	4.35	1.400	142
		Public Sector	4.85	.998	52
		Total	4.48	1.320	194

Table 17 summarizes the nine variables included within Research question 1, the associated Pearson Chi-squares with confirmation whether the assumption of minimum expected cell frequency was violated, and the most frequent response. Details of the first and second most frequent responses across the complete population as well as segmentation by the independent variable (private sector vs. public sector) are listed in Appendix B.

A review of the most frequent responses appears to follow Weill & Ross's (2004) top governance performance model where IT architecture and IT infrastructure are centralized, while IT strategic goals, business application needs and IT investment are shared in the form of a duopoly. This model is common across both private and public sector organizations.

Table 17: Research Question 1 - Summary of Pearson Chi-squares by Individual variables

Question	*Variable*	*Pearson Chi-square*	*Most frequent response*
6	GOV1DesStrucVision	0.172 > 0.05** **30% violation of minimum expected cell frequency	Evolving (35.1%)
7a	GOV3DesForm_ITStratGoalsObjs	0.247 > 0.05** **40% violation of minimum expected cell frequency	Shared (44.1%)
7b	GOV3DesForm_ITArch	0.484 > 0.05** **50% violation of minimum expected cell frequency	IT Centralized (84.0%)
7c	GOV3DesForm_ITInfraStrat	0.772 > 0.05** **60% violation of minimum expected cell frequency	IT Centralized (85.4%)
7d	GOV3DesForm_BusAppReqs	0.552 > 0.05** **30% violation of minimum expected cell frequency	Shared (50.3%)
7e	GOV3DesForm_ITInvest	0.255 > 0.05** **40% violation of minimum expected cell frequency	Shared (59.6%)
14	GOV4DesMaturity_Count	0.040 < 0.05** **41.7% violation of minimum expected cell frequency	Custom in house (45.1%)
9	GOV2DesScope_Count	0.057 > 0.05** ** no violation of minimum cell frequency	5 - Enterprise applications, Back office, Bus Unit applications, End to End, Front office (19.3%)
8	GOV2DesStructure	0.737 > 0.05** **25% violation of minimum expected cell frequency	Yes – incorporated into overall IT Governance org (44.8%)

Eight of nine variables violated the Phi-square assumption for minimum expected cell frequency of 5 or greater (or at least 80% of cells have expected values of 5 or more). The Pearson Chi-square computation found eight of nine variables with no significant association across the groups (private or public sector). One variable (Question 14 - GOV4DesMaturity_Count) found significant association across the groups in what

methodologies were used to design the ERP Governance organization, where X^2 (5, n = 194) = 11.662, p = 0.04, phi = 0.245.

To answer Research Question 1 and test the associated null hypothesis, a one-way between-groups multivariate of analysis (MANOVA) function was performed to determine whether differences existed in how Public and Private sector organizations have designed and are performing ERP governance.

Table 18: Research Question 1 – Correlation of dependent variables to determine mulitcollinearity

	GOV1DesStrucVision	GOV3DesForm_ITStratGoalsObjs	GOV3DesForm_ITArch	GOV3DesForm_ITInfraStrat	GOV3DesForm_BusAppReqs	GOV3DesForm_ITInvest	GOV4DesMaturity_Count	GOV2DesScope_Count	GOV2DesStructure
GOV1DesStrucVision	1	.027	.054	.135	.067	.119	.058	.146*	.262**
GOV3DesForm_ITStratGoalsObjs	.027	1	.185**	.303**	.224**	.486**	.017	.012	-.039
GOV3DesForm_ITArch	.054	.185**	1	.411**	.149*	.243**	.002	.036	.039
GOV3DesForm_ITInfraStrat	.135	.303**	.411**	1	.157*	.256**	-.029	.017	.041
GOV3DesForm_BusAppReqs	.067	.224**	.149*	.157*	1	.296**	.215**	.013	.102
GOV3DesForm_ITInvest	.119	.486**	.243**	.256**	.296**	1	.022	-.155*	-.036
GOV4DesMaturity_Count	.058	.017	.002	-.029	.215**	.022	1	.478**	.269**
GOV2DesScope_Count	.146*	.012	.036	.017	.013	-.155*	.478**	1	.472**
GOV2DesStructure	.262**	-.039	.039	.041	.102	-.036	.269**	.472**	1

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

The nine dependent variables as identified in Tables 15, 16 & 17 were then included in the MANOVA calculation with the independent variable identified as private versus public sector organizations. MANOVA analysis requires fit of the data against a number of

assumptions; the assumptions are normality, linearity, univariate and multivariate outliers, homogeneity of variance-covariance matrices and multicollinearity.

Following Pallant (2007) and Tabachnick & Fidell (2007), normality was assumed because the data sample of 194 cases exceeds a minimum of 20 responses for each dependent variable. Linearity was determined through a review of scatterplots for each variable and no evidence of non-linearity was identified. The data were tested for multivariate outliers through use of the Mahalanobis distance statistic. One case of the 194 total responses had a Mahalanobis distance = 52.363 and violated the critical value of 27.88. As a result one case (Case 440) was excluded from the MANOVA analysis for a total remaining number of cases = 193. Homogeneity of variance-covariance was assumed because Box's M Test of Equality of Covariance found a Sig value of 0.013 which is greater than the thresh-hold value of 0.001. Multicollinearity was reviewed through performance of a correlation matrix and the majority of variables appeared to have low or modest correlation (see Table 18 above). The strongest correlation between GOV3DesForm_ITStratGoalsObjs and GOV3DesForm_ITInvest equaled 0.486. As a result, all dependent variables were retained without further transformation for MANOVA analysis.

A review of Levene's Test of Equality found four of nine variables (variables 7a, 7e, 14 and 8) violated the test where Sig. should be greater than 0.05, and listed in Table 19.

Table 19: Research Question 1 - Levene's Test of Equality of Error Variances

Question	*Variable*	*F*	*df1*	*df2*	*Sig.*
6	GOV1DesStrucVision	2.685	1	191	.103
7a	GOV3DesForm_ITStratGoalsObjs	4.273	1	191	.04 < 0.05
7b	GOV3DesForm_ITArch	2.159	1	191	.143
7c	GOV3DesForm_ITInfraStrat	.021	1	191	.884
7d	GOV3DesForm_BusAppReqs	2.657	1	191	.105
7e	GOV3DesForm_ITInvest	5.756	1	191	.017 < 0.05
14	GOV4DesMaturity_Count	4.274	1	191	.04 < 0.05
9	GOV2DesScope_Count	2.416	1	191	.122
8	GOV2DesStructure	10.801	1	191	.001 < 0.05

Tests the null hypothesis that the error variance of the dependent variable is equal across groups.

a. Design: Intercept + DEMO2ORG_PR_PS1

Despite failure of Levene's test of equality for four of nine variables, the researcher did not adjust confidence to 97.5% as suggested by Pallant (2007) and Tabachnick & Fidell (2007). Confidence was retained at 95% with alpha (p) = 0.05. Data cases were excluded pairwise resulting in 192 cases included in the MANOVA analysis. The MANOVA analysis found that a statistically significant difference did exist in how private and public sector organizations design and perform ERP governance for the combined nine dependent variables, F (9, 182) = 1.98, p = 0.043, Wilk's Lambda = 0.911 & Hotelling's Trace = 0.098; partial eta^2 = 0.089. Because the p value (0.043) is less than the alpha level of 0.05, the null hypothesis can be rejected and the alternative hypothesis can be accepted.

Further examination of the dependent variables when considered separately found only one variable (GOV2DesStructure – Formal Governance Structure in Place) neared statistical significance with F (1, 190) = 9.61, p = 0.019, partial eta^2 = 0.029. The mean scores for this variable found that public sector organizations reported a slightly higher tendency toward a stand-alone ERP structure (M = 4.846, SD = 0.182) while private sector organizations reported a tendency toward governance of ERP within the overall IT governance structures (M = 4.343, SD = 0.111).

Because of rejection of the null hypothesis, the researcher was interested to understand whether a discriminant analysis function could provide additional insight into the nine dependent variables comprising Research Question 1. The variables listed in Table 15 were inserted as independent variables into SPSS along with the dependent variable (private or public sector organization) to separate groups and to perform the discriminant analysis calculation. Wilk's Lambda (λ) was evaluated to determine significance of the extracted variables and whether they could be used as predictors. Significance was confirmed where Sig. (p) < 0.05 for three of the nine variables. The three variables (GOV1DesStrucVision, GOV2DesScope_Count and GOV2DesStructure) are listed as shown in Table 20 below:

Table 20: Research Question 1: Discriminant analysis - Wilk's λ test for significance

						Exact F			
Step	Variables	Lambda	df1	df2	df3	Statistic	df1	df2	Sig.
1	GOV1DesStrucVision	.972	1	1	191	5.522	1	191.000	.020
2	GOV2DesScope_Count	.946	2	1	191	5.450	2	190.000	.005
3	GOV2DesStructure	.923	3	1	191	5.224	3	189.000	.002

Further examination of variable GOV1DesStrucVision (Survey Question 6) reveals dissimilar distributions existing across private and public sector organizations where private

sector is more closely aligned to the business strategy and vision. 86.1% of private sector respondents reported alignment as either defined (24.6%), mature (36.6%) and optimized (7.7%) as compared to 50% of public sector respondents (15.4%, 26.9% and 4.9%, respectively) as illustrated in Figure 9 below. The mean (M) = 3.11 and standard deviation (SD) = .980 for private sector contrasted with M = 2.87 and SD = 1.121 for public sector.

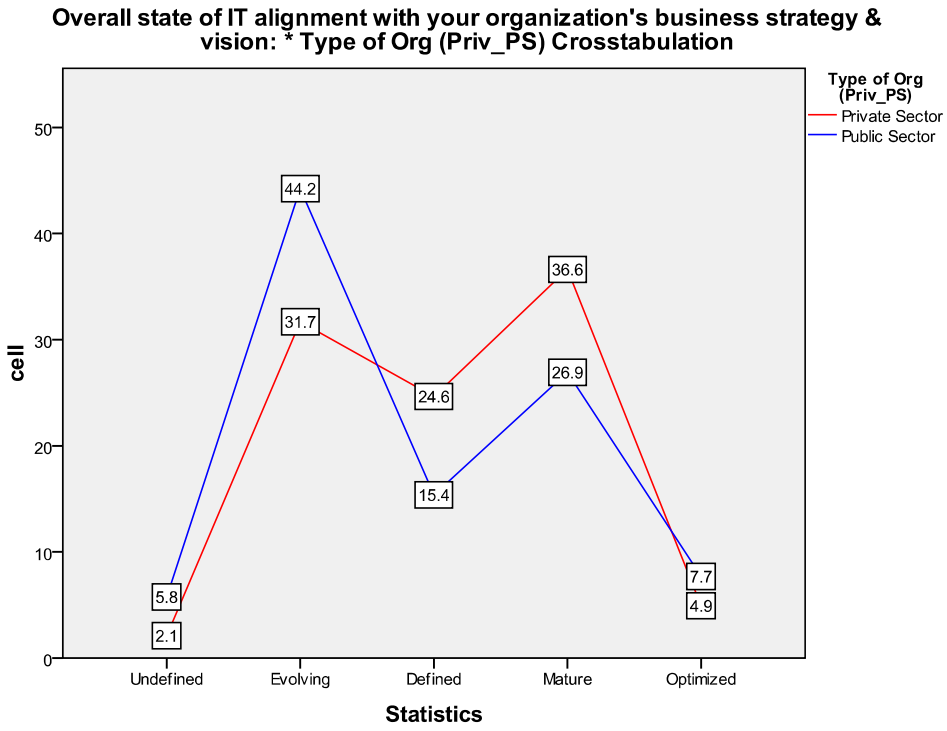

Figure 9: Key discriminant factor 1 - GOV1DesStrucVision

Examination of variable GOV2DesScope_Count (Survey Question 9) reveals that private sector organizations trend toward a broader span of governance oversight and control compared to public sector organizations where oversight and control can include end-to-end business process definition, enterprise applications, business unit applications, front office applications (i.e., CRM, SCM), back office applications (i.e., financials, HR/HCM & Payroll, Procurement)

or other, as illustrated in Figure 10 below, where private sector M = 2.87 with SD = 1.846 while public sector M = 2.60 with SD = 1.624. A broader governance control and oversight perspective within private sector organizations appears appropriate given the tendency for private sector organizations to incorporate ERP governance within the overall IT governance organization.

Figure 10: Key discriminant factor 2 - GOV2DesScope_Count

Examination of variable GOV2DesStructure reveals that 14.1% private sector public sector organizations have no plans to incorporate a governance organization compared to only 3.8% public sector organizations. But where established, private sector organizations tend to include ERP within the overall IT governance organizations. In addition to inclusion within the overall IT governance organization, public sector organizations reported a likelihood toward

either building an ERP governance organization or had established a separate ERP governance organization, as illustrated in Figure 11 below:

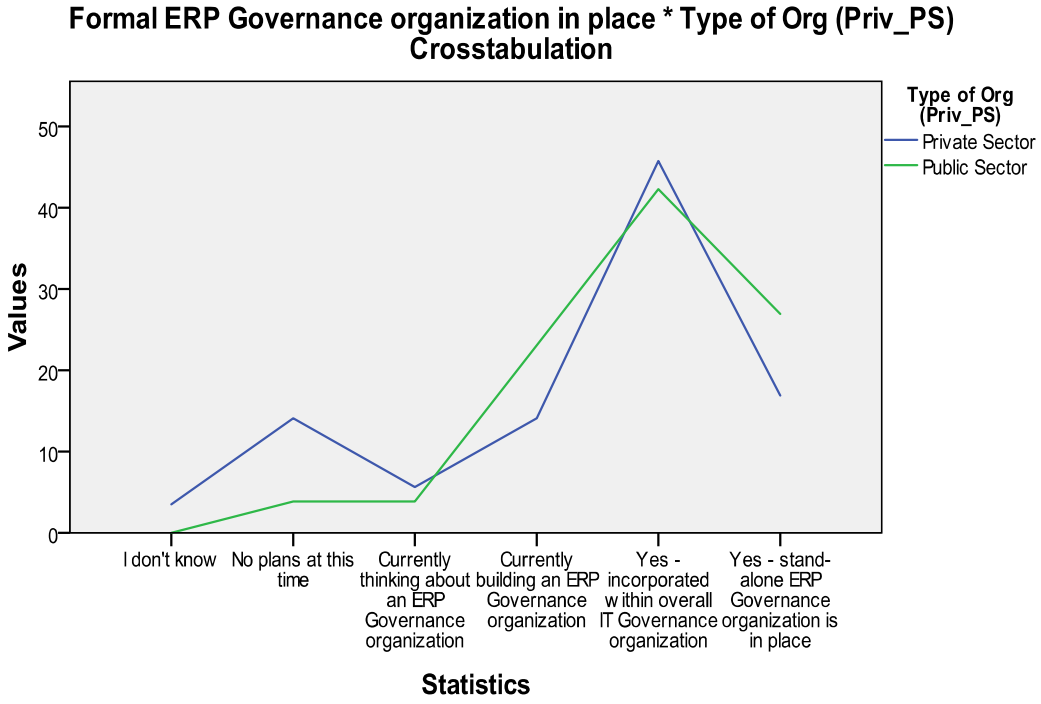

Figure 11: Key discriminant factor 3 - GOV2DesStructure

The discriminant function coefficients for the three variables are listed in Table 21 where the strongest predictors are variables GOV1DesStrucVision (Alignment of IT to the business) and GOV2DesStructure (ERP Governance structure).

Table 21: Research Question 1: Discriminant function coefficients

	Type of Org (Priv_PS)	
	Private Sector	Public Sector
GOV1DesStrucVision	2.229	1.863
GOV2DesScope_Count	-.029	-.272
GOV2DesStructure	2.065	2.600
(Constant)	-8.602	-9.311

Fisher's linear discriminant functions

With centroid values of 0.174 for private sector and -0.472 for public sector, the discriminant function model correctly classified 60% of organizations (against an estimated 50% assumption) as shown in Table 22 below:

Table 22: Research Question 1 - Discriminant analysis - original vs. predicted classification

		Type of Org (Priv_PS)	Predicted Group Membership		
			Private Sector	Public Sector	Total
Original	Count	Private Sector	84	58	142
		Public Sector	19	33	52
	%	Private Sector	59.2	40.8	100.0
		Public Sector	36.5	63.5	100.0

a. 60.3% of original grouped cases correctly classified.

The resulting discriminant analysis for Research Question 1 suggests the three key dependent variables differentiating governance design and performance of ERP between public and private sector organizations are 1) alignment of IT with the business, 2) scope of the IT domains controlled within the Governance structure and 3) whether the ERP governance structure exists, is incorporated within the IT organization or whether it exists as a stand-alone governance structure.

Phase A: Research Question 2

Is the level of importance for governance after implementation similar between public and private sector organizations?

In order to answer Research Question 2, survey participants were requested to respond to five survey questions: Questions 7, 10, 11, 13 and 15 (see Appendix A) as listed in Table 23:

Table 23: Research Question 2 - Variables for Governance Importance

Question	*Variable*	*Variable Description*
10a	GOV6ImpRespons_ITAlignBus	Decision-making role your ERP Governance organization fills for IT strategic alignment with the business
10b	GOV6ImpRespons_ITInvestValue	Decision-making role your ERP Governance organization fills for IT investment and value definition
10c	GOV6ImpRespons_ITRiskMngmt	Decision-making role your ERP Governance organization fills for IT risk management
10d	GOV6ImpRespons_ITPerfMngmt	Decision-making role your ERP Governance organization fills for IT performance management
10e	GOV6ImpRespons_ITResMngmt	Decision-making role your ERP Governance organization fills for IT resource management
10f	GOV6ImpResopns_BusReqsDef	Decision-making role your ERP Governance organization fills for Business requirements definition
10g	GOV6ImpRespons_BusAppSelection	Decision-making role your ERP Governance organization fills for Business application selection
10h	GOV6ImpRespons_ITProjectSelectOvers	Decision-making role your ERP Governance organization fills for IT project selection & oversight
11	GOV6ImpRank	ERP governance organization staffed primarily by:
13	GOV6ImpStability	Senior members of the ERP governance organization are:
15	GOV7ImpRepresentation	ERP Governance decision enforcement:
7e	GOV3DesForm_ITInvest	Decision-making responsibilities for IT investment prioritization

Descriptive statistics for the twelve variables included in Research Question 2 are listed in Table 24 below.

Table 24: Research Question 2 - Descriptive Statistics

Question	*Variable*	*Type of Org (Priv_PS)*	*Mean*	*Std. Deviation*	*N*
10a	GOV6ImpRespons_ITAlignBus	Private Sector	4.56	1.919	139
		Public Sector	5.12	1.698	50
		Total	4.71	1.875	189
10b	GOV6ImpRespons_ITInvestValue	Private Sector	4.52	2.016	139
		Public Sector	4.88	1.686	50
		Total	4.61	1.936	189
10c	GOV6ImpRespons_ITRiskMngmt	Private Sector	4.04	1.873	138
		Public Sector	4.34	1.586	50
		Total	4.12	1.802	188
10d	GOV6ImpRespons_ITPerfMngmt	Private Sector	3.63	1.794	135
		Public Sector	4.50	1.560	46
		Total	3.85	1.775	181
10e	GOV6ImpRespons_ITResMngmt	Private Sector	3.81	1.924	138
		Public Sector	4.70	1.632	50
		Total	4.05	1.888	188
10f	GOV6ImpResopns_BusReqsDef	Private Sector	4.15	1.880	139
		Public Sector	4.80	1.539	50
		Total	4.32	1.815	189
10g	GOV6ImpRespons_BusAppSelection	Private Sector	4.56	1.975	139
		Public Sector	5.12	1.480	50
		Total	4.71	1.869	189
10h	GOV6ImpRespons_ITProjectSelectOvers	Private Sector	4.80	2.033	138
		Public Sector	5.22	1.542	50
		Total	4.91	1.920	188
11	GOV6ImpRank	Private Sector	4.06	1.274	140
		Public Sector	4.44	.760	50
		Total	4.16	1.171	190
13	GOV6ImpStability	Private Sector	3.88	1.203	138
		Public Sector	4.28	.843	50
		Total	3.99	1.128	188
15	GOV7ImpRepresentation	Private Sector	4.15	1.637	139
		Public Sector	4.30	1.657	50
		Total	4.19	1.639	189
7e	GOV3DesForm_ITInvest	Private Sector	2.55	.847	142
		Public Sector	2.46	.670	52
		Total	2.53	.803	194

Table 25 below summarizes the results of the 12 variables, the Pearson Chi-square result and whether the assumption of minimum cell frequency was violated for each individual variable along with the corresponding most frequent response. Details of the first and second most frequent responses across the complete population as well as segmentation by the independent variable (private sector vs. public sector) are listed in Appendix C.

Governance responsibilities within private sector organizations tended toward more of an approving role while governance responsibilities within public sector organizations tended slightly more toward a reviewing role.

Table 25: Research Question 2 - Summary of Pearson Chi-squares by Individual Variable

Question	*Variable*	*Pearson Chi-square*	*Most frequent response*
10a	GOV6ImpRespons_ITAlignBus	0.096 > 0.05** ** no violation of minimum cell frequency	Recommends (23.3%)
10b	GOV6ImpRespons_ITInvestValue	0.275 > 0.05** ** no violation of minimum cell frequency	Approves (22.2%)
10c	GOV6ImpRespons_ITRiskMngmt	0.360 > 0.05** ** no violation of minimum cell frequency	Reviews (23.9%)
10d	GOV6ImpRespons_ITPerfMngmt	0.056 > 0.05** **28.6% violation of minimum expected cell frequency	Reviews (29.8%)
10e	GOV6ImpRespons_ITResMngmt	0.010 < 0.05** ** no violation of minimum cell frequency	No responsibility (23.4%)
10f	GOV6ImpResopns_BusReqsDef	0.205 > 0.05** ** no violation of minimum cell frequency	Reviews (22.2%)
10g	GOV6ImpRespons_BusAppSelection	0.032 < 0.05** ** no violation of minimum cell frequency	Recommends (22.2%)
10h	GOV6ImpRespons_ITProjectSelectOvers	0.107 > 0.05** **21.4% violation of minimum expected cell frequency	Approves (27.1%)
11	GOV6ImpRank	0.395 > 0.05** **40% violation of minimum cell frequency	Senior Executives (45.6%)
13	GOV6ImpStability	0.136 > 0.05** **30% violation of minimum expected cell frequency	Somewhat active and engaged (40.4%)
15	GOV7ImpRepresentation	0.020 < 0.05** **37.5% violation of minimum expected cell frequency	By IT Steering committee (36.5%)
7e	GOV3DesForm_ITInvest	0.255 > 0.05** **40% violation of minimum cell frequency	Shared (59.6%)

Six of twelve variables violated the Chi-square assumption for minimum expected cell frequency of 5 or greater (or at least 80% of cells have expected values of 5 or more). Eight of twelve variables revealed no significant association across the groups based on performance of a Pearson Chi-square analysis. Three variables were found to exhibit a significant association; these were Question 10e (GOV6ImpRespons_ITResMngmt: Governance responsibility for IT Resource Management), Question 10g (GOV6ImpRespons_ BusAppSelection: Governance responsibility for Business application selection) and Question 15 (GOV7ImpRepresentation: Enforcement of governance decisions). The Chi-square (X^2) calculation for Question 10e (GOV6ImpRespons_ITResMngmt: Governance responsibility for IT Resource Management) resulted in X^2 (6, n = 188) = 16.923, p = 0.01, phi = 0.300. The Chi-square calculation for Question 10g (GOV6ImpRespons_ BusAppSelection: Governance responsibility for Business application selection) resulted in X^2 (6, n = 189) = 13.805, p = 0.032, phi = 0.270. The Chi-square calculation for Question 15 (GOV7ImpRepresentation: Enforcement of governance decisions) resulted in X^2 (6, n = 189) = 16.594, p = 0.020, phi = 0.296.

To answer Research Question 2 and test the associated null hypothesis, a MANOVA function was performed to determine whether differences existed in the level of importance of governance activities between Public and Private sector organizations. The data obtained through the variables identified within Question 2 were reviewed for alignment with the assumptions of normality, linearity, univariate and multivariate outliers, homogeneity of variance-covariance matrices and multicollinearity in the same manner as described in Question 1.

Normality was confirmed because the data sample of 176 cases exceeds a minimum of 20 responses for each dependent variable (Pallant, 2007). Linearity was determined through a

review of scatterplots for each variable and no evidence on non-linearity was identified. No outliers were found in the data where the maximum Mahalanobis distance statistic = 32.126 was less than the critical value of 32.91; thus no outliers were found for exclusion.

Table 26: Research Question 2 – Correlation of dependent variables to determine multicollinearity

	GOV6ImpRespons_ITAlignBus	GOV6ImpResponse_ITInvestValue	GOV6ImpResponse_ITRiskMngmt	GOV6ImpResponse_ITPerfMngmt	GOV6ImpResponse_ITResMngmt	GOV6ImpResponse_ITPerfMngmt	GOV6ImpResponse_BusAppSelection	GOV6ImpResponse_ITProjectSelectOvers	GOV6ImpRank	GOV6ImpStability	GOV7ImpRepresentation	GOV3DesForm_ITInvest
GOV6ImpResponse_ITAlignBus	1	.589**	.514**	.433**	.456**	.429**	.493**	.559**	.410**	.279**	.360**	-.128
GOV6ImpResponse_ITInvestValue	.589**	1	.612**	.431**	.502**	.422**	.435**	.639**	.324**	.267**	.304**	-.150*
GOV6ImpResponse_ITRiskMngmt	.514**	.612**	1	.601**	.605**	.416**	.451**	.566**	.281**	.347**	.319**	-.080
GOV6ImpResponse_ITPerfMngmt	.433**	.431**	.601**	1	.632**	.424**	.378**	.470**	.233**	.338**	.269**	-.051
GOV6ImpResponse_ITResMngmt	.456**	.502**	.605**	.632**	1	.426**	.432**	.529**	.239**	.272**	.320**	-.077
GOV6ImpResponse_ITPerfMngmt	.429**	.422**	.416**	.424**	.426**	1	.624**	.513**	.263**	.148*	.223**	.018
GOV6ImpResponse_BusAppSelection	.493**	.435**	.451**	.378**	.432**	.624**	1	.601**	.335**	.263**	.282**	-.107
GOV6ImpResponse_ITProjectSelectOvers	.559**	.639**	.566**	.470**	.529**	.513**	.601**	1	.359**	.339**	.344**	-.109
GOV6ImpRank	.410**	.324**	.281**	.233**	.239**	.263**	.335**	.359**	1	.405**	.375**	-.049
GOV6ImpStability	.279**	.267**	.347**	.338**	.272**	.148*	.263**	.339**	.405**	1	.335**	-.053
GOV7ImpRepresentation	.360**	.304**	.319**	.269**	.320**	.223**	.282**	.344**	.375**	.335**	1	-.035
GOV3DesForm_ITInvest	-.128	-.150*	-.080	-.051	-.077	.018	-.107	-.109	-.049	-.053	-.035	1

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Multicollinearity was reviewed through performance of a correlation matrix and a majority of values showed modest correlation (see Table 26 above). The highest reported correlation was found between variables GOV6ImpRespons_IT InvestValue and GOV6ImpRespons_ITProjectSelectOvers equal to 0.639. Multicollinearity across the variables not found as would be found when correlation is strong ($r > 0.8$), see Table above. As a result, all nine dependent variables were retained without a further transformation for MANOVA analysis.

A violation of the assumption for equality of variance and co-variance was found in Box's M Test of Equality of Covariance where a Sig. value of 0.000 was calculated which is less than the thresh-hold value of 0.001. Seven (variables 10b, 10d, 10e, 10f, 10g, 10h and 7e) of twelve variables violated Levene's Test of Equality of Error Variances, where Sig. > 0.05 as noted in Table 27 below.

Table 27: Research Question 2 - Levene's Test of Equality of Error Variances

Question	*Variable*	*F*	*df1*	*df2*	*Sig.*
10a	GOV6ImpRespons_ITAlignBus	2.980	1	174	.086
10b	GOV6ImpRespons_ITInvestValue	4.041	1	174	.046 < 0.05
10c	GOV6ImpRespons_ITRiskMngmt	2.242	1	174	.136
10d	GOV6ImpRespons_ITPerfMngmt	4.213	1	174	.042 < 0.05
10e	GOV6ImpRespons_ITResMngmt	5.459	1	174	.021 < 0.05
10f	GOV6ImpResopns_BusReqsDef	7.201	1	174	.008 < 0.05
10g	GOV6ImpRespons_BusAppSelection	9.734	1	174	.002 < 0.05
10h	GOV6ImpRespons_ITProjectSelectOvers	7.347	1	174	.007 < 0.05
11	GOV6ImpRank	2.224	1	174	.138
13	GOV6ImpStability	2.283	1	174	.133
15	GOV7ImpRepresentation	.229	1	174	.633
7e	GOV3DesForm_ITInvest	10.017	1	174	.002

Despite failure of Levene's test of equality for seven of twelve variables, the researcher did not increase confidence to 97.5% as suggested by Pallant (2007) and Tabachnick & Fidell (2007). Confidence was retained at 95% with alpha (p) = 0.05 and cases were excluded pairwise, resulting in 176 cases included in the calculation. The MANOVA analysis did not reveal a statistically significant difference in the level of importance that private and public sector organizations ascribe to their ERP governance organizations based on the twelve dependent variables, $F(12, 163) = 1.78$, $p = 0.055$, Wilk's Lambda = 0.884 & Hotelling's Trace = 0.131; partial $eta^2 = 0.116$. Because the p value = 0.055 and is greater than alpha level = 0.05, the null hypothesis cannot be rejected.

Phase A: Research Question 3

Are there differences in how public and private sector organizations design, and manage ERP sustainment structures following implementation?

In order to answer Research Question 3, survey participants were requested to respond to four survey questions (see Appendix A for questions 16, 18, 21 and 22).

These four questions generated 11 variables as listed in Table 28 below:

Table 28: Research Question 3 - Variables for Sustainment Design & Performance

Question	*Variable*	*Variable Description*
21	SUS7ImpBudget	Average percentage (%) change in annual budget for your ERP Sustainment organization in the years following ERP implementation:
16a	SUS2StructureForm_BusProcessDesign	ERP Sustainment design for Business process design
16b	SUS2StructureForm_FuncAppDesign	ERP Sustainment design for Functional application design
16c	SUS2StructureForm_AppDev	ERP Sustainment design for Application development
16d	SUS2StructureForm_AppOps	ERP Sustainment design for Application operations
16e	SUS2StructureForm_Infrastructure	ERP Sustainment design for Infrastructure network & communications
16f	SUS2StructureForm_UserRoleAuth	ERP Sustainment design for User role & authorization management
16g	SUS2StructureForm_Help	ERP Sustainment design for Help desk
16h	SUS2Structure_EnduserTrain	ERP Sustainment design for End user training
22	EXT2ERPObjAchieved	Organization achieved its defined objectives for implementing ERP
18	SUS4StructMeas	Organization implemented defined metrics to assess and manage the services provided by your ERP Sustainment organization?

Descriptive statistics for the eleven variables included in Research Question 3 are listed in Table 29 below.

Table 29: Research Question 3 - Descriptive Statistics

Question	*Variable*	*Type of Org (Priv_PS)*	*Mean*	*Std. Deviation*	*N*
21	SUS7ImpBudget	Private Sector	2.66	1.678	140
		Public Sector	2.44	1.650	52
		Total	2.60	1.669	192
16a	SUS2StructureForm_BusProcessDesign	Private Sector	3.20	.839	141
		Public Sector	3.00	.840	52
		Total	3.15	.841	193
6b	SUS2StructureForm_FuncAppDesign	Private Sector	3.22	.781	139
		Public Sector	3.25	.796	51
		Total	3.15	.783	190
16c	SUS2StructureForm_AppDev	Private Sector	2.99	.798	139
		Public Sector	3.23	.703	52
		Total	3.05	.780	191
16d	SUS2StructureForm_AppOps	Private Sector	2.94	.787	139
		Public Sector	3.23	.645	52
		Total	3.02	.761	191
16e	SUS2StructureForm_Infrastructure	Private Sector	2.91	.731	139
		Public Sector	3.10	.534	52
		Total	2.96	.687	191
16f	SUS2StructureForm_UserRoleAuth	Private Sector	2.96	.706	139
		Public Sector	3.10	.721	52
		Total	3.00	.711	191
16g	SUS2StructureForm_Help	Private Sector	2.77	.792	139
		Public Sector	3.02	.641	52
		Total	2.84	.761	191
16h	SUS2Structure_EnduserTrain	Private Sector	2.78	.877	139
		Public Sector	2.96	.816	52
		Total	2.83	.862	191
22	EXT2ERPObjAchieved	Private Sector	2.63	.531	128
		Public Sector	2.57	.557	49
		Total	2.62	.543	177
18	SUS4StructMeas	Private Sector	3.27	1.224	141
		Public Sector	3.13	1.121	52
		Total	3.23	1.196	193

Table 30 summarizes the individual variables included in Research Question 3, the Pearson Chi-squares, whether a violation of the assumption of minimum cell frequency was

observed, and the most frequent response. Details of the first and second most frequent responses across the complete population as well as segmentation by the independent variable (private sector vs. public sector) are listed in Appendix D.

Table 30: Research Question 3 - Summary of Pearson Chi-square by Individual variable

Question	*Variable*	*Pearson Chi-square*	*Most frequent response*
21	SUS7ImpBudget	0.890 > 0.05** ** no violation of minimum cell frequency	Increased between 0 and 10% (25.0%)
16a	SUS2StructureForm_BusProcessDesign	0.277 > 0.05** ** 25% of cells violate minimum cell frequency	Shared/COE (42.5%)
16b	SUS2StructureForm_FuncAppDesign	0.609 > 0.05** ** 25% of cells violate minimum cell frequency	Centralized (43.2%)
16c	SUS2StructureForm_AppDev	0.252 > 0.05** ** 25% of cells violate minimum cell frequency	Centralized (59.7%)
16d	SUS2StructureForm_AppOps	0.024 < 0.05** ** 25% of cells violate minimum cell frequency	Centralized (61.3%)
16e	SUS2StructureForm_Infrastructure	0.333 > 0.05** ** 25% of cells violate minimum cell frequency	Centralized (74.9%)
16f	SUS2StructureForm_UserRoleAuth	0.530 > 0.05** ** 25% of cells violate minimum cell frequency	Centralized (59.2%)
16g	SUS2StructureForm_Help	0.196 > 0.05** ** no violation of minimum cell frequency	Centralized (72.8%)
16h	SUS2Structure_EnduserTrain	0.139 > 0.05** ** 25% of cells violate minimum cell frequency	Decentralized to Business Units (39.2%)
22	EXT2ERPObjAchieved	0.755 > 0.05** ** 33% of cell2 violate minimum cell frequency	Achieved objectives (64.4%)
18	SUS4StructMeas	0.192 > 0.05** ** no violation of minimum cell frequency	Yes, partially in place (34.2%)

The non-segmented responses when compared to Mirchandani's (2004) sustainment organizational models (see Figure 4) show a tendency toward the traditional IS model, but with end-user training supported by decentralized business units delivering end-user training. Both private sector and public organizations follow similar sustainment models, but public sector tending slightly more toward a shared service/center of excellence approach while private sector tend slightly more toward an IT centralized approach.

Eight of 11 variables violated the Chi-square assumption for expected cell frequency of 5 or greater (or at least 80% of cells have expected values of 5 or more). Despite the identified violation, the Pearson Chi-square found that ten of 11 variables revealed no significant association existed across the two groups (private and public sector organizations). One variable (Question 16d - SUS2StructureForm_AppOps) displayed a significant association existed across the groups where X^2 (3, n = 191) = 9.395, p = 0.024, phi = 0.222. Private sector organizations were oriented more toward centralized, shared services/Centers of Excellence and external/outsourced application operations support while public sector organization were oriented toward centralized and shared services/Centers of Excellence while reporting little use of external/outsourced application operation designs.

To answer Research Question 3 and test the associated null hypothesis, a MANOVA function was performed to determine whether differences exist between Public and Private sector organizations in the design and importance of sustainment operations based on the 11 variables identified above. The data obtained through the variables identified in Question 3 were reviewed for alignment with the assumptions of normality, linearity, univariate and multivariate outliers, homogeneity of variance-covariance matrices and multicollinearity in the same manner as Questions 1 and 2 above.

Normality was confirmed because the data sample of 171 cases exceeds a minimum of 20 responses for each dependent variable (Pallant, 2007). Linearity was determined through a review of scatterplots for each variable and no evidence of non-linearity was identified. An

analysis of the Mahalanobis distance statistic found seven of 171 cases exceeded the critical value of 31.26 with a maximum distance of 45.11.

Because the variance and number of cases were excessive, these seven cases (Cases 128, 89, 228, 27, 437, 281 and 348) were excluded from the MANOVA calculation. Homogeneity of variance-covariance can be assumed because Box's M Test of Equality of Covariance found a Sig value of 0.018 which is larger than the thresh-hold value of 0.001. Multicollinearity was reviewed through performance of a correlation matrix.

The majority of variables showed low and medium correlation (see Table 31 below) and the maximum correlation value between variables SUS2StructureForm_Infrastructure and SUS2StructureForm_Help equaled 0.460. As a result, multicollinearity (where $r > 0.8$) was not found and the dependent variables were retained without further transformation for MANOVA analysis.

Table 31: Research Question 3 – Correlation of dependent variables to determine multicollinearity

	SUS7ImpBudget	SUS2StructureForm_BusProcessDesign	SUS2Structure Form_FuncAppDesign	SUS2StructureForm_AppDev	SUS2StructureForm_AppOps	SUS2StructureForm_Infrastructure	SUS2Structure Form_UserRoleAuth	SUS2StructureForm_Help	SUS2Structure_EnduserTrain	EXT2ERPObjAchieved	SUS4StructMeas
SUS7ImpBudget	1	.059	.074	-.004	.006	.081	-.021	.014	.094	-.096	.062
SUS2StructureForm_BusProcessDesign	.059	1	.382**	.157*	.184*	.129	.272**	.129	.294**	.115	.113
SUS2StructureForm_FuncAppDesign	.074	.382**	1	.415**	.396**	.277**	.344**	.294**	.318**	-.002	.163*
SUS2StructureForm_AppDev	-.004	.157*	.415**	1	.442**	.315**	.266**	.320**	.264**	.059	.163*
SUS2StructureForm_AppOps	.006	.184*	.396**	.442**	1	.372**	.302**	.264**	.262**	.027	.093
SUS2StructureForm_Infrastructure	.081	.129	.277**	.315**	.372**	1	.187**	.460**	.157*	.089	.121
SUS2StructureForm_UserRoleAuth	-.021	.272**	.344**	.266**	.302**	.187**	1	.395**	.235**	.005	.087
SUS2StructureForm_Help	.014	.129	.294**	.320**	.264**	.460**	.395**	1	.189**	-.059	.030
SUS2Structure_EnduserTrain	.094	.294**	.318**	.264**	.262**	.157*	.235**	.189**	1	-.063	.157*
EXT2ERPObjAchieved	-.096	.115	-.002	.059	.027	.089	.005	-.059	-.063	1	.012
SUS4StructMeas	.062	.113	.163*	.163*	.093	.121	.087	.030	.157*	.012	1

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

All variables within Research Question 3 exceeded Sig. = 0.05 and did not violate the assumption of equal variance as indicated by Levene's Test of Equality of Error Variances (see Table 32 below).

Table 32: Research Question 3 - Levene's Test of Equality of Error Variances

	F	df1	df2	Sig.
SUS7ImpBudget	.028	1	169	.867
SUS2StructureForm_BusProcessDesign	.184	1	169	.669
SUS2StructureForm_FuncAppDesign	.388	1	169	.534
SUS2StructureForm_AppDev	.281	1	169	.597
SUS2StructureForm_AppOps	1.526	1	169	.218
SUS2StructureForm_Infrastructure	.003	1	169	.955
SUS2StructureForm_UserRoleAuth	1.604	1	169	.207
SUS2StructureForm_Help	3.408	1	169	.067
SUS2Structure_EnduserTrain	3.047	1	169	.083
EXT2ERPObjAchieved	.974	1	169	.325
SUS4StructMeas	1.770	1	169	.185

Tests the null hypothesis that the error variance of the dependent variable is equal across groups.

a. Design: Intercept + DEMO2ORG_PR_PS1

Confidence was set at 95% and alpha (p) = 0.05 and cases were excluded pairwise resulting in 164 cases included in the calculation. The MANOVA analysis found no statistically significant difference existed between Private and Public sector organizations in the level of importance for sustainment operations for the combined 11 dependent variables, F (11, 152) = 1.47, p = 0.147, Wilk's Lambda = 0.904 & Hotelling's trace = 0.104; partial eta^2 = 0.096. Because the p value (0.147) is greater than the alpha value of 0.05, the null hypothesis that there is no statistically significant difference in the design and performance of sustainment operations between Private and Public sector organizations cannot be rejected.

Phase A: Research Question 4

Is the level of importance for sustainment after implementation similar between public and private sector organizations?

In order to answer Research Question 4, survey participants were requested to respond to the four survey questions (see Appendix A for questions 17, 19, 20 and 21). These four questions generated 4 variables as listed in Table 33 below:

Table 33: Research Question 4 - Variables for Sustainment Importance

Question	*Variable*	*Variable Description*
19	SUS1StaffResponsibility	Resource allocation and work task responsibilities for members of your sustainment organization staff
17	SUS5ImpSponsorship	Organizational reporting distance between your ERP Sustainment organization's CEO or Agency head
20	SUS6ImpTraining	Level of importance for retaining current ERP skills/training within the core ERP Sustainment team
21	SUS7ImpBudget	Average percentage (%) change in annual budget for your ERP Sustainment organization in the years following ERP implementation:

Descriptive statistics for the four variables included in Research Question 4 are listed in Table 34 below.

Table 34: Research Question 4 - Descriptive Statistics

Question	*Variable*	*Type of Org (Priv_PS)*	*Mean*	*Std. Deviation*	*N*
19	SUS1StaffResponsibility	Private Sector	3.64	1.016	141
		Public Sector	3.76	.839	51
		Total	3.67	.972	192
17	SUS5ImpSponsorship	Private Sector	3.54	1.251	141
		Public Sector	3.82	1.228	51
		Total	3.61	1.248	192
20	SUS6ImpTraining	Private Sector	4.46	.819	139
		Public Sector	4.42	.848	52
		Total	4.45	.825	191
21	SUS7ImpBudget	Private Sector	2.66	1.678	140
		Public Sector	2.44	1.650	52
		Total	2.60	1.669	192

Table 35 summarizes the individual variables included in Research Question 4, its Pearson Chi-square, whether a violation of the assumption of minimum cell frequency was observed, and the most frequent response. Details of the first and second most frequent responses across the complete population as well as segmented by the independent variable (private sector vs. public sector) as listed in Appendix E

Table 35: Research Question 4 - Summary of Pearson Chi-square by individual variable

Question	*Variable*	*Pearson Chi-square*	*Most frequent response*
19	SUS1StaffResponsibility	0.408 > 0.05** **30% of cells violate minimum cell frequency	Supports both sustainment and deployment (63.8%)
17	SUS5ImpSponsorship	0.401 > 0.05** **33% of cells violate minimum cell frequency	2 Levels from CEO/Agency Head (43.2%)
20	SUS6ImpTraining	0.833 > 0.05** **40% of cells violate minimum cell frequency	Extremely important (62.8%)
21	SUS7ImpBudget	0.890 > 0.05** **no violation of minimum cell frequency	Increased between 0 and (25.0%)

Three of four variables violated the Chi-square assumption for expected cell frequency of 5 or greater (or at least 80% of cells have expected values of 5 or more). Despite these violations, the Pearson Chi-square calculation was performed. Four of four variables found no significant association across the private and public sector groups as all four Pearson Chi-squares exceeded 0.05.

To test the null hypothesis associated with Research Question 4, a MANOVA function was performed to determine whether differences existed in the level of importance that Public and Private sector organizations have for ERP sustainment operations. The data obtained from the variables identified in Question 4 were reviewed for alignment with the assumptions of

normality, linearity, univariate and multivariate outliers, homogeneity of variance-covariance matrices and multicollinearity using the methods described in Questions 1 – 3 above.

Normality was assumed because the data sample of 189 cases far exceeds a minimum of 20 responses for each dependent variable (Pallant, 2007). Linearity was determined through a review of scatterplots for each variable and no evidence of non-linearity was identified. An analysis of the Mahalanobis distance statistic found two of 189 cases exceeded the critical value of 18.47 with a maximum distance of 21.24. As a result, these two cases (Case 370 and 347) were excluded from the MANOVA calculation. Homogeneity of variance-covariance can be assumed because Box's M Test of Equality of Covariance found a Sig. value of 0.652 which is larger than the thresh-hold value of 0.001. Multicollinearity was reviewed through performance of a correlation matrix and all variables revealed low levels of correlation with the strongest correlation found between SUS6ImpTraining and SUS1StaffResponsibility = 0.271 (see Table 36, below). Moderate levels of correlation are desired (Pallant, 2007) to perform optimal MANOVA analysis. Despite the low levels of correlation and while not optimal, the researcher retained the variables without further transformation for MANOVA analysis.

Table 36: Research Question 4 - Correlation of dependent variables to determine multicollinearity

	SUS1StaffResponsibility	SUS5ImpSponsorship:	SUS6ImpTraining	SUS7ImpBudget
SUS1StaffResponsibility	1	.254**	.271**	.050
SUS5ImpSponsorship	.254**	1	.002	.232**
SUS6ImpTraining	.271**	.002	1	.137
SUS7ImpBudget	.050	.232**	.137	1

**. Correlation is significant at the 0.01 level (2-tailed).

All variables within Research Question 4 exceeded Sig. = 0.05 and did not violate the assumption of equal variance as indicated by Levene's Test of Equality of Error Variances (see Table 37 below).

Table 37: Research Question 4 - Levene's Test of Equality of Error Variances

	F	df1	df2	Sig.
SUS1StaffResponsibility	3.106	1	187	.080
SUS5ImpSponsorship	.012	1	187	.914
SUS6ImpTraining	.165	1	187	.685
SUS7ImpBudget	.002	1	187	.963

Tests the null hypothesis that the error variance of the dependent variable is equal across groups.

a. Design: Intercept + DEMO2ORG_PR_PS1

Confidence was set at 95.0% and alpha (p) = 0.05 and cases were excluded pairwise resulting in 187 cases included in the calculation. The MANOVA analysis found no statistically significant difference existed between Private and Public sector organizations for the level of importance for sustainment operations for the combined four dependent variables, F (4, 182) = 0.708, p = 0.588, Wilk's Lambda = 0.985 & Hotelling's Trace = 0.016; partial eta^2 = 0.015. Because the p value of 0.588 was greater than 0.05, the null hypothesis that there is no statistically significant difference in the level of importance for sustainment operations between Private and Public sector organizations could not be rejected.

Phase A: Research Question 5

Are there differences between public and private sector organizations in time frames to achieve acceptance and routinization of the initial ERP implementation?

In order to answer Research Question 5, survey participants were requested to respond to nine survey questions (see Appendix A for questions 22, 23, 24, 25, 26, 27, 28, 29 and 32). The nine questions formed the nine variables as listed in Table 38 below:

Table 38: Research Question 5 - Variables for Acceptance and Routinization of ERP

Question	*Variable*	*Variable Description*
25	EXT3ERPImpMethod	Deployment method for your ERP implementation
24	EXT4_ERPModulesCount_ CurrentSingMult	Count of Current Scope ERP Modules (whether Single or Multiple Vendors)
22	EXT1ERPObjectives	Clearly defined objectives for implementing the initial ERP phase
23	EXT2ERPObjAchieved	Organization achieved its defined objectives for implementing ERP:
26	EXT6StaffTurnover	ERP core team turnover compared to other IT workers
27	EXT7OrgFlexibility_Change	Organizational change acceptance
28	EXT8OrgFlexibility_Stabiliza tion	ERP post Go-live stabilization and acceptance period following implementation
32f	TRANS1RelImport_OrgCom mtTransformation	Importance of Organizational commitment to achieve organizational transformation
29	EXT9TIME	Please indicate the timeframe when an upgrade of your ERP system is planned:

Descriptive statistics for the nine variables included in Research Question 5 are listed in Table 39 below. Details of the first and second most frequent responses across the complete population as well as segmented by the independent variable (private sector vs. public sector) are listed in Appendix F.

Table 39: Research Question 5 - Descriptive Statistics

Question	*Variable*	*Type of Org (Priv_PS)*	*Mean*	*Std. Deviation*	*N*
25	EXT3ERPImpMethod	Private Sector	2.98	.702	141
		Public Sector	3.27	.689	52
		Total	3.06	.708	193
24	EXT4_ERPModulesCount_CurrentSingMult	Private Sector	18.75	6.917	142
		Public Sector	16.50	8.062	52
		Total	18.15	7.289	194
22	EXT1ERPObjectives	Private Sector	.90	.300	141
		Public Sector	.88	.323	52
		Total	.90	.306	193
23	EXT2ERPObjAchieved	Private Sector	2.63	.531	128
		Public Sector	2.57	.577	49
		Total	2.62	.543	177
26	EXT6StaffTurnover	Private Sector	3.91	1.242	141
		Public Sector	3.50	1.260	52
		Total	3.80	1.256	193
27	EXT7OrgFlexibility_Change	Private Sector	2.44	.498	139
		Public Sector	2.54	.503	52
		Total	2.47	.500	191
28	EXT8OrgFlexibility_Stabilization	Private Sector	2.95	1.123	141
		Public Sector	2.81	1.103	52
		Total	2.91	1.117	193
32	TRANS1RelImport_OrgCommtTransformation	Private Sector	4.72	.670	138
		Public Sector	4.85	.415	52
		Total	4.76	.612	190
29	EXT9TIME	Private Sector	4.15	1.775	138
		Public Sector	4.42	1.819	52
		Total	4.23	1.787	190

Table 40 summarizes the nine variables, their Pearson Chi-square, whether a violation of the assumption of minimum cell frequency was observed, and the associated most frequent responses (see Appendix F for additional details).

Table 40: Research Question 5 -Summary of Pearson Chi-square by individual variable

Question	*Variable*	*Pearson Chi-square*	*Most frequent response*
25	EXT3ERPImpMethod	0.062 > 0.05** **25% of cells violate minimum cell frequency	Phased (52.8%)
24	EXT4_ERPModulesCount_CurrentSingMult	**0.009 < 0.05**** **77% of cells violate minimum cell frequency	Implemented 15 modules (5.6%)
22	EXT1ERPObjectives	0.745 > 0.05** **no violation of minimum cell frequency	Yes (89.6%)
23	EXT2ERPObjAchieved	0.755 > 0.05** **33% of cells violate minimum cell frequency	Achieved objectives (64.4%)
26	EXT6StaffTurnover	0.450 > 0.05** **25% of cells violate minimum cell frequency	Equal turn-over (37.3%)
27	EXT7OrgFlexibility_Change	0.219 > 0.05** **no violation of minimum cell frequency	Change is accepted when communicated with rationale (53.4%)
28	EXT8OrgFlexibility_Stabilization	0.718 > 0.05** **10% violation of minimum cell frequency	Smooth (32.1%)
32f	TRANS1RelImport_OrgCommtTransformation	0.724 > 0.05** **50% violation of minimum cell frequency	Extremely important (81.9%)
29	EXT9TIME	0.517 > 0.05** **8% violation of minimum cell frequency	Within 6 - 12 months (32.1%)

Five of nine variables violated the Chi-square assumption for expected cell frequency of 5 or greater (or at least 80% of cells have expected values of 5 or more). Despite these violations, the Pearson Chi-square calculation was performed. Eight of nine variables found no association in distribution based on performance of Pearson Chi-square. One variable (Question 24 - EXT4_ERPModulesCount_CurrentSingMult: Current number of implemented modules) revealed a significant association existed between the number of modules implemented by public and private sector organizations, where X^2 (29, n = 194) = 51.433, p = 0.006, phi = 0.515.

In Question 24, respondents identified the number of ERP modules (either supplied by a single or via multiple vendor(s)) deployed during the implementation. Respondents were able to select up to 40 different modules that included front office (i.e., customer service management)

to back-office (i.e., finance, payroll, human resources, purchasing, etc.) functional areas as well as enablement technologies (i.e., portal, workflow, SOA, etc.). 80% of private sector organizations reported implementing at least 13 ERP modules with 11 (7.7%) implementing 19 modules and 10 (7.0%) implementing 15 modules. Comparatively, 80% of public sector organizations reported implementing at least 10 ERP modules with 9 (17.3%) implementing 12 modules and 5 (9.6%) implementing 16 modules. The top ten ERP modules implemented are listed in Table 41 below:

Table 41: Research Question 5 - Top 10 ERP Modules Implemented

ERP Modules	*Private Sector #*	*Private Sector %*	*Public Sector #*	*Public Sector %*	*Variance %*
Accounts Payable	133	100%	46	90%	+10%
General Ledger	129	97%	47	92%	+5%
Accounts Receivable	125	94%	44	86%	+8%
Purchasing	122	92%	45	88%	+4%
Inventory Control	119	89%	39	76%	+13%
Business Intelligence	113	85%	41	80%	+5%
Fixed Assets	111	83%	44	86%	-3%
Payroll	100	75%	40	78%	-3%
Human Capital Management	94	71%	43	84%	-13%
Portal	85	64%	40	78%	-14%

64% of private sector organization implemented the 10 modules listed in Table 38 compared to 76% of public sector organizations. Private sector organizations reported a tendency to implement slightly more modules than public sector organizations. Table 42 displays that private sector organizations have implemented a greater number of advanced material, procurement and supply chain related modules, including order management, MRP, Supply Chain, MPS, and CRM, compared to public sector organizations.

Table 42: Research Question 5 - Ten ERP modules with greatest variance

ERP Modules	*Private Sector #*	*Private Sector %*	*Public Sector #*	*Public Sector %*	*Variance %*
Order Management	110	83%	28	55%	+28%
Forecasting and Demand Planning	107	80%	25	49%	+31%
MRP (Material requirements planning)	105	79%	25	49%	+30%
Sales and Marketing	99	74%	19	37%	+37%
Supply Chain Management (SCM)	88	66%	21	41%	+13%
MPS (Master Production Scheduling)	84	63%	14	27%	+36%
Customer Relationship Management (CRM)	75	85%	19	37%	+48%
Project Management	59	44%	35	69%	-24%
Supplier Collaboration/scheduling	59	44%	16	31%	+25%
Workflow Technologies	59	44%	36	71%	-26%

To answer Research Question 5 and test the associated null hypothesis, a MANOVA function was performed to determine whether differences in timeframe to achieve acceptance and routinization of ERP existed between public and private sector organizations. The data obtained from the variables identified in Question 5 were reviewed for alignment with the assumptions of normality, linearity, univariate and multivariate outliers, homogeneity of variance-covariance matrices and multicollinearity using the methods described in Questions 1 – 4 above.

Normality was confirmed because the data sample of 172 cases exceeds a minimum of 20 responses for each dependent variable (Pallant, 2007). Linearity was determined through a review of scatterplots for each variable and no evidence of non-linearity was identified. An analysis of the Mahalanobis distance statistic found only one of 172 cases exceeded the critical value of 27.88 with a maximum distance of 53.39. Because the variance was large, the one case (Case 370) was excluded from the MANOVA calculation.

Homogeneity of variance-covariance was confirmed because Box's M Test of Equality of Covariance found a Sig. value of 0.032 which is larger than the thresh-hold value of 0.001. Multicollinearity was reviewed through performance of a correlation matrix. Correlation values were low (0.0 to 0.4) with variables EXT8OrgFlexibility_Stabilization and EXT2ERPObjAchieved having the strongest correlation (0.391) in the matrix (see Table 43 below).

Table 43: Research Question 5 - Correlation of dependent variables to determine multicollinearity

	EXT3ERPImpMethod	EXT4_ERPModulesCount_CurrentSingMult	EXT1ERPObjectives	EXT2ERPObjAchieved	EXT6StaffTurnover	EXT7OrgFlexibility_Change	EXT8OrgFlexibility_Stabilization	TRANS1RelImport_OrgCommtTransformation	EXT9TIME
EXT3ERPImpMethod	1	-.224**	.051	.059	-.028	-.031	-.086	-.096	-.028
EXT4_ERPModulesCount_CurrentSingMult	-.224**	1	.089	.017	.208**	-.035	.042	.020	-.005
EXT1ERPObjectives	.051	.089	1	.293**	-.055	-.160*	.156*	.089	.044
EXT2ERPObjAchieved	.059	.017	.293**	1	-.021	-.149*	.391**	.031	.003
EXT6StaffTurnover	-.028	.208**	-.055	-.021	1	.097	-.072	.021	.070
EXT7OrgFlexibility_Change	-.031	-.035	-.160*	-.149*	.097	1	-.090	.009	.007
EXT8OrgFlexibility_Stabilization	-.086	.042	.156*	.391**	-.072	-.090	1	.032	.023
TRANS1RelImport_OrgCommtTransformation	-.096	.020	.089	.031	.021	.009	.032	1	.014
EXT9TIME	-.028	-.005	.044	.003	.070	.007	.023	.014	1

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Moderate levels of correlation are desired (Pallant, 2007) to perform optimal MANOVA analysis. Despite weak levels of correlation and while not optimal, the researcher retained the variables without further transformation for MANOVA analysis.

Table 44 below reveals that eight of nine variables satisfied Levene's Test of Equality of Error Variance. However, one variable (TRANS1RelImport_OrgCommtTransformation) violated Levene's Test where Sig. = 0.005 and was less than 0.05.

Table 44: Research Question 5 - Levene's Test of Equality of Error Variances

	F	df1	df2	Sig.
EXT3ERPImpMethod	1.690	1	170	.195
EXT4_ERPModulesCount_CurrentSingMult	3.559	1	170	.061
EXT1ERPObjectives	.198	1	170	.657
EXT2ERPObjAchieved	.867	1	170	.353
EXT6StaffTurnover	.839	1	170	.361
EXT7OrgFlexibility_Change	.320	1	170	.573
EXT8OrgFlexibility_Stabilization	.023	1	170	.880
TRANS1RelImport_OrgCommtTransformation	8.252	1	170	.005
EXT9TIME	.000	1	170	.992

Tests the null hypothesis that the error variance of the dependent variable is equal across groups.

a. Design: Intercept + DEMO2ORG_PR_PS1

Despite failure of Levene's test of equality for one variable, confidence was set at 95% with alpha (p) = 0.05 to perform the MANOVA analysis. Cases were excluded pairwise resulting in 171 total cases included in the calculation. The MANOVA analysis found a statistically significant difference existed between private and public sector organizations in timeframe to achieve acceptance and routinization of ERP for the combined nine dependent variables, F (9, 161) = 2.01, p = 0.041, Wilk's Lambda = 0.899 and Hotelling's Trace = 0.112; partial eta^2 = 0.101. Because the p value (0.041) was less than alpha level = 0.05, the null hypothesis that there

is a no difference in timeframes to achieve acceptance and routinization of ERP between private and public sector organizations can be rejected and the alternative hypothesis can be accepted.

Further examination of the dependent variables when considered separately found only one variable (EXT4_ERPModulesCount_CurrentSingMult) neared statistical significance with $F(1, 169) = 4.987$, $p = 0.027$, partial $eta^2 = 0.029$. The mean scores for this variable found that private sector organizations implemented slightly higher numbers of ERP modules ($M = 19.082$, $SD = 0.646$) while public sector organizations implemented slightly lower numbers of ERP modules ($M = 16.388$, $SD = 1.019$).

Because of rejection of the null hypothesis, the researcher was interested to determine whether a discriminant analysis function could provide greater insight into the nine dependent variables comprising Research Question 5. The variables listed in Table 45 were inserted stepwise as independent variables along with the dependent variable (private or public sector organization) to separate groups during performance of the discriminant analysis calculation. Wilk's λ was evaluated to determine significance of the extracted variables and whether they could be used as predictors.

Significance was confirmed where Sig. (p) < 0.05 for only one of the nine variables (EXT4_ERPModulesCount_CurrentSingMult) as shown in the table below:

Table 45: Research Question 5: Discriminant analysis - Wilk's λ test for significance

						Exact F			
Step	Variables	Lambda	df1	df2	df3	Statistic	df1	df2	Sig.
1	EXT4_ERPModulesCount_CurrentSingMult	.953	1	1	156	7.768	1	156.000	.006

Further review of the variable EXT4_ERPModulesCount_CurrentSingMult illustrates public sector organizations implementing a wider, more disparate distribution of ERP modules during the implementation phase with spikes in distribution occurring at 12, 16 and 31 modules as contrasted with private sector implementation. Despite this, private sector organizations implementations were overall slightly more complex with M = 18.75 and SD = 6.917 compared to public sector organizations with M = 16.50 and SD = 8.062.

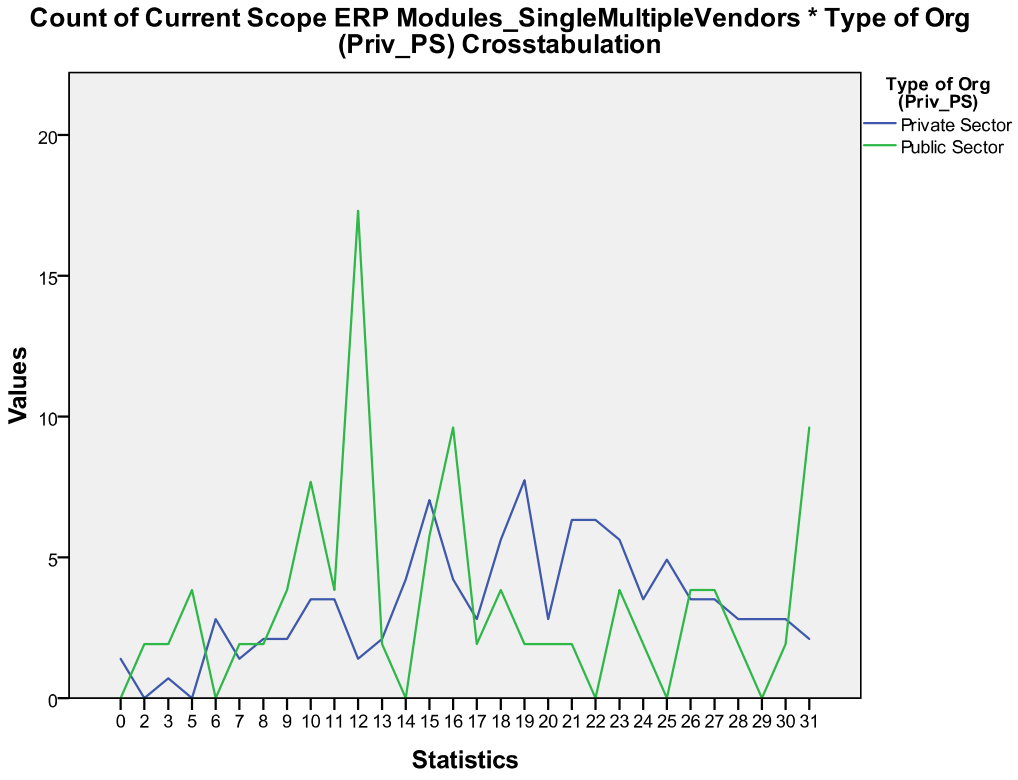

Figure 12: Key discriminant factor 4 - EXT4_ERPModulesCount_CurrentSingMult

The discriminant function coefficients for the single variable are listed in Table 46.

Table 46: Research Question 5: Discriminant function coefficients

	Type of Org (Priv_PS)	
	Private Sector	Public Sector
EXT4_ERPModulesCount_CurrentSingMult	0.386	0.316
(Constant)	-4.354	-3.152

Fisher's linear discriminant functions

With centroid values of 0.142 for private sector and -0.346 for public sector, the discriminant function model based on the single variable correctly classifies 63.1% (against an estimated 50% assumption) of organizations as shown in Table 47 below:

Table 47: Research Question 5 - Discriminant analysis - original vs. predicted classification

			Predicted Group Membership		
		Type of Org (Priv_PS)	Private Sector	Public Sector	Total
Original	Count	Private Sector	80	50	130
		Public Sector	16	33	49
	%	Private Sector	61.5	38.5	100.0
		Public Sector	32.7	67.3	100.0

a. 63.1% of original grouped cases correctly classified.

The resulting discriminant analysis for Research Question 5 suggests the key dependent variable for driving timeframe to accept and routinize ERP is the number of ERP modules implemented during the initial implementation period, thereby referencing complexity.

Phase A: Research Question 6

Are there differences between public and private sector organizations in time frames when to extend or upgrade the initial ERP implementation?

In order to answer Research Question 6, survey participants were requested to respond to five survey questions (see Appendix A for Questions 15, 24, 29, 31 and 32) that resulted in ten variables as listed in Table 48 below:

Table 48: Research Question 6 - Variables for Extending ERP

Question	*Variable*	*Variable Description*
24	EXT4_ERPModulesCount_FutureScope	Count of Future Scope ERP Modules
31a	EXT12_ERPAccept_NewSoftware	New Software requirements ranked as reason to extend or upgrade your ERP implementation
31b	EXT12_ERPAccept_GovtRegs	New Government regulations as reason to extend or upgrade your ERP implementation
31c	EXT12_ERPAccept_SoftwareMaint	Expiration of Software Maintenance agreement as reason to extend or upgrade your ERP implementation
31d	EXT12_ERPAccept_SupplyChain	Extension of Supply chain capabilities as reason to extend or upgrade your ERP implementation
31e	EXT12_ERPAccept_Competitiveness	Retention of competitiveness as reason to extend or upgrade your ERP implementation
31f	EXT12_ERPAccept_SOA	Implement Service Oriented Architecture infrastructure
15	GOV7ImpRepresentation	ERP Governance decision enforcement:
32f	TRANS1RelImport_OrgCommtTransformation	Importance of Organizational commitment to achieve organizational transformation:
29	EXT9TIME	Please indicate the timeframe when an upgrade of your ERP system is planned:

Descriptive statistics for the ten variables included in Research Question 6 are listed in Table 49 below. Details of the first and second most frequent responses across the complete population as well as segmented by the independent variable (private sector vs. public sector) are listed in Appendix G.

Table 49: Research Question 6 - Descriptive Statistics

Question	*Variable*	*Type of Org (Priv_PS)*	*Mean*	*Std. Deviation*	*N*
24	EXT4_ERPModulesCount_FutureScope	Private Sector	4.77	5.308	142
		Public Sector	4.88	5.512	52
		Total	4.80	5.349	194
31a	EXT12_ERPAccept_NewSoftware	Private Sector	4.66	1.406	130
		Public Sector	4.96	.848	51
		Total	4.75	1.279	181
31b	EXT12_ERPAccept_GovtRegs	Private Sector	3.62	1.718	124
		Public Sector	4.55	1.608	49
		Total	3.88	1.735	173
31c	EXT12_ERPAccept_Competitiveness	Private Sector	4.20	1.528	118
		Public Sector	2.90	1.780	40
		Total	3.87	1.688	158
31d	EXT12_ERPAccept_SoftwareMaint	Private Sector	4.09	1.605	126
		Public Sector	4.09	1.682	44
		Total	4.09	1.620	170
31e	EXT12_ERPAccept_SupplyChain	Private Sector	3.04	1.386	119
		Public Sector	2.61	1.115	41
		Total	2.93	1.332	160
31f	EXT12_ERPAccept_SOA	Private Sector	2.45	1.551	128
		Public Sector	2.67	1.261	45
		Total	2.50	1.481	173
15	GOV7ImpRepresentation	Private Sector	4.15	1.637	139
		Public Sector	4.30	1.657	50
		Total	4.19	1.639	189
32f	TRANS1RelImport_OrgCommtTransformation	Private Sector	4.72	.670	138
		Public Sector	4.85	.415	52
		Total	4.76	.612	190
29	EXT9TIME	Private Sector	4.15	1.775	138
		Public Sector	4.42	1.819	52
		Total	4.23	1.787	190

Table 50 summarizes the ten variables included within Research Question 6, the Pearson Chi-square, whether violation of the minimum cell frequency has occurred and the associated responses for the aggregated population (see Appendix G for additional details). Private sector and public sector organization followed this pattern except that private sector reversed rankings for compliance with government regulations (ranked 3rd least important) and competitiveness (ranked 2nd most important).

Table 50: Research Question 6 - Summary of Pearson Chi-square by individual variable

Question	*Variable*	*Pearson Chi-square*	*Summary Responses*
24	EXT4_ERPModulesCount_FutureScope	0.834 > 0.05** **77% of cells violate minimum cell frequency	Plan to implement 2 modules (8.8%)
31a	EXT12_ERPAccept_NewSoftware	**0.019 < 0.05**** **33% of cells violate minimum cell frequency	Most important
31b	EXT12_ERPAccept_GovtRegs	**0.001 < 0.05**** **8% of cells violate minimum cell frequency	2nd most important
31c	EXT12_ERPAccept_SoftwareMaint	0.549 > 0.05** **8% of cells violate minimum cell frequency	3rd most important
31d	EXT12_ERPAccept_SupplyChain	0.328 > 0.05** **8% of cells violate minimum cell frequency	2nd least important
31e	EXT12_ERPAccept_Competitiveness	**0.000 < 0.05**** **25% of cells violate minimum cell frequency	3rd least important
31f	EXT12_ERPAccept_SOA	**0.042 < 0.05**** **25% of cells violate minimum cell frequency	Least important
15	GOV7ImpRepresentation	0.354 > 0.05** **37% of cells violate minimum cell frequency	By IT Steering committee (36.5%)
32f	TRANS1RelImport_OrgCommtTransformation	0.724 > 0.05** **50% of cells violate minimum cell frequency	Extremely important (81.9%)
29	EXT9TIME	0.517 > 0.05**8% of cells violate minimum cell frequency	Within 6 - 12 months (32.1%)

Six of ten variables violated the Chi-square assumption for expected cell frequency of 5 or greater (or at least 80% of cells have expected values of 5 or more). Despite these violations, the Pearson Chi-square calculation was performed. Six of ten variables revealed no significant association across private and public sector organizations based on Pearson Chi-square analysis. However, significant associations were found in the remaining four variables - Question 31a (EXT12_ERPAccept_NewSoftware), Question 31b (EXT12_ERPAccept_GovtRegs), Question 31e (EXT12_ERPAccept_Competitiveness), and Question 31f (EXT12_ERPAccept_SOA). For Question 31a (ExT12_ERPAccept_NewSoftware), the Chi-square association was X^2 (5, n = 181) = 13.578, p = 0.019, phi = 0.274. For question 31b (EXT12_ERPAccept_GovtRegs), the

Chi-square association was X^2 (5, n = 173) = 19.839, p = 0.001, phi = 0.339. For question 31e (EXT12_ERPAccept_Competitiveness), the Chi-square association was X^2 (5, n = 158) = 24.380, p = 0.000, phi = 0.393. For question 31f (EXT12_ERPAccept_SOA), the Chi-square association was X^2 (5, n = 173) = 11.523, p = 0.042, phi = 0.258.

To answer Research Question 6 and test the null hypothesis, a MANOVA function was performed to determine whether difference in timeframe to upgrade or extend ERP between public and private sector organizations. The data obtained from the variables identified in Question 6 were reviewed for alignment with the assumptions of normality, linearity, univariate and multivariate outliers, homogeneity of variance-covariance matrices and multicollinearity using the methods described in Questions 1 – 5 above. Normality was confirmed because the data sample of 132 cases exceeds a minimum of 20 responses for each dependent variable (Pallant, 2007). Linearity was determined through a review of scatterplots for each variable and no evidence of non-linearity was identified. An analysis of the Mahalanobis distance statistic found three of 132 cases exceeded the critical value of 29.59 with a maximum distance of 68.06. Because the variance was large, the three cases (Cases 178, 397 and 370) were excluded in the MANOVA calculation. The assumption of homogeneity of variance-covariance could not be confirmed via Box's M because only one covariance matrix could be calculated within SPSS. Multicollinearity was reviewed through performance of a correlation matrix.

Table 51: Research Question 6: Correlation of dependent variables to determine multicollinearity

	EXT4_ERPModulesCount_FutureScope	EXT12_ERPAccept_NewSoftware	EXT12_ERPAccept_GovtRegs	EXT12_ERPAccept_Competitiveness	EXT12_ERPAccept_SoftwareMaint	EXT12_ERPAccept_SupplyChain	EXT12_ERPAccept_SOA	GOV7ImpRepresentation	TRANS1RelImport_OrgCommtTransformation	EXT9TIME
EXT4_ERPModulesCount_FutureScope	1	.016	.034	-.055	-.032	.009	-.041	-.003	-.189**	.074
EXT12_ERPAccept_NewSoftware	.016	1	-.319**	-.242**	-.008	-.160*	.048	.060	-.059	.082
EXT12_ERPAccept_GovtRegs	.034	-.319**	1	-.215**	-.205**	-.284**	-.246**	-.018	.074	-.054
EXT12_ERPAccept_Comptetiveness	-.055	-.242**	-.215**	1	-.452**	.056	-.156	.145	.016	.048
EXT12_ERPAccept_SoftwareMaint	-.032	-.008	-.205**	-.452**	1	-.147	.011	-.088	.049	-.001
EXT12_ERPAccept_SupplyChain	.009	-.160*	-.284**	.056	-.147	1	.074	.074	.029	-.056
EXT12_ERPAccept_SOA	-.041	.048	-.246**	-.156	.011	.074	1	-.153*	-.124	.077
GOV7ImpRepresentation	-.003	.060	-.018	.145	-.088	.074	-.153*	1	.025	-.019
TRANS1RelImport_OrgCommtTransformation	-.189**	-.059	.074	.016	.049	.029	-.124	.025	1	.014
EXT9TIME	.074	.082	-.054	.048	-.001	-.056	.077	-.019	.014	1

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Table 51 above reveals weak levels of correlation (0.0 to 0.4) for the majority of variables with the strongest correlation found between variables EXT12_ERPAccept_SoftwareMaint and EXT12_ERPAccept_Competitiveness = -0.452. As a result, multicollinearity was not found and the nine variables were retained without further transformation.

Table 52 below reveals that eight of ten variables satisfied Levene's Test of Equality of Error Variance. Two of ten variables (EXT12_ERPAccept_NewSoftare and

TRANS1RelImport_OrgCommtTransformation) violated Levene's Test of Equality of Error where Sig = 0.000 and 0.032, respectively, and were less than 0.05.

Table 52: Research Question 6 - Levene's Test of Equality of Error Variance

Question	*Variable*	*F*	*df1*	*df2*	*Sig.*
24	EXT4_ERPModulesCount_FutureScope	1.459	1	130	.229
31a	EXT12_ERPAccept_NewSoftware	13.512	1	130	.000
31b	EXT12_ERPAccept_GovtRegs	.638	1	130	.426
31c	EXT12_ERPAccept_SoftwareMaint	1.638	1	130	.203
31d	EXT12_ERPAccept_SupplyChain	.563	1	130	.454
31e	EXT12_ERPAccept_Competitiveness	1.144	1	130	.287
31f	EXT12_ERPAccept_SOA	.471	1	130	.494
15	GOV7ImpRepresentation	.786	1	130	.377
32f	TRANS1RelImport_OrgCommtTransformation	4.678	1	130	.032
29	EXT9TIME	.033	1	130	.856

Despite failure of Levene's test of equality for two variables, the researcher did not increase confidence to 97.5% as suggested by Pallant (2007) and Tabachnick & Fidell (2007). Confidence was set at 95.0% with alpha (p) = 0.05 and cases were excluded pairwise resulting in 129 cases within the calculation. The MANOVA analysis found a statistically significant difference existed between private and public sector organizations in timeframe to extend or upgrade ERP for the combined ten dependent variables, F (9, 119) = 3.214, p = 0.002, Wilk's Lambda = 0.804 & Hotelling's Trace = 0.112; partial eta^2 = 0.196. Because the p value = 0.002 and is less than the alpha level of 0.05, the null hypothesis can be rejected and the alternative hypothesis is accepted. Further examination of the dependent variables when considered separately found two variables (EXT12_ERPAccept_Competitiveness) and (EXT12_ERPAccept_GovtRegs) neared statistical significance. Variable EXT12_ERPAccept_Competitiveness reported F (1, 127) = 18.22, p = 0.000, partial eta^2 = 0.125 while EXT12_ERPAccept_GovtRegs reported F (1, 127) = 8.552, p =

0.004, partial eta^2 = 0.063. The mean scores for variable EXT12_ERPAccept_Competitiveness found that private sector organizations reported retention of competitiveness as a more important driver for upgrading or extending ERP (M = 4.185, SD = 0.168) while public sector organizations reported retention of competitiveness as a less important driver (M = 2.765, SD = 0.280). The mean scores for variable EXT12_ERPAccept_GovtRegs revealed an opposite pattern where public sector organizations reported need to comply with government regulatory requirements as a more important driver for upgrading or extending ERP (M = 4.618, SD = 0.286) while private sector organizations need to comply with government regulatory requirements as a less important driver (M = 3.642, SD = 0.171).

Because of rejection of the null hypothesis, the researcher was interested to determine whether a discriminant analysis function could provide greater insight into the ten dependent variables comprising Research Question 6. The variables listed in Table 53 were inserted as independent variables into SPSS along with the dependent variable (private or public sector organization) to separate groups during performance of the discriminant analysis calculation. Wilk's λ was evaluated to determine significance of the extracted variables and whether they could be used as predictors. Significance was confirmed where Sig. (p) < 0.05 for two of the ten variables (EXT12_ERPAccept_Competitiveness and EXT12_ERPAccept_SoftwareMaint) as shown in the table below:

Table 53: Research Question 6: Discriminant analysis - Wilk's λ test for significance

						Exact F			
Step	Variables	Lambda	df1	df2	df3	Statistic	df1	df2	Sig.
1	EXT12_ERPAccept_Competitiveness	.876	1	1	130	18.470	1	130.000	.000
2	EXT12_ERPAccept_SoftwareMaint	.835	1	1	130	12.789	2	129.00	.000

Review of variable EXT12_ERPAccept_Competitiveness reveals that public sector organizations evaluate a need to retain competitiveness as the least important factor for extending ERP while private sector organization ranked retention of competitiveness much more highly. This is illustrated in Figure 13 below:

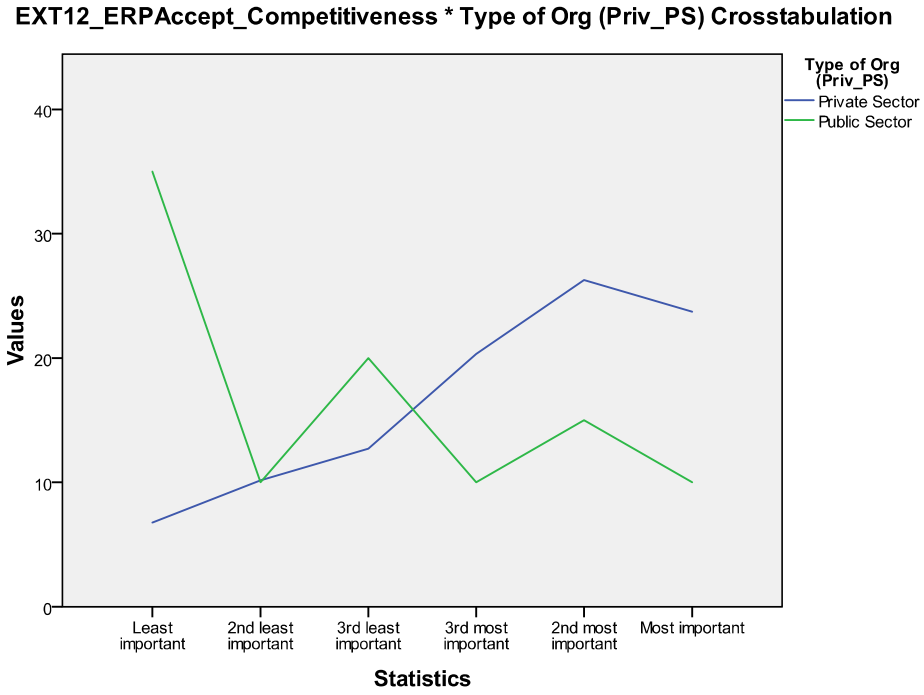

Figure 13: Key discriminant factor 5 - EXT12_ERPCompetitiveness

Review of variable EXT12_ERPAccept_SoftwareMaint shows that expiration of ERP software maintenance licenses is very important for both private and public sector organizations, however a dissimilar distribution is observed between private and public sector organizations that may have caused this variable to emerge as a discriminating factor. This is illustrated in Figure 14 below:

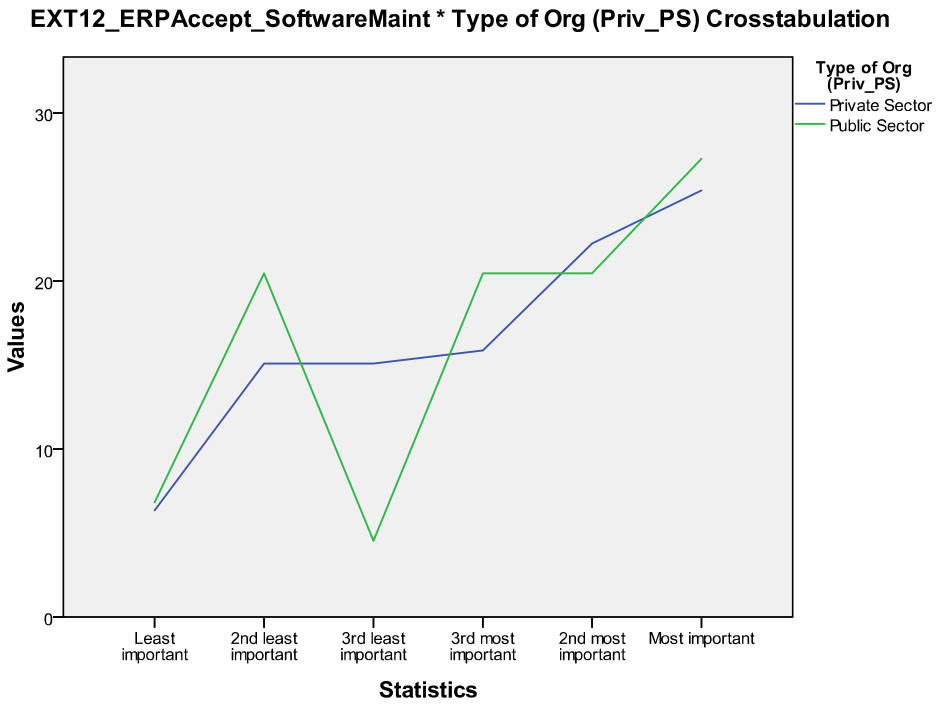

Figure 14: Key discriminant factor 6 - EXT12_ERPAccept_SoftwareMaint

The discriminant function coefficients for the single variables are listed in Table 54.

Table 54: Research Question 6: Discriminant function coefficients

	Type of Org (Priv_PS)	
	Private Sector	Public Sector
EXT12_ERPAccept_Competitiveness	3.114	2.393
EXT12_ERPAccept_SoftwareMaint	2.975	2.596
(Constant)	-12.868	-8.927

Fisher's linear discriminant functions

With centroid values of 0.260 for private sector and -0.750 for public sector, the discriminant function model based on the two variables correctly classified 70% (against an estimated 50% assumption) of organizations as shown in Table 55 below:

Table 55: Research Question 6 - Discriminant analysis - original vs. predicted classification

		Type of Org (Priv_PS)	Predicted Group Membership		
			Private Sector	Public Sector	Total
Original	Count	Private Sector	112	30	142
		Public Sector	27	25	52
	%	Private Sector	78.9	21.1	100.0
		Public Sector	51.9	48.1	100.0

a. 70.6% of original grouped cases correctly classified.

The resulting discriminant analysis for Research Question 6 suggests the two key dependent variables driving timeframe to extend ERP are need to maintain competitiveness, a characteristic reported as extremely important for private sector organizations but not so for public sector organizations, and expiration of software maintenance agreements.

Phase A: Research Question 7

What are the relative levels of importance for Governance, Sustainment and Extension capabilities relative to each other to achieve transformation objectives across public and private sector organizations?

To answer Research Question 7, survey participants were requested to respond to only one survey question (see Appendix A for question 32). This one question generated six variables as listed below:

Table 56: Research Question 7 - Variables for Relative Importance of GSE to achieve transformation

Question	*Variable*	*Variable Description*
32a	TRANS1RelImport_GovDesign	Importance of Governance design to achieve organizational transformation:
32b	TRANS1RelImport_GovImport	Importance of Organizational support for Governance operations to achieve organizational transformation:
32c	TRANS1RelImport_SusDesign	Importance of Sustainment design to achieve organizational transformation:
32d	TRANS1RelImport_SusImport	Importance of Organizational support for Sustainment operations to achieve organizational transformation:
32e	TRANS1RelImport_EndUsrAccpt	Importance of End-user acceptance to achieve organizational transformation:
32f	TRANS1RelImport_OrgCommtTransformation	Importance of Organizational commitment to achieve organizational transformation:

Descriptive statistics for the six variables included in Research Question 7 are listed in Table 57 below. Details of the first and second most frequent responses across the complete population as well as segmented by the independent variable (private sector vs. public sector) are listed in Appendix H.

Table 57: Research Question 7 - Descriptive Statistics

Question	*Variable*	*Type of Org (Priv_PS)*	*Mean*	*Std. Deviation*	*N*
32a	TRANS1RelImport_GovDesign	Private Sector	4.11	.835	135
		Public Sector	4.31	.860	51
		Total	4.17	.844	186
32b	TRANS1RelImport_GovImport	Private Sector	4.26	.879	137
		Public Sector	4.48	.804	52
		Total	4.32	.861	189
32c	TRANS1RelImport_SusDesign	Private Sector	4.17	.772	137
		Public Sector	4.29	.672	51
		Total	4.20	.747	188
32e	TRANS1RelImport_SusImport	Private Sector	4.30	.787	138
		Public Sector	4.55	.610	51
		Total	4.37	.750	189
32f	TRANS1RelImport_EndUsrAccpt	Private Sector	4.49	.717	138
		Public Sector	4.67	.513	52
		Total	4.54	.671	190
32g	TRANS1RelImport_OrgCommtTransformation	Private Sector	4.72	.670	138
		Public Sector	4.85	.415	52
		Total	4.75	.612	190

Table 58 below summarizes each dependent variable within Research Question 7, the Pearson Chi-square, whether a violation of the minimum cell frequency has occurred and the move frequent response.

Table 58: Research Question 7 - Summary of Pearson Chi-square by individual variable

Question	*Variable*	*Pearson Chi-square*	*Most frequent Responses*
32a	TRANS1RelImport_GovDesign	0.141 > 0.05** **40% of cells violate minimum cell frequency	Somewhat important 87 (46.8%)
32b	TRANS1RelImport_GovImport	0.382 > 0.05** **40% of cells violate minimum cell frequency	Extremely important 97 (51.3%)
32c	TRANS1RelImport_SusDesign	0.819 > 0.05** **40% of cells violate minimum cell frequency	Somewhat important 90 (47.9%)
32d	TRANS1RelImport_SusImport	0.386 > 0.05** **40% of cells violate minimum cell frequency	Extremely important 96 (50.8%)
32e	TRANS1RelImport_EndUsrAccpt	0.329 > 0.05** **37% of cells violate minimum cell frequency	Extremely important 119 (62.6%)
32f	TRANS1RelImport_OrgCommtTransformation	0.734 > 0.05** **50% of cells violate minimum cell frequency	Extremely important 158 (83.2%)

Six of six variables violated the Chi-square assumption for expected cell frequency of 5 or greater (or at least 80% of cells have expected values of 5 or more). Despite these violations, the Pearson Chi-square calculation was performed. Six of six variables revealed no significant association across private and public sector organizations based on Pearson Chi-square analysis

To test the null hypothesis for Research Question 7, a MANOVA function was performed on the six dependent variables to determine whether a difference in the relative level of importance between governance, sustainment and extension capabilities to achieve transformation objectives exists. The data obtained from the variables identified in Question 7 were reviewed for alignment with the assumptions of normality, linearity, univariate and multivariate outliers, homogeneity of variance-covariance matrices and multicollinearity using the methods described in Questions 1 – 6 above.

Normality was assumed because the data sample of 183 cases exceeds a minimum of 20 responses for each dependent variable (Pallant, 2007). Linearity was determined through a review of scatterplots for each variable and no evidence of non-linearity was identified. An analysis of the Mahalanobis distance statistic found four of 183 cases exceeded the critical value of 22.46. As a result, the four cases (Cases 320, 370, 337 and 260) were excluded from the MANOVA calculation.

Homogeneity of variance-covariance was assumed because Box's M Test of Equality of Covariance found a Sig. value of 0.006 which is greater than the thresh-hold value of 0.001. Multicollinearity was assessed through performance of a correlation matrix and the values as shown in Table 59 below ranged from low (0.0 to 0.4) to moderate (0.4 to 0.8). The strongest

correlation (0.722) was found between variables TRANS1RelImport_GovDesign TRANS1RelImport_GovImport. Because the variables were below the 0.8 threshold, multicollinearity was not found and all variables were retained without further transformation.

Table 59: Research Question 7 - Correlation of dependent variables to determine multicollinearity

	TRANS1RelImport_GovDesign	**TRANS1RelImport_GovImport**	TRANS1RelImport_SusDesign	TRANS1RelImport_SusImport	TRANS1RelImport_EndUsrAccpt	TRANS1RelImport_OrgCommtTransformation
TRANS1RelImport_GovDesign	1	**.722****	.377**	.285**	.166*	.339**
TRANS1RelImport_GovImport	**.722****	1	.313**	.432**	.218**	.321**
TRANS1RelImport_SusDesign	.377**	.313**	1	.656**	.428**	.503**
TRANS1RelImport_SusImport	.285**	.432**	.656**	1	.451**	.425**
TRANS1RelImport_EndUsrAccpt	.166*	.218**	.428**	.451**	1	.475**
TRANS1RelImport_OrgCommtTransformation	.339**	.321**	.503**	.425**	.475**	1

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Table 60 below reveals that four of six variables exceeded Sig. = 0.05 and satisfy the assumption of equality of error variances. Two variables (TRANS2RelImport_EndUsrAccpt and TRANS1RelImport_OrgCommtTransformation) violated Levene's Test of Equality of Error where alpha values = 0.006 and were less than 0.05.

Table 60: Research Question 7 - Levene's Test of Equality of Error Variances

	F	df1	df2	Sig.
TRANS1RelImport_GovDesign	1.698	1	181	.194
TRANS1RelImport_GovImport	.354	1	181	.553
TRANS1RelImport_SusDesign	.012	1	181	.912
TRANS1RelImport_SusImport	3.010	1	181	.084
TRANS1RelImport_EndUsrAccpt	**7.886**	**1**	**181**	**.006**
TRANS1RelImport_OrgCommtTransformation	**7.657**	**1**	**181**	**.006**

Tests the null hypothesis that the error variance of the dependent variable is equal across groups.

a. Design: Intercept + DEMO2ORG_PR_PS1

Despite failure of Levene's test of equality for two variables, the researcher decided to not increase confidence as suggested by Pallant (2007) and Tabachnick & Fidell (2007). Confidence was retained at 95.0% with alpha (p) = 0.05 and cases were excluded pairwise resulting in 179 cases included in the calculation. The resulting MANOVA analysis found no statistically significant difference existed between Private and Public sector organizations for the combined 6 variables, F (6, 172) = 1.29, p = 0.265,Wilk's Lambda = 0.957 & Hotelling's Trace = 0.045; partial eta^2 = 0.043. Because the p value = 0.265 and > 0.05, the null hypothesis that there is no statistically significant different in the relative level of importance for governance, sustainment and extension capabilities between Private and Public sector organizations cannot be rejected.

Table 61: Research Question 7 - Transformation Coefficient Matrix

		TRANS1RelImport_GovDesign	TRANS1RelImport_GovImport	TRANS1RelImport_SusDesign	TRANS1RelImport_SusImport	TRANS1RelImport_EndUsrAccpt	TRANS1RelImport_OrgCommtTransformation
Correlation	TRANS1RelImport_GovDesign	1.000	.635	.405	.240	.162	.283
	TRANS1RelImport_GovImport	.635	1.000	.316	.407	.212	.296
	TRANS1RelImport_SusDesign	.405	.316	1.000	.603	.348	.454
	TRANS1RelImport_SusImport	.240	.407	.603	1.000	.364	.389
	TRANS1RelImport_EndUsrAccpt	.152	.212	.348	.364	1.000	.439
	TRANS1RelImport_OrgCommtTransformation	.283	.296	.454	.389	.439	1.000

The researcher was also interested to identify whether any of the six factors played a stronger role than any other. A factor reduction analysis function of the six variables was performed to evaluate these inter-relationships. The researcher excluded all outlier cases identified during prior MANOVA analysis – these were Cases 370, 320, 337, 260, 397, 347, 218, 263, 283, 133, 178, 148 222, 255 and 440). The remaining data were assessed for suitability.

The above correlation matrix in Table 61 revealed that the majority of the displayed co-efficients exceed 0.3; suggesting use of factor reduction analysis may not be appropriate (Pallant, 2007 and Tabachnick & Fidell, 2007). However, the Kaiser-Olin-Meyer (KMO) value was calculated at 0.680 which exceeds the recommended value of 0.6 (Kaiser, 1970, 1974) and the Bartlett's Test of Sphericity (Bartlett, 1954) was significant (Sig. = 0.000), both of which support use of factor reduction analysis. Because communalities for the variables were 0.570 or greater,

all variables were retained. An oblimin rotation method with 25 rotations was selected to perform the factor reduction analysis.

Table 62: Research Question 7 - Total Variance Explained

	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings
Component	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total
1	2.865	47.751	47.751	2.865	47.751	47.751	2.514
2	1.113	18.542	66.294	1.113	18.542	66.294	2.054
3	.721	12.011	78.304				
4	.574	9.559	87.863				
5	.478	7.971	95.834				
6	.250	4.166	100.00				

Extraction Method: Principal Component Analysis.

Two of the six components had eigenvalues that exceeded 1.0, as shown in Table 62 above. The scree plot provided in Figure 9 shows that the first two components lie on the vertical axis where components three through six bend to follow the horizontal axis. A Monte Carlo PCA for Parallel Analysis was performed which confirms that use of two components is appropriate in that the eigenvalues for the two components both exceeded the corresponding eigenvalues for a randomly generated data matrix of the same size (6 variables x 179 respondents).

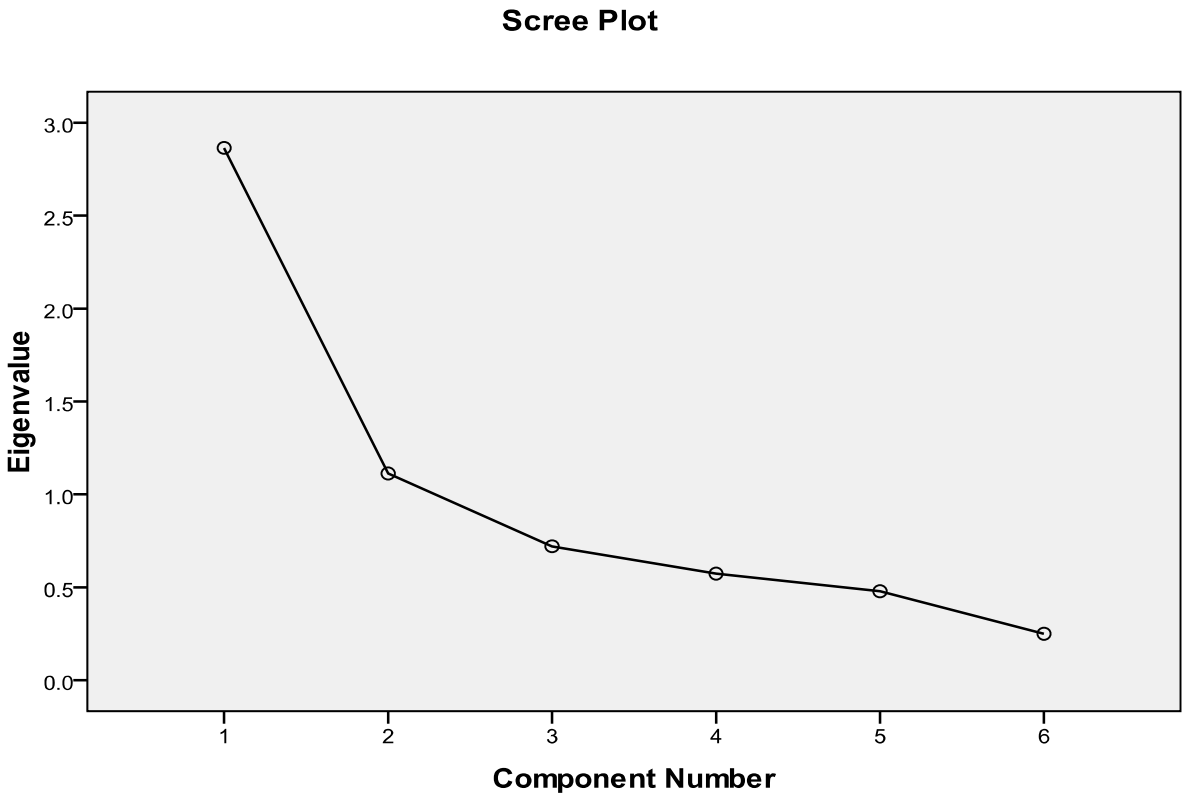

Figure 15: Research Question 7 - Transformation Scree Plot.

The factor reduction analysis solution reveals 66.3% of the variance is explained by two derived components. Table 63 below shows that Component 1 contributes 47.8% and Component 2 contributing 18.5% for a total explanation of 66.3% of the variance.

Table 63: Research Question 7 – Factor Reduction Components by Variable

	Pattern Matrix Component		Structure Matrix Component	
	1	2	1	2
TRANS1RelImport_GovDesign	-.017	-924	.302	-.902
TRANS1RelImport_GovImport	.071	-855	.371	-.880
TRANS1RelImport_SusDesign	.685	-222	.763	-.462
TRANS1RelImport_SusImport	.707	-.151	.760	-398
TRANS1RelImport_EndUsrAccpt	.817	.201	.746	-.085
TRANS1RelImport_OrgCommtTransformation	.743	-.033	.755	-.293

Extraction Method: Principal Component Analysis.

Rotation Method: Oblimin with Kaiser Normalization.

a. Rotation converged in 4 iterations.

Table 64 below shows that Component 1 is best described by variables 3 – 6 (Sustainment design, Sustainment importance, End-user acceptance and organizational commitment to transformation). Component 2 is best described as inclusive of the Governance design/performance and level of importance within the organizations.

Table 64: Factor Reduction Analysis component correlation

Component	1	2
1	1.000	-.351
2	-.351	1.000

Extraction Method: Principal Component Analysis.

Rotation Method: Oblimin with Kaiser Normalization.

A weak negative correlation of -0.351 (see Table 64 above) was found between the two components indicating appropriateness that perception of ERP governance design and

importance can be assessed separately from the perception of ERP sustainment and extension as contributors to transformation (Watson, Clark & Tellegen, 1988; Pallant, 2007).

Ten individual variables within the Research Questions that were found to have a significant association across the groups based on performance of Pearson Chi-square analysis are listed in Table 65 below:

Table 65: Summary of Individual Variables found with significant association across groups

Research Question	Survey Question	Variable Name	Pearson Chi-square	Most Frequent Response
1	14	GOV4DesMaturity_Count	0.040 < 0.05	Custom in house (45.1%)
2	10e	GOV6ImpRespons_ITResMngmt	0.010 < 0.05	No responsibility (23.4%)
2	10g	GOV6ImpRespons_BusAppSelection	0.032 < 0.05	Recommends (22.2%)
2	15	GOV7ImpRepresentation	0.020 < 0.05	By IT Steering committee (36.5%)
3	16d	SUS2StructureForm_AppOps	0.024 < 0.05	Centralized (61.3%)
5	24	EXT4_ERPModulesCount_CurrentSingMult	0.009 < 0.05	Implemented 15 modules (5.6%)
6	31a	EXT12_ERPAccept_NewSoftware	0.019 < 0.05	Most important
6	31b	EXT12_ERPAccept_GovtRegs	0.001 < 0.05	2nd most important
6	31e	EXT12_ERPAccept_Competitiveness	0.000 < 0.05	3rd least important
6	31f	EXT12_ERPAccept_SOA	0.042 < 0.05	Least important

The researcher presents a summary of the seven hypotheses and determination whether the null hypothesis can be rejected and/or whether the alternative hypothesis can be accepted in Table 66 below.

Table 66: Summary of Seven Hypotheses tested during Phase A

Hypothesis	Description	P results	Null hypothesis
1_0	There is no significant difference in how public sector organizations design and perform ERP governance compared to private sector organizations.	P = 0.043; < 0.05	Reject Null and accept the Alternative
2_0	There is no significant difference in importance for public sector governance of ERP technologies compared to private sector organizations.	P = 0.055; > 0.05	Can not reject Null
3_0	There is no significant difference in how public sector organizations design and manage sustainment structures for ERP technologies compared to private sector organizations.	P = 0.147; > 0.05	Can not reject Null
4_0	There is no significant difference in importance for public sector sustainment of ERP technologies compared to private sector organizations.	P = 0.588; > 0.05	Can not reject Null
5_0	There is no significant difference in time frame within public sector organizations to accept, and achieve routinization of ERP technology following the initial implementation as compared to private sector organizations.	P = 0.041; < 0.05	Reject the Null and accept the Alternative
6_0	There is no significant difference in time frame for public sector organizations to extend or upgrade the baseline ERP implementation compared to private sector organizations.	P = 0.002; < 0.05	Reject the Null and accept the Alternative
7_0	There is no significant difference in relative importance between ERP Governance, Sustainment and Extension capabilities to achieve transformation objectives across public and private sector organizations.	P = 0.265; > 0.05	Can not reject Null

However because the collected data of only 194 qualified responses adjusted downward for exclusion of outliers were less than the 377 needed responses, the quantitative findings summarized in Table 66 above fail to achieve statistical significance. In accordance with the proposed sequential exploratory mixed method approach identified in Chapter 2 and to collect additional evidence, the quantitative information collected in Phase A was used to prepare for Phase B (the qualitative phase) of the research study. The following sections present the results of four interviews that occurred during Phase B of the research study.

Phase B: Selection of Interview Population

Question 33 of the survey requested that respondents indicate willingness to participate in an additional follow-on interview (between 45 and 60 minutes in length). Any interested survey respondents were asked to provide name, telephone number and an email address so that subsequent contact could be made. Twenty-nine of the 194 total respondents indicated a willingness to be participants in the interviews. Four respondents (two private sector organizations – a manufacturing company and a pharmaceutical company - and two public organizations – a state/local government entity and a federal agency) were selected. Initial contact inviting the respondents to participate in an additional interview was submitted by email. Following a return confirmation from the Phase B respondents of willingness to participate, the interview dates were established.

The researcher prepared for the interviews by analyzing each organization's survey responses and comparing those to the most frequent and 2nd most frequent survey responses. Comparative analysis of responses between private and public sector organizations was also performed (each organization's survey responses are included as Appendix I). The researcher also generated five additional questions (see Appendix J) to aid the interview discussion: Question 1) what are your organization's current and future focus areas for improving ERP governance activities? Question 2) what are your organization's current and future focus areas for improving ERP sustainment activities? Question 3) what are your organization's current and future focus areas for extending ERP across its current state? Question 4) how have your ERP governance, sustainment and extension activities contributed to organizational transformation

since ERP implementation? and Question 5) what additional organizational transformation goals can be achieved as a result of implementing, governing, sustaining and extending ERP?

The prepared interview materials, along with declarations of informed consent and confirmation of the researcher's obligation to retain privacy on the interviewees, were forwarded to the interview participants in advance. The four interviews were then conducted via telephone. The researcher requested and received permission from the participants to digitally record the conversations. The interviews were transcribed and entered into NVivo7 for coding to identify themes which are provided in Appendix K. The following sections describe the results of the four interviews.

Phase B: Interview Organization 1

The first interview was conducted with the supply chain and IT systems leader for a U.S. food manufacturing company with global manufacturing, distribution and sales operations. Organization 1 has manufacturing operations in the U.S. Canada, Latin America, Europe and Asia and distribution/sales operations in 120 countries with sales amounting to over $7.5 billion. Organization 1's ERP implementation focused on implementation of 15 modules: these included finance (general ledger, accounts payable & receivable, and fixed assets), business intelligence, forecasting and demand supply, inventory control, master production scheduling, materials resource planning, order management, product configuration, purchasing, sales & marketing, and shop floor control. Organization 1's ERP implementation was completed in 2008.

While the researcher provided materials to guide the interview, the interviewee in turn forwarded two internal presentations that covered the similar subject areas of governance, sustainment and extension. The dialogue with Organization 1 was spirited as the interviewee had

been with the organization almost one year and was very enthusiastic about her role as creating a link between IT/technology and the business. A walk-through of these additional materials as well as the materials prepared for the interview was performed.

Governance

Organization 1's responses to the Governance sections of the survey identified itself as being "mature" in its alignment between IT and the overall business vision and strategy. Organization 1 reported that decision making responsibilities for IT strategic goals & objectives, business applications requirements definition and IT investment prioritization were a "shared" responsibility between the business and IT, while decision-making responsibilities for IT strategic goals & objectives, IT architecture and IT infrastructure were "IT centralized". Organization 1 governs its ERP via a stand-alone governance organization that spans enterprise, back-office and front-office applications implemented as part of the ERP suite. Organization 1 further defined its ERP governance organization decision-making and responsibility structure for ERP in that it "generates" IT alignment requirements for the business, it "reviews" IT investments, IT risk, IT performance, IT resources and business requirements definition; and it "approves" business application selection/procurement and IT project selection. The ERP Governance organization is staffed by senior executives that were reported to be somewhat active and engaged, while enforcement of governance organization decisions is performed by the IT steering committee. As summarized above, Organization 1's ERP governance organization appears to mirror Weill & Ross's (2004) IT governance performance model arrangement 1 (see Figure 3) where a close & trusted working relationship between the business and IT exists. As

per Weill & Ross (2004, p. 133), this arrangement "requires IT groups to understand the business needs, and requires business and IT to trust each other".

The following comments reveal a high degree of interactivity to align vision and strategy action between the business understanding and trust is reflected in the comments collected during the first interview below:

> Our whole model [for] our enterprise application governance model is, we take a single set of priorities to deliver the greater good for the larger audience.
>
> It starts with our PAG which is our process action group, which is your senior leadership. So they're setting strategy, priority, budget, and they're basically giving approval for work to commence in the space.
>
> We have account-to-report, make-to-ship, and order-to-cash, and we call them streams, and each of those streams has a PAG which is made up of senior leadership in that space which basically sends directions as priority and provides resources in that stream for work to be done.

Organization 1 also described briefly the role its governance organization was performing reviewing associated performance metrics and seeking to drive personal accountability.

> The PAGs are really taking corporate direction and translating into what those projects mean in their space. I'm trying to think of the best way to describe it. You know, everyone's watching the scorecards, enablers, its common enablers here at [Organization 1], which is the benefit. What you signed up for has benefits.

Sustainment

Organization 1 responded to the sustainment sections of the survey by stating that responsibility for definition of business process design is "decentralized to the business units", while functional application design, development, operations, infrastructure network & communications, user role & authorizations, help desk and end-user training are "centralized" within the sustainment organization. Organization 1 "partially achieved" its objectives and

reported that it had "no formal measurement processes in place" to assess and manage the services it provides in its sustainment organization. Organization 1's resources support "both sustainment and deployment". Organization 1's sustainment operation is a highly visible function, placed only 1 level below the CEO. Organization 1 reported that retention of ERP skills within the core ERP team was "extremely important". The interviewee, however, did not have information as to budget increases or decreases since implementation, having joined Organization 1 within the past year. Based on the survey responses, Organization 1's sustainment operation appears to follow Mirchandani's (2004) "Traditional IS Model" (see Figure 5).

Information collected during the interview appears to confirm Somers & Nelson (2004) where the primary focus was to conduct a successful implementation, but some entropy appears to have occurred in the post-implementation period. The following comments support this perspective:

> Deploy, deploy, deploy, just don't break the business. Get it in. The primary driver was reducing a huge spaghetti mess of Legacy applications as well as providing some opportunity to provide business enablers ……and saving[s].
>
> [Organization 1] did a really great job of deploying.
>
> Customers didn't even know [we had gone live]. Which was the whole goal [to] not to do a 'Hershey'.
>
> The ratings for deploy were very good, the ratings for sustained were horrible.

To respond and improve sustainment operations, one of Organization 1's key strategies has been re-focusing end-user training to address the end-to-end process. By doing so, it could assist in overall job performance, beyond just how to use the system.

> It was just focusing on what happens on the screen as opposed to understanding your piece in the big picture process. So again, role-center training is how to do your job better. Not just having to use the tools because we found we can train you to do your job better, you will by default, effectively use the tools better.

Organization 1 also described the importance of developing strong data management processes in addition to implementing process focused training and end-user support.

> Supporting of this ongoing sustain process, there's 3 elements that are foundational to this ongoing process improvement. The first is, clearly defining your master data ownership process. [Organization 1] still has a long way to go in this area. We recognize that this is something that we need to fix, but it gets back to, you can have the best, most efficient operating process but if you're building it on faulty master data, you're still not going to have an effective [process].

Organization 1 described that it was formalizing system performance and business process metrics and beginning to assign personal accountability to drive additional organizational discipline.

> Whatever your metrics are at your scorecard level, you need to take them down to the appropriate level of detail, usually 2 to 3 levels down, so that they ultimately become the responsibility of somebody's role in the organization.
>
> In our metrics piece, we have an 8- or 10-point level of definition for each metric so, who's the owner, how is it calculated, what frequency is it created, where does the data come from? Along those lines there are 10 different things for each metric that has to be very clearly defined.

Acceptance and Extension

Organization 1 responded to the Acceptance and Extension sections of the survey by stating it followed a "Phased" implementation approach, thus allowing for enhanced organizational learning as the 15 modules within its ERP suite were deployed through the organization. While having "clearly defined" objectives, Organization 1 stated it only "partially achieved" those objectives. Organization 1 stated that its post-implementation stabilization

period was “more difficult than expected”, but that “change was accepted when communicated with sound rationale.” Internal staff turnover within the ERP core team was equal to other IT staff. Organization 1 reported that an upgrade might occur within the next 12 to 24 months, but no modules had yet been identified as a specific planned implementation. Organization 1 reported that expiration of its software maintenance agreement, addition of new software functionality and extension of its supply chain capability were the first, second and third most important reasons for upgrading its ERP application suite. Organization 1 reported that organizational commitment to achieving transformation was “extremely important”. Based on the survey responses, Organization 1 appears to be within Klee’s (2005) Extending value within the ERP lifecycle phase.

Organization 1 again emphasized the contribution that its training strategy focusing not on how to use the system, but how to do one’s job better, contributed to achieving acceptance of the ERP application.

> The role-centered training strategy, our focus is on how to do your job better, not on just how to use SAP, and actually you can take this and apply it to anything. It's not, we've learned that you can't just focus and train people on how to use the tool. You have to train them on what's the day in their life in that space, whatever the space is. What do you need to do to do your job better?

Organization 1 also described the critical importance that empowering and leveraging power-users within the organization to continue to drive acceptance and routinization of the ERP application.

> What kind of happened is we really depended on power users with deployment, and we did a really great job and built wonderful relationships and networks, and then it kind of withered on the vine. We didn't formally really do a good job of maintaining it as we meant to when it went out at deployment. So we're coming back to really stress the importance of the power user network organization.

You have to identify who are the power users in your organization who have responsibility for keeping the training to be real current. They're also tasked with on-boarding new users of the area, so very much, we develop the materials, give them the body of knowledge, they take ownership for maintaining it because it's their work instruction, their work processes. Their stuff. They have to own it, and then they train new people on it.

It starts with the process. Whenever someone is coming to you with a problem, I need to implement this system to solve my problem, well you step back and you have to say, what's your process, validate it or refine it to have it be what you want it to be, what are the roles within the process, so who does what, when? Once you define the process and the roles then you have to define your metrics and targets, so you know what are the objectives in that space.

And so they provide that thought leadership based on where the process owner wants to take the process. These are the people who are planning and designing the implementation of the optimization and improvements. They understand that if I push down here, it's going to have an impact over there, and how do I handle that? How do I account for it? So they're designing and implementing. They work really closely with the power users.

Additional Questions

When asked about focus areas for continuing to improve governance, sustainment and extension of the ERP application, Organization 1 responded with passionate enthusiasm that acceptance and routinization is achieved through continued focus on the business process supported by the ERP application.

I look at my space as again, here I am between the technology and the business and that so much of the opportunity for business or benefits capture comes not from just using the technology but understanding the process that the technology is supporting. Focusing on the processes.

Understanding what [are] the aspirations of the process? Where do you want to be? What's driving the process? Where's the competition? What's the leverage point? Understanding all that drives how you implement the technology because I can guarantee you if you implement technology without having an understanding of the process, and you've got a bad process in place, you're just going to get bad stuff faster. And you're pouring cement.

> That the key to our model is a focus on ongoing process management to get benefits capture.

Regarding transformation, Organization 1 responded that full transformation was still in process, but the organization found optimization of business processes would aid in achieving full benefit from its ERP system:

> Again, it comes back to process optimization. Right, that we've recognized that without optimizing the processes, you're going to gravitate back to fragmentation, and so we want to leverage our tool in a sustainable way to capture the full benefits, and it's only going to happen if we have commitment to ongoing process management.

Organization 1 also noted that transformation is a continuous and cyclical process:

> Because that's what happens in the communication and change management space. And it's an ongoing thing. You proceed through this the first time, and you end up with a new normal, and then at some point in the future you start back at the beginning again.

Further, Organization 1 shared that its organization had recently initiated a new global marketing and distribution initiative launching into new markets in Russia and China. As external and internal environmental forces shape and redefine the organization, it is paramount that Organization 1's ERP organization continues to work with the senior leadership to remain aligned with the business vision and strategy.

> But 3 years in, when you look back and say, "Okay, so where are we, and what do we need to focus on now?"

Confirming Yates and Van Maanen (2001), Organization 1 reflected that time also plays a critical role in routinization and ultimate transformation.

> So over time, it will kind of cross the entire corporate space, but that will take a long time.

Summarization of key themes emerging from the Organization 1 interview is provided in the following table:

Table 67: Organization 1 Interview Themes

Governance	• Engaged senior leadership providing resources and reviewing for results
Sustainment	• Focusing on the business process • Extending individual process knowledge, ownership and personal accountability • Embedding power user networks into the organization • Amending training to enable end-users to do their job better, not just use the application
Extension	• Corporate global business initiative driving what comes next
Transformation	• Avoiding fragmentation to establish a "new normal" • Transformation takes time

Phase B: Interview Organization 2

The second interview was conducted with the vice president of global application development and support for a U.S. pharmaceutical company with global manufacturing, distribution and sales operations located in 100 countries and sales exceeding $3.5 billion. Organization 2's ERP implementation was initially completed in 1996; so it has an extensive run-time and organizational experience with ERP applications. Also, of the four interviewed organizations, Organization 2 has deployed the most extensive set of ERP modules (25), including financials (general ledger, accounts payable & receivable and fixed assets), business intelligence, corporate performance management, customer relationship management, distribution requirements planning, engineering change management, forecast demand planning, human capital management, inventory control, master production scheduling, materials resource planning, order management, payroll, portal, product configuration, purchasing, service oriented architecture, shop floor control, and supplier resource management. Further, Organization 2

completed an upgrade to SAP's ECC 6.0 in 2008. The interviewee had been with Organization 2 for nine years.

Governance

Organization 2 responded to the Governance sections of the survey by describing its overall state of IT alignment with the business strategy & vision as 'defined'. Similar to Organization 1, Organization 2 reported that decision making responsibilities for IT strategic goals & objectives, business applications requirements definition and IT investment prioritization were also a "shared" responsibility between the business and IT, and that its decision-making responsibilities for IT strategic goals & objectives, IT architecture and IT infrastructure were "IT centralized". Differing from Organization 1, Organization 2 governs its ERP suite within an overall IT governance organization that spans enterprise, back-office and front-office, business unit and end-to-end applications. Organization 2 further defined its ERP governance organization decision-making and responsibility structure in that it "approves" IT alignment requirements for the business as well as all IT investments, while it "reviews" IT risk management, business application selection and IT project selection. Organization 2 reported its governance organization had "no responsibility" for IT resources and business requirements definition as these are responsibilities of the IT projects themselves. The ERP Governance organization is staffed by senior executives that were reported to be "fully active and engaged", while enforcement of governance organization decisions is performed by Organization 2's CIO.

Organization 2 commented on its governance structures with the following:

> When I respond to governance, I'm responding to prioritization, projects. I'm responding to governing changes or modifications to the software.

> The governance organization is a higher level organization that deals with, you know, big changes that would govern over anything that was going to drastically change our ERP system.
>
> Prioritization and approval of projects, we have a pretty good method, you know, with regional steering committees that kind of look at, look at their overall budget, look at what you're trying to achieve and then prioritize their projects in different ways, either their compliance or they're…going to increase revenue or they're going to reduce cost or whatever they're going to do and make a decision that way.
>
> For bigger projects, and regardless of whether they're ERP or non-ERP, to go back…because we have to do a write-up of major project proposals, a write-up that has an ROI cost relation and, you know, delineates where the benefits are.
>
> So we're trying to implement a value capture where you come back and audit, for bigger projects, whether or not that was achieved.

Sustainment

Organization 2 responded to the sustainment sections of the survey by stating that responsibility for definition of business process design is "shared within a Center of Excellence", while functional application design, development, operations, infrastructure network & communications, user role & authorizations, help desk were provided by "centralized" resources. Sustainment of end-user training relied on use of "business and shared/Center of Excellence" resources. Organization 2 "achieved" its objectives and reported that it fully implemented formal measurement processes to assess and manage the services it provides in its sustainment organization. Organization 2's sustainment resources are "fully dedicated to perform sustainment tasks". Organization 2's sustainment operation is organizationally aligned at the 3rd level below the CEO. Organization 2 reported that retention of ERP skills within the core ERP team was "somewhat important". The interviewee reported that its annual budget change had increased between 0% and 10% in the years following implementation.

Based on the survey responses, Organization 2's sustainment operation appears to incorporate aspects of Mirchandani's (2004) "Competency" support model (see Figure 5).

Organization 2 confirmed a close association with the business units to capture business requirements:

> The business requirements are collected between our business relationship manager and the business, and so that's the first step in terms of what it is that they need, and then I run the application development group and we'll do the deeper dive on the requirements.

Organization 2 also has discrete organizational structures for sustaining its ERP application:

> We separate our maintenance and support from our enhancements and the infrastructure has their metrics that was, you know, uptime, if you will, 99.9% uptime and track against those SLA's for problem tickets. We've got metrics that say, you know, that define your problem tickets according to criticality and SLA's and how fast they will be resolved. SLA and communication back and forth.
>
> We've got a separate group that does production support and they're got sort of a little knowledge based knowledge that tracks, you know, frequent problems and you know, we can track and be able to solve faster. We do the root cause analysis that does highlight when training's an issue. When it'[s] apparent that the reason why we're getting certain calls is that there's a training void somewhere in the organization and try to address those directly.
>
> Another thing that could be called sustainment, you know, because we're FDA monitored, it's very important that we keep our documentation evergreen. So we do have an evergreen process with the HP Quality Center to keep our user requirements, our design specifications, our test scripts 'evergreened' with each change.

Extension and Acceptance

Organization 2 responded to the Acceptance and Extension sections of the survey by responding that it implemented a "Phased" implementation approach as it implemented 25 modules within its ERP suite. Organization 2 stated it had "clearly defined" objectives for its implementation that were "achieved". Organization 2 described its post-implementation stabilization period as "difficult", which was a slightly lower ranking reported by several other

organizations. Organization 2 also reported that "change was accepted when communicated with sound rationale." Organization 2's internal staff turnover within the ERP core team was equal to other IT staff. Organization 2 reported that an upgrade might occur within the next 37 to 48 months with an emerging plan to add 5 additional modules (note: during the interview, Organization 2 confirmed its normal upgrade schedule follows a formal five year cycle). Organization 2 reported that compliance with government regulations, expiration of its software maintenance agreement, and enhancing its competitiveness within its industry were the first, second and third most important reasons for upgrading its ERP application suite. Organization 2 reported that organizational commitment to achieving transformation was "extremely important". Based on the survey responses, Organization 2 appears to be within Klee's (2005) Extending value and approaching Klee's (2005) Maintaining value ERP lifecycle phases.

Organization 2 confirmed that a major challenge of the implementation and organizational acceptance of the ERP application hinged around the area of training and the need to emphasis continued business process understanding.

> So the difficulty was in the area of, again, change management, understanding the process.
>
> But it's a change management component. From what I understand, there was some situation in our warehouse where they were shipping product but not denoting it in the ERP system. They were just shipping…[for]getting the paperwork and shipping. It got a little bit chaotic. They had to do a lot to clean it all up after the fact.

Additional Questions

When asked about current or future focus areas to improve Governance, Sustainment and Extension of ERP, Organization 2 provided the following comments.

Regarding Governance, Organization 2 responded:

> We're pretty mature. So we're not really doing anything drastically different to change that governance process.

Regarding Sustainment, Organization 2 responded:

> We do have…RWD InfoPak, which is the training tool that SAP promotes. It's more specific to process and how exactly each process is done. So that's what's in place. We don't have, right now, any future plans on, you know, doing anything significantly different.
>
> Where for bigger projects, and regardless of whether they're ERP or non-ERP, to go back…because we have to do a write-up of major project proposals, a write-up that has an ROI cost relation and, you know, delineates where the benefits are.

Regarding Governance, Extension and Transformation:

> Governance and extension are more important in the organizational transformation.
>
> There has been a big transformation for the company and it's still apparent. The extension is transformational because of all the new things that have brought…like the CRM system and now the ability to do a web channel and things of that nature, which start transforming the way we do our work.

As a conclusionary remark, Organization 2 offered that the research study might find differences in Governance, Sustainment and Extension might more be based on the applications being put into use and where in the implementation and deployment lifecycle, rather than discrete difference across the private and public sector segments.

> There are some differences you're going to find in the lifecycle of the ERP and your particular ERP. There's probably going to be some themes that are more specific to the application you use, more specific to the lifecycle you're in and then the private or public [segments].

Key themes emerging from the Organization 2 interview are summarized in the following table:

Table 68: Organization 2 Interview Themes

Governance	• Experienced, engaged and mature
Sustainment	• Fully defined, established structures • Focusing on value capture • Continuing focus on business processes
Extension	• Moving beyond ERP-centric focus to integrate new technologies
Transformation	• Significant accomplishments • Continuing transformation through incremental and careful governance and extension

Phase B: Interview Organization 3

The third interview was conducted with the operations manager of a U.S. state and local government entity located in the mid-Atlantic region with annual revenue of almost $900 million. Organization 3's ERP implementation focused on deployment of Oracle financials (including accounts payable & receivable, fixed assets, and general ledger), human capital management, portal, payroll and workflow applications for state and local governments. Organization 3's ERP implementation was completed in 2006 and relies on Oracle's 'On-demand' hosting solution to support hardware and software operations.

Governance

Organization 3 responded to the Governance sections of the survey by reporting its overall state of IT alignment with the organization's business strategy & vision was 'evolving'. Organization 3 reported that decision making responsibilities for IT strategic goals & objectives, IT architecture and IT infrastructure were "IT centralized" while business applications requirements definition and IT investment prioritization were a "shared" responsibility between the business and IT. Organization 3 governs its ERP within its overall IT governance

organization that spans back-office and end-to-end applications implemented as part of the ERP suite. Organization 3 further defined its ERP governance organization decision-making and responsibility structure in that it "approves" IT alignment requirements for the business, IT performance management and IT resources management requirements while it "consults" on IT investments, IT risk management, business requirements definition, business application selection/procurement and IT project selection. The ERP governance organization is staffed by senior executives that were reported to be "fully active and engaged", while enforcement of governance organization decisions is performed by the IT steering committee. Organization 3's governance structure appears to follow a more centralized governance model than Organization 1 and 2, approaching Governance Performance Arrangement 3, which is used "when cost control is more important" (Weill & Ross, 2004, p.134).

Organization 3 reported that its sponsoring executives were satisfied with its ERP implementation, but that governance was a secondary process compared to the activities of sustainment and extension.

> The Executives, I would have to say, they are all very, very, happy.

> I was just thinking to myself, is kind of the whole thing about Governance is that the reality of what happens is that the sustainment and extension, if you're drawing it in terms of the size, are bigger pieces than Governance. The Governance kind of gets shoved in there as a secondary thought. Where Sustainment being, in my eyes, one of the biggest things that we have to deal with because of the level of a lot of the users and turnover and complexity.

Organization 3's governance strategy in its current state appeared to be simple and direct.

> Get it done, keep it alive.

Sustainment

Organization 3 responded to the sustainment sections of the survey by describing its responsibilities for definition of business process design, functional application design, development, operations, infrastructure network & communications, user role & authorizations, help desk and end-user training are "centralized" within the sustainment organization. Organization 3 "partially achieved" its objectives and reported that it had "no formal measurement processes in place" to assess and manage the services it provides in its sustainment organization. Organization 3's resources support "both sustainment and deployment". Organization 3's sustainment operation is placed 4 levels below the CEO/Agency head. Organization 3 reported that retention of ERP skills within the core ERP team was "extremely important". The interviewee reported that its budget had decreased by greater than 10% since implementation. Based on the survey responses, Organization 3's sustainment operation appears to follow Mirchandani's (2004) "Traditional IS" support model.

> Basically, we should have had since we've gone live maybe a hand full of times where the instances was not available; our up times has been maybe 99.8% over three year life. In terms of SLA's (service level agreements) for support, that's kind of a little harder for a while in terms of the user, the Help Desk has been handling a lot of their questions, but not necessarily versed in how to fix the issues.

Despite establishment of SLAs, Organization 3 shared a level of frustration in that the SLAs appeared to unachievable based on the level of available resources.

> They had set SLAs up, but we were never going to meet them.

Organization 3 has been working to refine and improve its Sustainment activities despite strained resources.

> We're trying to help more which we are doing more to sustain kind of Help Desk type work, and in the meantime still trying to balance the extension of doing new improvements in the system that will help people do things better.
>
> And also that gets back to we're trying to do Help Desk support as a team, as well as move things forward, and it's hard to balance the SLA's that have been set up, the timing, with the timing spent in meetings looking at moving things forward.

Organizational resistance was noted in how end-users worked with and accepted delivered end-user training.

> What has been difficult is, the culture there, users expect somebody to sit down with them and walk you through …different things. We've been met with a lot of resistance.
>
> A lot of the users do not like UPK, which makes the training very difficult.

Acceptance & Extension

Organization 3 responded to the Acceptance and Extension sections of the survey by stating its implementation used a "Big Bang" approach as it implemented 12 modules within its ERP suite. Organization 3 confirmed it had "clearly defined" objectives for its implementation that were "partially achieved", and reported a post-implementation stabilization period that was "much smoother than expected". Organization 3 also reported that "change was extremely difficult". Organization 3's internal staff turnover within the ERP core team has had lower turn-over compared to other IT staff. Organization 3 also reported that an upgrade might occur within the next 24 to 36 months with an emerging plan to add 2 additional modules. Organization 3 reported that compliance with government regulations, addition of new software functionality and expiration of its software maintenance agreement were the first, second and third most

important reasons for upgrading its ERP application suite. Organization 3 reported that organizational commitment to achieving transformation was “extremely important”. Based on an assessment of Organization 3’ survey responses, Organization 3 appears to be continuing within Klee’s (2005) Implementation Phase I ERP lifecycle phase.

Organization 3 reported mixed results in achieving its objectives, primarily due to need to control costs:

> I would say from the Executives, they definitely would say that they achieved their objectives. They’ve got a lot more visibility into what’s going on now, and there’s a lot more processes that are in place at once, Workflows, can find out where anything is. Online benefits, the whole process is significantly improved from what is was.
>
> Where the partial part come[s] is [from] one of our biggest organizations (Department of Engineering); because a lot of what they do is project based. We did not implement a project for grants for Oracle was something that people really wanted, and honestly, really needed, but when the implementation occurred; it was [a] budgetary decision to cut those modules. And, we’ve not been able to find the resources financially or people wise that we would be able to.
>
> What’s the biggest bang for your buck right now.
>
> One of the new modules is the Performance Management module, but we are not sure we are going to use it. We've just created a Total Compensation statement that you can see total cost of pay and benefits....The 3rd area of focus is reporting. Our data is there, we need to know the best way to get it out to you. We purchased a tool called NOETICs, we are using their platform and their views to get the information out...it has been pretty successful.
>
> Yeah, there are a couple of different fronts. One in the Finance area is focusing on the P2P modules and functionality; we recently implemented I-procurement; and now want to with I-procurement; enhance the shopping cart look and feel to purchasing is something called "punch out". It’s allowed people to go to an actual vendor's site and find their items on their site so that we don't even need to maintain that item.
>
> You know there was talk of moving to CRM. There is a lot of interest and that definitely goes to the budget crunch issues. We’re almost moving now, 80% of our time, 70% sustainment. So, you really can’t really take on a big project such as CRM.

Additional Questions

When asked about focus areas for improving current or future Governance, Sustainment and Extension activities, Organization 3 responded with the following:

Regarding Governance, Organization 3 stated:

> What I would say are areas of improving governance rely on the new things that we are doing gives us the opportunity for us to redefine how things are organized from a Governance perspective and as we are going through, we're implementing one of our new modules in the P2P (I-supplier) and providing an opportunity to structure what we don't have in place right now. I would say not going back and revisiting what's there, but as new things come on.

Regarding Sustainment, Organization 3 stated:

> We're trying to help more which we are more doing to sustain[ment] kind of Help Desk type work, and in the meantime still trying to balance the extension of doing new improvements in the system that will help people do things better. And, the Governance kind of gets stuck in the background somewhere.
>
> Right now, we're just trying to figure out what's the best path to go. We're actually in conversation yesterday with Sustainment Issues, with the training, is that people aren't getting it, and people are never going to get it. Is it more training? Is it going back to the super user, doing it to create some type of certifications? We're trying at the training process and making sure are people as versed and are we giving everyone the opportunity to learn.
>
> One of the things they are looking to try to do, Training being centralized because of budget crunches, we are trying to ……spread the wealth a little bit. We are looking at 'Is there a way we can develop super users out in the Department?' they can assist from the questions coming into our area. We are centralized but we're interested in maybe trying to change that.

Regarding Extension, Organization 3 stated:

> Short Term, I would say there are a couple of areas. Primarily on the P2P side, looking at where some cost savings measures, where you can punch out the different things that we can benefit from; organizational buying, by consolidating purchasing 100 reams of paper; negotiate a better price; there a whole bunch of areas in purchasing. On the HR side, performance management, workflow processing; verify that everyone's goals are in line with the [organization].

You know I would say that is becoming a higher priority. Now, because it change[s] some of the things that we can do like modules that we're looking at implementing now are in the supply chain area.

Yeah, and that is strictly a budget issue. The plan was much, much sooner; we are definitely interested in upgrading we are on Oracle version 11.510.2 and want to upgrade to release 12; our plan would be to start not next year, but the year after that; but I think that is in jeopardy now unless we can find some really cheap, good way to do it.

Key themes emerging from the Organization 3 interview are summarized in the following table:

Table 69: Organization 3 Interview Themes

Governance	• Senior executives satisfied with initial implementation • Focused on budget concerns and keeping the system "alive"
Sustainment	• Primary focus of the ERP organization • Technical infrastructure/hosting solution is working • Seeking to improve training & help desk methods
Extension	• Managing some end-user un-met expectations • Dealing with end-user resistance to change • Budget constraints slowing extension & upgrade
Transformation	• Achieving data transparency • Implementing stronger organizational controls • Still underway

Phase B: Interview Organization 4

The fourth interview was conducted with the ERP system program manager for a U.S. federal agency supporting global supply and logistics with annual revenue of almost $38 billion. Organization 4's ERP implementation intended to transforms its supply and logistics business processes by deploying 21 modules within SAP's ECC release 5.0. These included financials (accounts payable & receivable, fixed assets, and general ledger) business intelligence, corporate performance management, customer relationship management, engineering change management, forecast demand planning, inventory control, master production scheduling, order management, portal, production control, product lifecycle management, sales & marketing, supplier

collaboration scheduling, supplier resource management, supply chain management and workflow. Organization 4's ERP implementation was completed in 2007.

Governance

Organization 4 responded to the Governance sections of the survey by stating that its overall alignment of IT with the business strategy & vision was 'mature'. Organization commented that:

> I think the rationale for putting mature in here was that there is...there was documentation from DOD to transform our business ...uh... processes. So, it came from...on high from the department of defense, right? With ...uh... their guidance and their policy on this ...um... on how to do the ERP ...um... and various milestones and how you would manage a system like this. But, they were a top level guidance.

Organization 4 reported that decision making responsibilities for IT strategic goals & objectives, IT architecture and business applications requirements definition were "business centralized", while IT infrastructure was "IT centralized" and IT investment prioritization was a "shared" responsibility between the business and IT. Organization 4 governs its ERP systems within a stand-alone ERP governance organization that spans enterprise, front-office, back-office, business unit and end-to-end applications, the majority implemented as part of the ERP suite. Organization 4 further defined its ERP governance organization decision-making and responsibility structure in that it "approves" IT alignment requirements for the business, IT investments, IT performance management, IT risk management, and IT resources management requirements while it "reviews" business requirements definition and business application selection/procurement and consults on IT project selection. The ERP Governance organization is staffed by senior executives that were reported to be "fully active and engaged", while enforcement of governance organization decisions is performed by Organization 4's CIO. Based

on the preceding, Organization 4 appears to follow Weill & Ross's IT governance performance model arrangement 2 (see Figure 3), where a duopoly exists for IT principles and business application needs, but IT investments is closely held centrally.

Organization 4 expanded on the strong role its governance organization performed during implementation by commenting:

> We were concerned about changed management and governance across the entire enterprise. So, we had what we call a transformation executive board, and that transformation executive board consisted of what we call Jcodes.
>
> J3-4 is logistics and material. Uh, J8 is finance. So, all of our heads, the SESs, ...uh... or their designated deputies ...uh... would come to the transformation executive board and then the deputies of everyone of our sides or field activities would come to the transformation executive board, every other week for eight hours, for seven years.
>
> Everyone felt that this would be such a dramatic impact across the enterprise, that we need that kind of a commitment and that in order to do the change management that was required and to have everybody buy in on the sponsorship, that they wanted everybody in that room together for those eight hours, and what we did during those eight hours were these things.
>
> That board probably dove down and knew a lot more details then probably most senior executives would know.
>
> We even sometimes got into the weeds of, this is the business process, this is the rule why we have this rule, or we are not going to do this anymore, right, that is not the best practice out there, we are going to change this, and everybody sat there through those discussions and ...uh... came to an agreement, and if they didn't have an agreement, then they came back the next week and discussed it some more.
>
> They approved the resources, and they approved the funding. Right, they, they approved what would be our….metrics and our performance. Moving forward, what the new measurements would be. Uh, they approved ...uh... the risks that we knew we were taking.

Throughout the interview, Organization 4 emphasized the importance of IT alignment to the business:

> It has been on our strategic ... plan and in our vision for the last seven years.
>
> Throughout the program you will see that this was not the IT folks going off and doing their own IT implementation ...um... void of the business goals and objectives. This was definitely a partnership, ...uh... and we had as many IT and ERP people involved as we had business people, and the direction was as a business ...um... corporation that does logistics and supply chain.
>
> Very much business driven.
>
> We definitely made this an enterprise wide one ERP. Uh, however, because of the breadth and depth of our supply chain being totally different, I mean, from medical to aviation parts, I mean and nuts and bolts. I mean, that is just so diversified there, that we realize that there were some differences that had to occur, but overall, we were all in one enterprise.
>
> I think the overall goals, vision; the business was all centralized together. Um, but when it came to ...um... individual requirements of some of the functions ...um... some of that came from the business units that were out there. And, it is mainly because ...um... and this was the rationale behind picking that one...mainly because a lot of our business units are so different from each other.
>
> But it was focused towards the business, and what we want to achieve as a business.

Sustainment

Organization 4 responded to the sustainment sections of the survey by stating that responsibility for definition of business process design is “decentralized to the business units”, while functional application design and development were “shared” with the business. Application operations, infrastructure network & communications, user role & authorizations, and help desk are “centralized” within the sustainment organization while end-user training uses a “shared/center of excellence” approach. Organization 4 “fully achieved” its objectives and reported that it had formal measurement processes to assess and manage the services it provides

in its sustainment organization were “partially in place”. Organization 4’s resources support “both sustainment and deployment”. Organization 4’s sustainment operation is placed 3 levels below the CEO/Agency head. Organization 4 reported that retention of ERP skills within the core ERP team was “somewhat important”. The interviewee, however, did not have information as to budget increases or decreases since implementation. Based on the survey responses, Organization 4’s sustainment operation appears to approach Mirchandani’s (2004) “Competency” support model.

Organization 4 found that despite use of dedicated, skilled trainers, it needed to emphasize process-oriented training and insert subject matter experts that were fully versed in the revised business processes.

> The lesson learned was that we couldn't just give it to the defense training center, because what would happen when people come, would come in and take the courses and the instructors would not be able to answer the functional question. Uh, and so, we wanted to them to understand not so much how to go in and operate the ERP, we wanted them to understand what the new business process was and why. Why we did business this way versus some other.

Organization 4 also identified the need to improve how

> One of the things we did that probably influenced this was, in the beginning we spent an awful lot of time looking at ...um... private sector implementation lessons learned. Uh, and we, we looked at that and considered why ERPs fail and why they succeed, and a lot of the things that we learned from that were then adopted in the way we moved forward.

Acceptance & Extension

Organization 4 responded to the Acceptance and Extension sections of the survey by responding that it implemented a “Phased” implementation approach as it implemented 21 modules within its ERP implementation. Organization 4 stated it had “clearly defined” objectives for its implementation that were “achieved”, and reported a “smooth” post-implementation

stabilization period. Organization 4 also reported that change was “extremely difficult”. Organization 4’s internal staff turnover within the ERP core team has had equal turn-over compared to other IT staff. Organization 4 also reported that it had no firm plans to upgrade its ERP implementation, but was interested in adding 9 additional modules. Organization 4 reported that addition of new software functionality, increasing accessibility with its supply chain partners and complying with government regulations were the first, second and third most important reasons for upgrading its ERP application suite. Organization 4 reported that organizational commitment to achieving transformation was “extremely important”. Based on the survey responses, Organization 4 appears to be within Klee’s (2005) Extending value ERP lifecycle phase.

When asked to review its perspective about acceptance of ERP and its usability, Organization 4 responded:

> We want[ed] to make sure that what, what got put in place was something that met the needs of the people who actually had to use it.
>
> I think where M… is going is if it is not a tool that they use and like, change management is going to become really hard.

Organization 4 shared that managing change was a significant challenge due to end-user resistance:

> Even though they could see that you could get there the same way, it is just a different process and it may be faster, they just didn't want to change. So, it was very difficult that the other thing was ...uh... as I said before, we were going from different organizations with different supply chains, and they all had their individual culture.
>
> That kind of stifled everybody too and made it more difficult, to change, because we were changing the whole culture of the organization.

The extent of resistance led Organization 4 to consider how to best attract new, younger personnel that could offer new thinking that would offset resistance:

> We didn't have ...um... a lot of really...we are working on it as an agency trying to change that around and get younger people back in, right, with new ideas. Um, and so, folks didn't want to change after doing it that long that other way.

Organization 4 also implemented strong management practices by assuming budgetary control for new IT projects:

> We also got a hold of their budgets to. That would be fair. So, to get back to your point about having little science projects scattered about by...eventually, not right away, but after a couple of years, by grabbing and controlling the budget we were able [to force change].
>
> And, we got rid of the tools. Um, which was another different big cultural difference, because [Organization 4] has always fostered ...uh... being a, an entrepreneur and having everyone going out and being innovative and bringing new innovative ideas to make the process better. On that all of the sudden, we don't really want you to do that. We are all going to go to the ERP.

Additional Questions

Organization 4 was asked to respond to what additional focus areas were desired to continue Governance, Sustainment, and Extension of their ERP system and well as future Transformation goals.

Regarding Governance, Organization 4 found that it needed to re-engage its senior executive leadership:

> A year ago they said, well, wait a minute. There is a lot of transforming that we are still doing via our ERP by bringing on these new capabilities, and there are some other subjects that we need to talk as a group. So, they, they call it now the alignment group.
>
> That board did go away when we hit FOC (full operational capability), however, then we had a lesson learned because we are continuing to enhance capabilities in the ERP.

I think the, the big area was that the TEC kind of went away and we brought back the Alignment group. That was the main way that we are improving our governance now moving forward.

Evolving that and then what does that mean to [Organization 4] and our internal policies ...uh... for improving that policy. So, so that is one area. Of course we have that ...uh... business capability life cycle, the BCL that we have to follow now too, but that is a little bit vague so, ...um... we are trying to put some parameters around that.

Regarding Sustainment, Organization 4 stated:

So some of the things we are trying to do now, um, being we reached FOC is strengthen that governance and how we pass things to sustainment, and how we work together.

[Have] we followed all the rules for architecture? have all the artifacts now [been completed?], what happens when it gets to sustainment? Does that continue like it should…. So, there are a lot of rules now that we are working on and that is kind of evolving.

Regarding Extension, Organization 4 stated:

Now we have the enterprise architecture in place, but we are bringing in eProcurement, which is a new module ...uh... that SAP has.

Regarding Transformation, Organization 4 stated:

We actually even changed our entire organization when we built the ERP. So ...um... ...uh... we were very...we had a lot of functional stovepipes. A lot of folks didn't talk to each other. Um, these are very good in their little functional stovepipes. We decided to take on the adventure of the, bringing in ERP. We ...uh... broadened that and we actually realized that we needed to change our organization structure.

And, in doing that I am bringing in…. eProcurement, we are again transforming our Procurement division.

It will in the future, because what has happened is now that we have had our implementation, and had our overall ERP enterprise set. Okay, we are ...uh... actually still doing some transformation as we bring in the new capability.

Key themes emerging from the Organization 4 interview are summarized in Table 70:

Table 70: Organization 4 Interview Themes

Governance	• Formalized top-down process in place • Deep executive commitment during deployment, but needed to re-engage executive leadership due to continuing transformation • Emphasized importance of business alignment
Sustainment	• Working to improve hand-offs between development and sustainment organizations
Extension	• Dealing with end-user resistance to change through improved training • Continuing to extend ERP with new functionality
Transformation	• Driven top-down • Eliminating "functional stovepipes" and business silos • Working carefully to continue transformation

Phase B Interview Comparison

The key interview themes and findings from the 4 organizations are summarized across the dimensions of governance, sustainment, extension and transformation in Table 71 below.

Table 71: Qualitative Summary by Organization

	Organization 1	Organization 2	Organization 3	Organization 4
Implementation date	2008	1996	2006	2007
Governance	Active & engaged	Mature & embedded	Defending & controlled	Committed & re-engaged
Governance model (Weill & Ross)	Governance arrangement 1: Bus/IT understanding & trust	Governance arrangement 1: Bus/IT understanding & trust	Governance arrangement 3: Centralized control	Governance arrangement 2: Bus/IT trust w/ centralized investment
Sustainment	Focused on process routinization and improving training to better assist job execution	Focused on value capture & ROI	Focused on "keeping it alive"	Focused on improving internal processes between development and sustainment organizations
Sustainment model (Mirchandani)	IS Traditional	Competency	IS Traditional	Competency
Extension	Defining vision; needing alignment with global strategy	Achieved & extending beyond ERP	Temporarily paused	Undergoing careful planning
ERP Lifecycle (Klee)	Extending value	Extending/ Maintaining value	Extending value	Extending value
Transformation	Continuing & evolving	Optimized & reaping	Initiated & extending	Significant & refining

Summary

Chapter 4 presents the analyses of data associated with the seven research questions identified in Chapter 1. Quantitative analyses using Chi-square, MANOVA and factor analysis was performed against the 34 survey questions that formed the seven research questions and results found that the null hypotheses for four of seven research questions could not be rejected. However, three hypotheses (Research question 1: that there is no difference in design and performance of ERP governance structures, Research question 5: that there is no difference in achieving acceptance and routinization of ERP and Research question 6: that there was no difference in the timeframe to extend ERP) could be rejected and the alternative hypothesis could be accepted. Qualitative analyses of four interviews using NVivo software and coding techniques to determine major themes was performed to compare and contrast the information collected from the survey and to support validation and triangulation against the quantitative analysis. Despite the uniqueness of the Phase B organizations and their ERP post-implementation status, common traits were that each organization is actively engaged in extending value of its ERP organization following implementation. Also, while often considered secondary, governance holds a critical role to ensure continued alignment between business and technology. Leadership must continually and consistently be engaged following implementation to provide oversight and set priorities as value capture occurs. And finally, continued attention to optimizing business process understanding through continued and increasingly effective forms of training are needed because transformation is a continuous phenomenon.

CHAPTER 5. RESULTS, CONCLUSIONS, AND RECOMMENDATIONS

Introduction

This chapter is divided into six sections. The first section is the statement of the problem. The second section describes the methodology used in the study. The third section provides the results of each research question within Phase A via a summary and short discussion. The fourth section presents the results of the interviews within Phase B and a short discussion. The fifth section presents the conclusions of the study. The sixth and final section presents recommendations for practice and future research.

Statement of the problem

Despite the continuing emergence of public sector ERP implementations, little if any research exists that compares public and private sector and the structures each have put in place to govern, sustain and extend their ERP systems. The purpose of this study was to compare how private and public sector organizations that have implemented ERP systems continue to support transformation through creation of governance and sustainment structures as well as identify differences in rationale and timeframe for accepting and extending their ERP systems following initial implementation. Based on these findings, the research was then reviewed to identify whether distinctive or common operational models for governance and sustainment organizations exist, identify whether distinctive reasons for differences in timelines for acceptance and extension of ERP systems exist and assess relative importance of governance, sustainment and extension to achieve transformation.

Methodology

The research study used a sequential, exploratory mixed method approach consisting of two phases, Phase A and Phase B. Phase A was a quantitative phase where the results of a web-based survey submitted to senior and mid level IT professionals was subjected to Chi-square, MANOVA, Discriminant and Factor Reduction statistical analysis. Phase B was a Qualitative phase that consisted of four interviews with senior and mid level IT professionals from organizations that had previously implemented an ERP solution, who had completed the Phase A survey and who had also self-identified themselves as willing to participate in a further discussion ranging from 45 to 60 minutes in length.

Results of Phase A Research Questions

Research Question 1

> *Are there differences in how public and private sector organizations design and perform governance following ERP implementation?*

The research found that both private and public sector ERP governance organizations design and performance largely follow Weill & Ross's (2004) governance performance model where IT architecture and infrastructure are centralized and where IT strategic goals, business application needs and investment are shared in the form of a duopoly between the IT organization and the business. Despite a common model, the MANOVA analysis of the nine variables within Research question 1 revealed a significant difference exists in how private and public sector organizations are designing and performing ERP governance with one variable (whether a formal governance structure was in place) approaching statistical significance. Private

sector organizations merge ERP governance within the organization's overall IT governance structure while public sector organizations were in process to build their ERP governance organization or tended toward stand-alone ERP governance structures in addition to incorporation within the overall IT governance organization. Further examination of the data using a discriminant analysis function revealed three key discriminating indicators were alignment of IT to business goals and strategy, breadth of IT domains within scope of the governance organization and the form of the ERP governance structure in place.

Research Question 2

Is the level of importance for governance after implementation similar between public and private sector organizations?

The research found that both public and private sector governance organizations tend toward senior executives as being somewhat active and engaged participants and maintain an approval role for determination of IT investment value and project selection, a reviewing role for IT risk management, performance management, business requirements definition, a recommending role for IT alignment strategies with the business and selection of business applications and a shared role with business organizations for IT investment prioritization. Enforcement of IT decisions is conducted by IT steering committee. The MANOVA analysis of the 12 variables revealed no significant differences exists in how private and public sector organizations position the importance of their respective ERP governance organizations.

Research Question 3

Are there differences in how public and private sector organizations design and manage sustainment structures following implementation?

The research found that both private and public sector organizations follow Mirchandani's (2004) traditional IS sustainment model where services for application design, development, infrastructure, end user role security and help desk are centralized within the IT organization. Public sector organizations reported a slightly greater tendency toward use of shared service/center of excellence structures especially for application design. End-user training within private sector organizations was reported as decentralized to business units while for public sector organizations, end-user training was retained as a centralized responsibility. Business process design for both private and public sector organization was reported as using a shared services/center of excellence structure. Achievement of ERP objectives were reported as essentially the same. Public sector organizations, however, appear to trail private sector organizations in establishing metrics that assist in assessing and managing their sustainment operations. Despite these differences, the MANOVA analysis of 11 variables revealed that no significant differences exist in how private and public sector organizations design and manage sustainment structures following implementation.

Research Question 4

Is the level of importance for sustainment after implementation similar between public and private sector organizations?

The research found that sustainment organizations within both private and public sector organizations hold essentially the same level of importance based on reporting distance from the

CEO or agency head and the level of annual budget increases. Both private and public sector organizations utilize sustainment resources in a similar fashion by utilizing staff resources to both support existing user base while continuing to deploy ERP functionality. Both private and public sector organization rate equally the level of importance for retaining internal staff. The MANOVA analysis of four variables confirmed that no significant difference exists in the level of importance for sustainment after implementation.

Research Question 5

Are there differences between public and private sector organizations in time frames to achieve acceptance and routinization of the initial ERP implementation?

The research found that differences do exist in time frames to achieve acceptance and routinization between public and private sector organizations. While both public and private sector organizations lean toward phased implementations, had similar experiences in setting and achieving their organizational objectives for their respective implementations, and reported similar levels of organizational commitment to change, timeline for upgrade and ability to retain core team members compared to other IT staff, there were differences where public sector organizations implemented slightly less complex projects based on number of modules and reported greater difficulty to gain acceptance and stabilize their implementations as compared to private sector organizations. The MANOVA analysis of nine variables confirmed a statistical difference existed in timeframes to achieve acceptance and routinization of the initial ERP implementation with one factor (number of ERP modules deployed in the initial implementation) approaching statistical significance. Further examination of the data using a discriminant

analysis function revealed that the number of modules implemented during the implementation was the most important factor.

Research Question 6

Are there differences between public and private sector organizations in time frames when to extend or upgrade the initial ERP implementation?

The research found that differences do exist between public and private sector organization in timeframe of when to extend or upgrade ERP following the initial ERP implementation. Both public and private sector organizations exhibit similar patterns of response for number of future ERP modules currently planned, importance of organizational commitment to transformation, ERP governance importance, need to satisfy new software requirements, expiration of software maintenance agreements, need to extend supply chain capabilities, implementation of service oriented architecture capabilities and planned timeline. The MANOVA analysis of the ten variables confirmed that a statistical difference existed in timeframes to extend or upgrade the initial ERP implementation where two variables (need to retain competitiveness and need to comply with government regulatory requirements) were primary contributors exhibiting statistical significance. Further examination of the data using a discriminant analysis function revealed that two key discriminators whether to upgrade or extension of ERP for public or private sector organizations were the need to satisfy new software requirements and the need to retain competitiveness.

Research Question 7

What are the relative levels of importance for Governance, Sustainment and Extension capabilities relative to each other to achieve transformation objectives across public and private sector organizations?

The research found that both public and private sector organizations reported similar levels of relative importance for Governance, Sustainment and Extension capabilities to achieve transformation objectives. This was confirmed by a MANOVA analysis of the six variables. A weak inverse relationship between two components when performing a Factor Reduction analysis using oblimin rotation confirmed that the importance of ERP sustainment and extension to achieving transformation served as Component 1 with the importance of ERP governance design and importance serving as Component 2.

Results of Phase B Interviews

The qualitative interviews of two public sector and two private sector organizations found each was unique in the ERP software and business processes it had implemented. Despite that uniqueness, each organization shared common traits in that each was actively engaged in extending value of its ERP organization following implementation. Each organization found governance holding a critical role to ensure continued alignment between business and technology. Three of four organizations found the need for continuous and active engagement with leadership following implementation to provide oversight and set priorities as value capture occurs while the fourth organization, the organization which had the longest and deepest ERP implementation seemed to have successfully embedded ERP governance and continued leadership involvement into the fabric of the organization. Following implementation each

organization continued attention toward optimizing business processes by carefully considering new ERP software capabilities but with increased attention to return on investment. Each organization continued to seek increasingly effective forms of training so as to embed new business processing, thereby continuing to drive transformation. This finding correlates with Somer & Nelson (2004) where entropy occurs following actual implementation which must be resisted through continued organizational alignment through active and continuous engagement with leadership and continued embedding of business process oriented training.

Conclusions

Based on the findings of the research, several conclusions emerge – these are presented within the body of this section.

It was concluded that private sector organizations tend to more closely align with their organization's business strategy and vision as compared to public sector organizations.

When governance for ERP is established, private sector organizations are more likely to have formalized ERP governance structures integrated within their overall IT governance organization while public sector organizations are either in process to build ERP governance organizations, have incorporated it into their overall IT governance organization or have built a stand-alone ERP governance organizations.

It was concluded that private sector governance organizations are more likely to incorporate a greater span of governance responsibilities to include end-2-end business process definition, enterprise applications, business unit applications, and front and back office applications compared to public sector organizations.

Regardless of whether private and public sector organizations have established ERP governance organizations that are integrated within the IT organization or are independent, it was concluded that both private and public sector organizations consider their ERP governance organizations to be of equal importance within their organizations.

It was concluded that ERP sustainment design and performance for both private and public sector organizations are similar following Mirchandani's (2004) sustainment model despite minor differences in use of shared service/centers of excellence for provisioning of business process and application design, how end-user training is supported and whether metrics are used to support operational improvement.

It was concluded that the level of importance of ERP sustainment organizations within private and public sector organizations is equivalent.

It was concluded that timelines for acceptance and routinization of ERP implementations within public sector organizations are different from private sector despite somewhat lower complexity as indicated by the number of modules incorporated with the implementation.

It was concluded that reduced ability to accept change within public sector organizations coupled with more difficult post-implementation transition to sustainment periods when compared to private sector organizations contribute to the difference in timeline for acceptance and routinization.

Because of the complexity in ERP systems, it was concluded that both public and private sector organizations must continue focus on business processes and delivery of business process oriented training to end-users to continue and complete understanding of the process(es) being deployed.

It was concluded that timelines to extend ERP systems are different between public and private sector organizations, but whether longer or shorter could not be concluded.

It was also concluded that public sector organization needs to comply with governmental regulations, support new business software requirements and resolve expiration of software maintenance licenses hold higher priority when considering timelines for extending ERP. Comparatively, private sector organizations place higher priority on need to maintain competitiveness in addition to need to resolve expiration of software maintenance.

While all survey respondents and interviews stipulated the importance of governance, sustainment and extension were necessary for continued organizational transformation, it was concluded that governance design and importance are perceived as less important to drive transformation compared to sustainment design and importance, and extension of ERP.

Lastly, it was concluded and confirmed by interviewees that engagement with senior leadership using governance mechanisms is a continuing need and responsibility beyond the initial ERP implementation.

Recommendations

The purpose of this study was to determine whether differences exist in governance, sustainment and extension structures between private and public sector organizations following the initial ERP implementations. Based on the findings and conclusions of the study, the researcher offers the following recommendations:

Due to ERP implementation and sustainment costs and complexity of organizational change, public and private sector organizations must establish authoritative governance

structures that oversee investment prioritization, risk and resource management and retain alignment with the organization's business/mission.

Public sector organizations should establish internal sustainment metrics and governance assessment structures to enable continued optimization and improvement of sustainment operations.

Public sector organizations should incorporate strong and effectual leadership through-out the entire ERP application lifecycle, not solely during initial pre go-live adoption and adaptation phases.

Public sector organizations should continue to collect and incorporate know-how and lessons learned from private sector organizations to reduce organizational resistance during ERP acceptance and routinization phases to improve timeframes.

Because sustainment organizations require continued engagement with leadership and corresponding governance organizations, both private and public sector organizations must continue upward communication with senior management/leadership that by implementing dashboards that provide business process, investment, resource and risk management reporting to enable comprehension of complex ERP installations.

This study extends research into the topic of ERP implementations that are occurring within public sector organizations focusing on the period following initial implementation. The research supported previous findings offered by Weill & Ross (2004), Mirchandani (2004) and Somers & Nelson (2004). The research also initiated a review of the inter-relationships between governance, sustainment and extension as ERP software is implemented regardless of private or public sector organizations.

As ERP implementations continue across the public sector environment, the researcher recommends repeating the study to determine whether similar findings are obtained so as to identify and refine best practice definitions for design of governance and sustainment organizations.

The researcher also recommends conducting a case study research of several public sector organizations using the researcher's conceptual model, survey instrument and interview questions to collect further insight into the interaction between governance, sustainment and extension practices.

Due to the importance of time as a factor to achieve transformation, the researcher recommends conducting a time series study to track how one or several public sector organizations evolve and mature their governance and sustainment organizations and what decisions are used to rationalize extension of their ERP implementations.

Due to the importance of cost containment and risk management, the researcher recommends conducting Conduct a study to review how public sector organizations transition ERP sustainment operations resources from reliance on external consultants to internal core staff, or transition toward internally or externally staffed centers of excellence or ultimately to outsourcing arrangements and identify common metrics and tools that support ERP sustainment operational optimization.

The researcher recommends repeating the study to increase the total valid sample (e.g., increase qualified respondents from 194 to greater than 377) and perform a structural equation modeling (SEM) analysis to determine whether a predictive model of the governance, sustainment and extension conceptual framework can be obtained.

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APPENDIX A – PHASE A SURVEY INSTRUMENT

Governance, Sustainment and Extension of ERP across Public and Private Sector Organizations

This survey has been created to collect information about Governance, Sustainment and Extension activities that occur after the initial Go-Live ERP implementation. The survey has been submitted to senior level IT executives within U.S private and public sector organizations. The results of the survey will be used to understand whether differences in Governance, Sustainment and Extension of ERP technologies exist across private and public sector organizations.

Any questions regarding the survey may be directed to me at 703 626-1676 (or via e-mail to cbachman@mchsi.com) or my committee chair, Dr. Jose M. Nieves at 504 351-1563 (or via e-mail to jose.nieves@faculty.capella.edu). Questions or concerns about research participant's rights may be directed to the CAPELLA University Institutional Review Board at CAPELLA University, 225 South 6th Street, 9th Floor, Minneapolis, MN 55402. The telephone number is 888 227-2736.

The survey is constructed in five sections (Demographics, Governance, Sustainment, Extension and Transformation) consisting of 32 questions. It is requested that you respond to each question offered - however, because participation is completely voluntary, you may elect to skip any question as desired. The survey will require approximately 15 - 20 minutes to complete.

SECTION I: DEMOGRAPHICS
This section requests identification of demographic information related to your organization. Five questions are contained within this section.

1) Please indicate the type and size of your organization

- ❍ Private Sector
- ❍ Public Sector (State & local)
- ❍ Public Sector (Federal)

2) Please indicate the type and size of your organization

- ❍ Less than 5,000 employees
- ❍ 5,000 to 9,999 employees
- ❍ Over 10,000 employees

3) Please indicate whether your organization has implemented an ERP solution:

- ❍ Yes
- ❍ No (Answering "No" will end the survey)

4) Please indicate the year of your organization's initial ERP implementation:

- ❍ Before 1995

- ❍ 1995
- ❍ 1996
- ❍ 1997
- ❍ 1998
- ❍ 1999
- ❍ 2000
- ❍ 2001
- ❍ 2002
- ❍ 2003
- ❍ 2004
- ❍ 2005
- ❍ 2006
- ❍ 2007
- ❍ 2008

5) Please indicate whether your initial ERP implementation has been completed:

- ❍ Yes
- ❍ No

SECTION II: GOVERNANCE

The next section is focused on your organization's governance of ERP technologies.

Governance as defined by Partnership with the Voluntary Sector (http://www.phac-aspc.gc.ca/vs-sb/voluntarysector/glossary.html) is "the act of affecting government and monitoring (through policy) the long-term strategy and direction of an organization. In general, governance comprises the traditions, institutions and processes that determine how power is exercised, how citizens are given a voice, and how decisions are made on issues of public concern."

The following 11 questions are created to collect information about your organization's governance of its ERP technologies.

6) Please comment on the overall state of IT alignment with your organization's business strategy & vision:

- ❍ Optimized
- ❍ Mature
- ❍ Defined
- ❍ Evolving
- ❍ Undefined

7) Please indicate where decision-making responsibilities (whether centralized, decentralized or shared) lie for the following areas:

	Business centralized	IT centralized	Decentralized to Business Units	Shared
IT strategic goals & objectives	○	○	○	○
IT architecture	○	○	○	○
IT infrastructure strategies	○	○	○	○
Business application requirements definition	○	○	○	○
IT investment prioritization	○	○	○	○

8) Does your organization have a formal ERP Governance organization in place?

- ○ Yes - stand-alone ERP Governance organization is in place
- ○ Yes - incorporated within overall IT Governance organization in place
- ○ Currently building an ERP Governance organization
- ○ Currently thinking about an ERP Governance organization
- ○ No plans at this time
- ○ I don't know

9) Please indicate the Information Technology domains where your ERP Governance organization maintains oversight & control (select all that apply):

- ❑ End-to-end business process definition
- ❑ Enterprise applications
- ❑ Business unit applications
- ❑ Front office applications (i.e., CRM, SCM, other)
- ❑ Back office applications (i.e., Financials, HR/HCM & Payroll, Procurement, other)
- ❑ Other
- ❑ None
- ❑ I don't know

10) Please indicate the decision-making role your ERP Governance organization fills for the following areas:

	Generates	Recommends	Reviews	Consults	Approves	No responsibility	I don't know
IT strategic alignment with the business	○	○	○	○	○	○	○
IT investment	○	○	○	○	○	○	○

and value definition							
IT risk management	○	○	○	○	○	○	○
IT performance management	○	○	○	○	○	○	○
IT resource management	○	○	○	○	○	○	○
Business requirements definition	○	○	○	○	○	○	○
Business application selection	○	○	○	○	○	○	○
IT project selection & oversight	○	○	○	○	○	○	○

11) The ERP governance organization is staffed primarily by:

- ○ Senior Executives
- ○ Middle management
- ○ Rank & file
- ○ External participants or consultants
- ○ Other
- ○ I don't know

12) Please indicate the decision-making role your ERP Governance organization fills for the following areas:

	Generates	Recommends	Reviews	Consults	Approves	No responsibility	I don't know
IT strategic alignment with the business	❑	❑	❑	❑	❑	❑	❑
IT investment and value definition	❑	❑	❑	❑	❑	❑	❑
IT risk management	❑	❑	❑	❑	❑	❑	❑
IT performance management	❑	❑	❑	❑	❑	❑	❑
IT resource management	❑	❑	❑	❑	❑	❑	❑
Business requirements definition	❑	❑	❑	❑	❑	❑	❑
Business application selection	❑	❑	❑	❑	❑	❑	❑
IT project selection &	❑	❑	❑	❑	❑	❑	❑

oversight							

13) Senior members of the ERP governance organization are:

- ○ Fully active and engaged
- ○ Somewhat active and engaged
- ○ Participate sporadically
- ○ Very difficult to engage
- ○ I don't know

14) Please indicate the framework used as a template to define and build your ERP Governance organization:

- ☐ Control Objectives for Information Technology (CObIT)
- ☐ Capability Maturity Model Integration (CMMI)
- ☐ Information Technology Infrastructure Library (ITIL)
- ☐ ISO 17799:2006/ISO 27002:2005
- ☐ Custom developed in house
- ☐ Custom provided by consultant
- ☐ None
- ☐ I don't know

15) How are ERP Governance decisions enforced within your organization:

- ○ By CEO, Secretary or Agency head
- ○ By Chief Financial Officer or equivalent
- ○ By Chief Information Officer (CIO)
- ○ By IT steering committee
- ○ By internal audit
- ○ Other
- ○ Decisions are not enforced
- ○ I don't know

SECTION III: SUSTAINMENT

This section is focused on how your organization continues to support and sustain your ERP implementation following implementation. Sustainment includes activities associated with keeping fielded products or information technology systems operational and maintained.

The following section consists of seven questions on the topic of sustainment.

16) Please indicate how the following ERP Sustainment functions are provided:

	Centralized	Decentralized	Shared/Center	Enternal/Outso

		to Business Units	of Excellence	urced
Business process design	❍	❍	❍	❍
Functional application design	❍	❍	❍	❍
Application development	❍	❍	❍	❍
Application operations	❍	❍	❍	❍
Infrastructure network & communications	❍	❍	❍	❍
User role & authorization management	❍	❍	❍	❍
Help desk	❍	❍	❍	❍
End user training	❍	❍	❍	❍

17) Please identify the organizational reporting distance between your ERP Sustainment organization the CEO or Agency head:

- ❍ 1 Level
- ❍ 2 Levels
- ❍ 3 Levels
- ❍ 4 Levels
- ❍ More than 4 Levels
- ❍ I don't know

18) Has your organization implemented defined metrics to assess and manage the services provided by your ERP Sustainment organization?

- ❍ Yes, fully in place
- ❍ Yes, partially in place
- ❍ In planning phase to implement
- ❍ No formal measurement processes in place
- ❍ Don't know

19) Please indicate resource allocation and work task responsibilities for members of your sustainment organization staff:

- ○ Fully dedicated to sustainment tasks
- ○ Support both sustainment and deployment tasks
- ○ Works in partnership with external partners
- ○ Internal staff monitors external sustainment activities
- ○ I don't know

20) Please indicate the level of importance for retaining current ERP skills/training within the core ERP Sustainment team:

- ○ Extremely Important
- ○ Somewhat Important
- ○ Neutral
- ○ Not Very Important
- ○ Not At All Important

21) Please indicate the average percentage (%) change in annual budget for your ERP Sustainment organization in the years following ERP implementation:

- ○ Increased by greater than 10%
- ○ Increased between 0 and 10%
- ○ Remained the same
- ○ Decreased between 0 and 10%
- ○ Decreased by greater than 10%
- ○ I don't know

SECTION IV: EXTENSION

This section focuses on timeframe to accept and extend the ERP implementation. Extension can be deployment of additional organizations across the enterprise, implementation of additional software modules included within the ERP application suite, or upgrade of the ERP applications to a more current release.

This section consists of ten questions on the topic of extension.

22) Please indicate whether your organization had clearly defined objectives for implementing the initial ERP phase:

- ○ Yes
- ○ No

23) Please indicate whether your organization achieved its defined objectives for implementing ERP:

- ○ Significantly surpassed objectives.
- ○ Achieved objectives
- ○ Partially achieved objectives
- ○ Did not achieve

24) Please indicate the ERP modules currently implemented and/or planned for future implementation by your organization (check all that apply):

	Current scope - Single software vendor	Current scope - Multiple software vendors integrated via middleware	Future scope
Accounts Payable	❑	❑	❑
Accounts Receivable	❑	❑	❑
After Market Service (e.g. Field Service/Depot Repair)	❑	❑	❑
Business Intelligence (BI)	❑	❑	❑
Corporate Performance Management (CPM)	❑	❑	❑
Customer Relationship Management (CRM)	❑	❑	❑
DRP (Distribution Requirements Planning)	❑	❑	❑
Engineering Change Management	❑	❑	❑
Event Management	❑	❑	❑
Fixed Assets	❑	❑	❑

Forecasting and Demand Planning	❑	❑	❑
General Ledger	❑	❑	❑
Human Capital Management	❑	❑	❑
Inventory Control	❑	❑	❑
MPS (Master Production Scheduling)	❑	❑	❑
MRP (Material requirements planning)	❑	❑	❑
Order Management	❑	❑	❑
Other	❑	❑	❑
Payroll	❑	❑	❑
Portal	❑	❑	❑
Product Configuration	❑	❑	❑
Product Lifecycle Management (PLM)	❑	❑	❑
Project Management	❑	❑	❑
Purchasing	❑	❑	❑
Sales and Marketing	❑	❑	❑
Service oriented architecture (SOA)	❑	❑	❑

Shop Floor Control	❑	❑	❑
Supplier Collaboration/scheduling	❑	❑	❑
Supplier Relationship Management (SRM)	❑	❑	❑
Supply Chain Management (SCM)	❑	❑	❑
Workflow Technologies	❑	❑	❑

25) Please indicate the deployment method for your ERP implementation:

- ❍ Big Bang (All functionality deployed for all business units)
- ❍ Phased (All functionality deployed for successive Business Units)
- ❍ Spiral (Initial baseline; followed with increased functionality for successive Business Units)
- ❍ Other

26) ERP core team turnover compared to other IT workers has had:

- ❍ Higher turn-over
- ❍ Slightly higher turn-over
- ❍ Equal turn-over
- ❍ Lower turn-over
- ❍ Much lower turn-over
- ❍ I don't know

27) Please indicate how your organization accepts change:

- ❍ Change is extremely difficult
- ❍ Change is accepted when communicated with sound rationale
- ❍ Adapting to change is the norm

28) The ERP post Go-live stabilization and acceptance period following implementation was:

- ❍ Much smoother than expected
- ❍ Smooth
- ❍ Neutral
- ❍ Difficult
- ❍ More difficult than expected

29) Please indicate the timeframe when an upgrade of your ERP system is planned:

❍ Within 6 - 12 months
❍ Between 13 - 24 months
❍ Between 25 - 36 months
❍ Between 37 to 48 months
❍ Beyond 48 months
❍ No plans to extend

30) **Please indicate the importance of the following to achieve ERP acceptance:**

	Extremely important	Somewhat important	Neither important nor unimportant	Not very important	Not at all important
Senior management leadership	❍	❍	❍	❍	❍
Middle management engagement	❍	❍	❍	❍	❍
Help desk responsiveness	❍	❍	❍	❍	❍
Enduser training accessibility	❍	❍	❍	❍	❍
Enduser user community participation	❍	❍	❍	❍	❍
Internal superuser evangelism	❍	❍	❍	❍	❍

31) **Please rank order the following factors for determining whether to extend or upgrade your ERP implementation:**

Add new software functionality _____

Comply with government regulations _____

Enhance competitiveness within Industry _____

Extend software maintenance agreement due to expiration of current release _____

Implement Service oriented architecture infrastructure _____

Increase supply chain partners/constituent accessibility _____

SECTION V: TRANSFORMATION
This section asks one question about organizational transformation achieved through governance, sustainment, enduser acceptance and extension.

32) **Please indicate the level of importance for the following factors to achieve organizational transformation:**

	Extremely important	Somewhat important	Neutral importance	Not very important	Not at all important
Governance design	❍	❍	❍	❍	❍
Organizational support for Governance operations	❍	❍	❍	❍	❍
Sustainment design	❍	❍	❍	❍	❍
Organizational support for Sustainment operations	❍	❍	❍	❍	❍
Enduser acceptance	❍	❍	❍	❍	❍
Organizational commitment to transformation	❍	❍	❍	❍	❍

33) **Please indicate your willingness to participant in an extended 45 to 60 minute interview to investigate further the significance of governance, sustainment and extension of ERP to achieve organizational transformation:**

❍ Yes
❍ No

34) **If Yes, please provide contact information so that a following interview can be planned:**

Name _____
Email address: _____
Phone: _____

Thank you for supporting this research. Your response will be included with responses from other public and private sector CIOs to aid in better understanding organizational events occurring after ERP technologies have been implemented.

APPENDIX B – PHASE A QUESTION 1 RESULTS: MOST FREQUENT RESPONSES

Governance Design & Performance	Summary		Private Sector		Public Sector	
Variable Description	Most frequent	2nd most frequent	Most frequent	2nd most frequent	Most frequent	2nd most frequent
Overall state of IT alignment with your organization's business strategy & vision:	Evolving 68 (35.1%)	Mature 60 (34.0%)	Mature 52 (36.6%)	Evolving 45 (31.7%)	Evolving 23 (33.8%)	Mature 14 (26.9%)
Decision-making responsibilities for IT strategic goals & objectives	Shared 78 (44.1%)	IT Centralized 70 (39.5%)	Shared 62 (44.0%)	IT Centralized 51 (36.2%)	Shared 26 (50.0%)	IT Centralized 22 (42.3%)
Decision-making responsibilities for IT architecture	IT Centralized 163 (84.0%)	No response 22 (11.3%)	IT Centralized 120 (84.5%)	No response 14 (9.9%)	IT Centralized 43 (82.7%)	No response 8 (15.4%)
Decision-making responsibilities for IT infrastructure strategies	IT Centralized 164 (85.4%)	Shared 21 (10.9%)	IT Centralized 120 (85.7%)	Shared 14 (10.0%)	IT Centralized 44 (84.6%)	Shared 7 (13.5%)
Decision-making responsibilities for Business application requirements definition	Shared 97 (50.3%)	Business Centralized 55 (28.5%)	Shared 75 (53.2%)	Business Centralized 37 (26.2%)	Shared 22 (42.3%)	Business Centralized 18 (34.6%)
Decision-making responsibilities for IT investment prioritization	Shared 115 (59.6%)	IT Centralized 43 (22.3%)	Shared 82 (58.2%)	IT Centralized 29 (20.6%)	Shared 33 (63.5%)	IT Centralized 14 (26.9%)
Framework used as a template to define and build your ERP Governance organization:	1 105 (45.1%)	2 21 (9.0%)	1 80 (49.1%)	2 19 (11.5%)	1 25 (35.7%)	3 5 (7.1%)
IT Domains under Governance control and oversight	5 45 (19.3%)	3 33 (14.2%)	5 36 (22.1%)	4 & 3 24 (14.7%)	2 13 (18.6%)	1 11 (15.7%)
Formal ERP Governance organization in place	Yes – incorporated into overall IT Governance org 87 (44.8%)	Yes – stand-alone ERP Governance org is in place 38 (19.6%)	Yes – incorporated into overall IT Governance org 66 (47.1%)	Yes – stand-alone ERP Governance org is in place 24 (17.5%)	Yes – incorporated into overall IT Governance org 22 (42.3%)	Yes – stand-alone ERP Governance org is in place 14 (26.9%)

APPENDIX C – PHASE A QUESTION 2 RESULTS: MOST FREQUENT RESPONSES

Governance Importance	Summary		Private Sector		Public Sector	
Variable	Most frequent	2nd most frequent	Most frequent	2nd most frequent	Most frequent	2nd most frequent
Decision-making role your ERP Governance organization fills for IT strategic alignment with the business	Recommends 44 (23.3%)	Approves 39(20.6%)	Recommends 34 (24.5%)	Approves 25 (18.0%)	Approves 14 (35.9%)	Recommends/ Reviews 10 (20.0%)
Decision-making role for IT investment and value definition	Approves 42 (22.2%)	Recommends 34 (18.0%)	Approves 32 (23.0%)	Recommends 23 (16.5%)	Recommends / Reviews 11 (22.0%)	Approves 10 (20.0%)
Decision-making role for IT risk management	Reviews 45 (23.9%)	Consults 34 (18.1%)	Reviews 28 (20.3%)	Consults 26 (18.8%)	Reviews 17 (34.0%)	Consults / No responsibility 8 (16.0%)
Decision-making role for IT performance management	Reviews 54 (29.8%)	No responsibility 44 (24.3%)	Reviews 36 (26.7%)	No responsibility 35 (25.9%)	Reviews 18 (39.1%)	No responsibility 9 (19.6%)
Decision-making role for IT resource management	No responsibility 44 (23.4%)	Reviews 39 (20.7%)	No responsibility 37 (26.8%)	Reviews 29 (21.0%)	Consults 12 (24.0%)	Reviews 10 (20.0%)
Decision-making role for Business requirements definition	Reviews 42 (22.2%)	Consults 29 (15.3%)	Reviews 27 (19.4%)	No responsibility 22 (15.8%)	Reviews 15 (30.0%)	Consults 10 (20.0%)
Decision-making role for Business application selection	Recommends 42 (22.2%)	Consults 36 (19.0%)	Approves 31 (22.3%)	Consults 27 (19.4%)	Recommends 18 (36.0%)	10 (10.0%) Reviews
Decision-making role for IT project selection & oversight	Approves 51 (27.1%)	Recommends 38 (20.2%)	Approves 40 (29.0%)	Reviews 23 (16.7%)	Recommends 16 (32.0%)	Approves 11 (22.0%)
ERP governance organization staffed primarily by:	Senior Executives 87 (45.6%)	Middle management 80 (42.1%)	Senior Executives 60 (42.9%)	Middle management 60 (42.9%)	Senior Executives 27 (54.0%)	Middle management 20 (40.0%)
Senior members of the ERP governance organization are:	Somewhat active and engaged 76 (40.4%)	Fully active and engaged 72 (38.3%)	Somewhat active and engaged 58 (42.0%)	Fully active and engaged 48 (34.8%)	Fully active and engaged 24 (48.0%)	Somewhat active and engaged 18 (36.0%)
ERP Governance decision enforcement:	By IT Steering committee 69 (36.5%)	By CIO 55 (29.5%)	By IT Steering Committee 53 (38.1%)	By CIO 41 (29.5%)	By IT Steering Committee 16 (32.0%)	By CIO 14 (28.0%)
Decision-making responsibilities for IT investment prioritization	Shared 115 (59.6%)	IT Centralized 43 (22.3%)	Shared 82 (58.2%)	IT Centralized 29 (20.6%)	Shared 33 (63.5%)	IT Centralized 14 (26.9%)

APPENDIX D – PHASE A QUESTION 3 RESULTS: MOST FREQUENT RESPONSES

Sustainment Design & Performance	Summary		Private Sector		Public Sector	
Variable	Most frequent	2nd most frequent	Most frequent	2nd most frequent	Most frequent	2nd most frequent
Average percentage (%) change in annual budget for your ERP Sustainment organization in the years following implementation:	Increased between 0 and 10% 48 (25.0%)	Remained the same 41 (21.4%)	increased between 0 and 10% 35 (25.0%)	Remained the same 29 (20.7%)	Increased between 0 and 10% 13 (25.0%)	Remained the same 12 (23.1%)
ERP Sustainment functions provided: Business process design	Shared/COE 82 (42.5%)	Centralized 59 (30.6%)	Shared/COE 64 (45.4%)	Centralized 43 (30.5%)	Shared/COE 18 (34.6%)	Centralized 16 (30.8%)
ERP Sustainment functions provided: Functional application design	Centralized 82 (43.2%)	Shared/COE 79 (41.6%)	Centralized 63 (45.3%)	Shared/COE 56 (40.3%)	Shared/COE 23 (45.1%)	Centralized 19 (37.3%)
ERP Sustainment functions provided: Application development	Centralized 114 (59.7%)	Shared/COE 50 (26.2%)	Centralized 84 (60.4%)	Shared/COE 32 (23.0%)	Centralized 30 (57.7%)	Shared/COE 18 (34.6%)
ERP Sustainment functions provided: Application operations	Centralized 117 (61.3%)	Shared/COE 45 (23.6%)	Centralized 89 (64.0%)	Shared/COE 27 (19.4%)	Centralized 28 (53.8%)	Shared/COE 18 (34.6%)
ERP Sustainment functions provided: Infrastructure network & communications	Centralized 143 (74.9%)	Shared/COE 27 (14.1%)	Centralized 103 (74.1%)	Shared/COE 18 (12.9%)	Centralized 40 (76.9%)	Shared/COE 9 (17.3%)
ERP Sustainment functions provided: User role & authorization management	Centralized 113 (59.2%)	Shared/COE 42 (22.0%)	Centralized 85 (61.2%)	Shared/COE 27 (19.4%)	Centralized 28 (53.8%)	Shared/COE 15 (28.8%)
ERP Sustainment functions provided: Help desk	Centralized 139 (72.8%)	External/ Outsourced & Shared/COE 21 (11.0%)	Centralized 99 (71.2%)	External/ Outsourced 18 (12.9%)	Centralized 40 (79.6%)	Shared/COE 8 (15.2%)
ERP Sustainment functions provided: End user training	Decentralized to Business Units 75 (39.2%)	Centralized 59 (30.9%)	Decentralized to Business Units 60 (43.2%)	Centralized 38 (27.3%)	Centralized 21 (40.4%)	Decentralized to Bus Units & Shared/COE 15 (28.8%)
Organization achieved its defined objectives for implementing ERP:	Achieved objectives 114 (64.4%)	Partially achieved objectives 58 (32.8%)	Achieved objectives 84 (65.6%)	Partially achieved objectives 41 (32.0%)	Achieved objectives 30 (61.2%)	Partially achieved obj 17 (34.7%)
Organization implemented defined metrics to assess and manage the services provided by your ERP Sustainment organization?	Yes, partially in place 66 (34.2%)	No formal measurement processes in place 55 (28.5%)	Yes, partially in place 52 (36.9%)	No formal measurement processes in place 36 (25.5%)	No formal measurement process in place 19 (36.5%)	Yes, Partially in place 14 (26.9%)

APPENDIX E – PHASE A QUESTION 4 RESULTS: MOST FREQUENT RESPONSES

Sustainment Importance	Summary		Private Sector		Public Sector	
Variable	Most frequent	2nd most frequent	Most frequent	2nd most frequent	Most frequent	2nd most frequent
Resource allocation and work task responsibilities for members of your sustainment organization staff:	Supports both sustainment and deployment 130 (63.8%)	Works in partnership with external providers 21 (10.9%)	Supports both sustainment and deployment 90 (63.8%)	Works in partnership with external partners 17 (12.1%)	Supports both sustainment and deployment 40 (78.4%)	Works in partnership with external partners 4 (7.8%)
Organizational reporting distance between your ERP Sustainment organization the CEO or Agency head:	2 Levels from CEO/Agency Head 83 (43.2%)	1 Level & 3 levels from CEO/Agency Head 42 (21.9%)	2 Levels from CEO/Agency Head 62 (44.4%)	3 Levels from CEO/Agency Head 34 (24.1%)	2 Levels from CEO/Agency Head 21 (41.2%)	1 Level from CEO/Agency Head 16 (31.4%)
Level of importance for retaining current ERP skills/training within the core ERP Sustainment team:	Extremely important 120 (62.8%)	Somewhat important 43 (22.5%)	Extremely important 88 (63.3%)	Somewhat important 31 (22.3%)	Extremely important 32 (61.5%)	Somewhat important 12 (23.1%)
Average percentage (%) change in annual budget for your ERP Sustainment organization in the years following ERP implementation:	Increased between 0 and 10% 48 (25.0%)	Remained the same 41 (21.4%)	Increased between 0 and 10% 35 (25.0%)	Remained the same 29 (20.7%)	Increased between 0 and 10% 13 (25.0%)	Remained the same 12 (23.1%)

APPENDIX F – PHASE A QUESTION 5 RESULTS: MOST FREQUENT RESPONSES

Timeframe to Accept & Achieve Results	Summary		Private Sector		Public Sector	
Variable	Most frequent	2nd most frequent	Most frequent	2nd most frequent	Most frequent	2nd most frequent
Deployment method for your ERP implementation:	Phased 102 (52.8%)	Big Bang 52 (26.9%)	Phased 78 (55.3%)	Big Bang 31 (22.0%)	Phased 24 (46.2%)	Big Bang 21 (40.4%)
Count of Current Scope ERP Modules (Single & Multiple Vendors):	Implemented 15 modules 13 (5.6%)	Implemented 19 modules 12 (5.2%)	Implemented 19 modules 11 (6.7%)	Implemented 15 modules 10 (6.1%)	Implemented 12 modules 9 (12.9%)	Implemented 16 & 31 modules 5 (7.1%)
Clearly defined objectives for implementing the initial ERP phase:	Yes 173 (89.6%)	No 20 (10.4%)	Yes 127 (90.1%)	No 14 (9.9%)	Yes 46 (88.5%)	No 6 (11.5%)
Organization achieved its defined objectives for implementing ERP:	Achieved objectives 114 (64.4%)	Partially achieved objectives 58 (32.8%)	Achieved objectives 84 (65.6%)	Partially achieved objectives 41 (32.0%)	Achieved objectives 30 (61.2%)	Partially achieved objectives 17 (34.7%)
ERP core team turnover compared to other IT workers has had:	Equal turn-over 72 (37.3%)	Lower turn-over 43 (22.3%)	Equal turn-over 53 (37.6%)	Lower turn-over 30 (21.3%)	Equal turn-over 19 (36.5%)	Lower turn-over 13 (25.0%)
Organizational change acceptance:	Change is accepted when communicated with rationale 102 (53.4%)	Extremely difficult 89 (46.6%)	Change is accepted when communicated with sound rationale 78 (56.1%)	Extremely difficult 61 (43.9%)	Change is extremely difficult 28 (53.8%)	Change is accepted when communicated with sound rationale 24 (46.2%)
ERP post Go-live stabilization and acceptance period following implementation was:	Smooth 62 (32.1%)	Difficult 59 (30.6%)	Smooth 49 (34.8%)	Difficult 40 (28.4%)	Difficult 19 (36.5%)	Smooth 13 (25.0%)
Importance of Organizational commitment to achieve organizational transformation:	Extremely important 158 (81.9%)	Somewhat important 21 (11.1%)	Extremely important 113 (81.9%)	Somewhat important 15 (10.9%)	Extremely important 45 (86.5%)	Somewhat important 6 (11.5%)
Please indicate the timeframe when an upgrade of your ERP system is planned:	Within 6 - 12 months 61 (32.1%)	Between 13 - 24 months 49 (25.8%)	Within 6 - 12 months 39 (28.3%)	Between 13 - 24 months 39 (28.3%)	Within 6 - 12 months 22 (42.3%)	Between 13 - 24 months 10 (19.2%)

APPENDIX G – PHASE A QUESTION 6 RESULTS: MOST FREQUENT RESPONSES

	Summary		Private Sector		Public Sector	
Variable	Most frequent	2nd most frequent	Most frequent	2nd most frequent	Most frequent	2nd most frequent
Count of Future Scope ERP Modules:	Plan to implement 2 modules 17 (8.8%)	Plan to implement 4 modules 16 (8.2%)	Plan to implement 2 modules 14 (9.9%)	12 (8.5%) plan to implement 1 & 5 modules	5 (9.6%) plan to implement 4 modules	3 (7.7%) plan to implement 3 modules
New Software requirements ranked as reason to extend or upgrade your ERP implementation:	Most important 63 (34.8%)	2nd most important 54 (29.8%)	Most important 49 (37.7%)	2nd most important 30 (23.1%)	2nd most important 24 (47.1%)	Most important 14 (27.5%)
New Government regulations as reason to extend or upgrade your ERP implementation:	Most important 41 (23.7%)	2nd most important 33 (19.1%)	2nd most important 26 (21.0%)	3rd Least important 22 (17.7%)	Most important 20 (40.8%)	3rd most important 13 (26.5%)
Expiration of Software Maintenance agreement as reason to extend or upgrade your ERP implementation:	Most important 44 (23.7%)	2nd most important 37 (21.8%)	2nd most important 32 (26.5%)	Most important 28 (23.9%)	Most important 12 (27.3%)	2nd/3rd most important 9 (20.5%)
Extension of Supply chain capabilities as reason to extend or upgrade your ERP implementation:	Least important 55 (35.9%)	3rd Least important 37 (24.2%)	Least important 46 (42.2%)	2nd Least important 25 (22.9%)	3rd least important 17 (38.6%)	2nd least important 10 (22.7%)
Retention of competitiveness as reason to extend or upgrade your ERP implementation	2nd most important 37 (23.4%)	Most Important 32 (20.3%)	2nd most important 31 (26.3%)	Most important 26 (23.7%)	Least important 14 (35.0%)	3rd least important 8 (20.0%)
ERP Governance decision enforcement:	By IT Steering committee 69 (36.5%)	By CIO 55 (29.5%)	By IT Steering Committee 53 (38.1%)	By CIO 41 (29.5%)	By IT Steering Committee 16 (32.0%)	By CIO 14 (28.0%)
Importance of Organizational commitment to achieve transformation:	Extremely important 158 (81.9%)	Somewhat important 21 (11.1%)	Extremely important 113 (81.9%)	Somewhat important 15 (10.9%)	Extremely important 45 (86.5%)	Somewhat important 6 (11.5%)

APPENDIX H – PHASE A QUESTION 7 RESULTS: MOST FREQUENT RESPONSES

Relative Importance to Achieve Transformation	Summary		Private Sector		Public Sector	
Variable	Most frequent	2nd most frequent	Most frequent	2nd most frequent	Most frequent	2nd most frequent
Importance of Governance design to achieve organizational transformation:	Somewhat important 87 (46.8%)	Extremely important 70 (37.6%)	Somewhat important 70 (51.9%)	Extremely important 44 (32.6%)	Extremely important 26 (51.0%)	Somewhat important 17 (33.3%)
Importance of Organizational support for Governance operations to achieve organizational transformation:	Extremely important 97 (51.3%)	Somewhat important 66 (34.9%)	Extremely important 65 (47.4%)	Somewhat important 51 (37.2%)	Extremely important 32 (61.5%)	Somewhat important 15 (28.8%)
Importance of Sustainment design to achieve organizational transformation:	Somewhat important 90 (47.9%)	Extremely important 70 (37.2%)	Somewhat important 66 (48.2%)	Extremely important 49 (35.8%)	Somewhat important 24 (47.1%)	Extremely important 21 (41.2%)
Importance of Organizational support for Sustainment operations to achieve organizational transformation:	Extremely important 96 (50.8%)	Somewhat important 69 (36.5%)	Extremely important 65 (47.1%)	Somewhat important 52 (37.7%)	Extremely important 31 (60.8%)	Somewhat important 17 (33.3%)
Importance of Enduser acceptance to achieve organizational transformation:	Extremely important 119 (62.6%)	Somewhat important 57 (30.0%)	Extremely important 83 (60.1%)	Somewhat important 42 (30.4%)	Extremely important 36 (69.1%)	Somewhat important 15 (2.8%)
Importance of Organizational commitment to achieve organizational transformation:	Extremely important 158 (81.9%)	Somewhat important 21 (11.1%)	Extremely important 113 (81.9%)	Somewhat important 15 (10.9%)	Extremely important 45 (86.5%)	Somewhat important 6 (11.5%)

APPENDIX I – PHASE A SURVEY RESPONSES FOR PHASE B INTERVIEW CASES

		Phase B Interviews			
Section	Variable Description	Organization Case 1	Organization Case 2	Organization Case 3	Organization Case 4
Governance Design & Performance	Overall state of IT alignment with your organization's business strategy & vision:	Mature	Defined	Evolving	Mature
	Decision-making responsibilities for IT strategic goals & objectives	Shared	Shared	IT Centralized	Business centralized
	Decision-making responsibilities for IT architecture	IT Centralized	IT Centralized	IT Centralized	Business centralized
	Decision-making responsibilities for IT infrastructure strategies	IT Centralized	IT Centralized	IT Centralized	IT Centralized
	Decision-making responsibilities for Business application requirements definition	Shared	Shared	Shared	Decentralized to Business Units
	Decision-making responsibilities for IT investment prioritization	Shared	Shared	Shared	Shared
	Framework used as a template to define and build your ERP Governance organization:	0	1	0	1 (Custom In house)
	IT Domains under Governance control and oversight	3 (Enterprise, Back-office, Front-office)	5 (Ent., Back-office, Bus Unit, E2E,Front off.)	2 (End-2-end; Back office)	5 (Ent., Back off., Bus Unit, E2E,Front off.)
	Formal ERP Governance organization in place	Yes – stand-alone ERP governance structure in place	Yes – incorporated into overall IT Governance org	Yes – incorporated into overall IT Governance org	Yes – stand-alone ERP Governance org is in place

Section	Variable Description	Organization Case 1	Organization Case 2	Organization Case 3	Organization Case 4
Governance Importance	Decision-making role your ERP Governance organization fills for IT strategic alignment with the business	Generates	Approves	Approves	Approves
	Decision-making role your ERP Governance organization fills for IT investment and value definition	Reviews	Approves	Consults	Approves
	Decision-making role your ERP Governance organization fills for IT risk management	Reviews	Reviews	Consults	Approves
	Decision-making role your ERP Governance organization fills for IT performance management	Reviews	Reviews	Approves	Approves
	Decision-making role your ERP Governance organization fills for IT resource management	Reviews	No responsibility	Approves	Approves
	Decision-making role your ERP Governance organization fills for Business requirements definition	Reviews	No responsibility	Consults	Reviews
	Decision-making role your ERP Governance organization fills for Business application selection	Approves	Reviews	Consults	Reviews
	Decision-making role your ERP Governance organization fills for IT project selection & oversight	Approves	Reviews	Consults	Consults
	ERP governance organization staffed primarily by:	Senior Executives	Senior executives	Senior Executives	Senior Executives
	Senior members of the ERP governance organization are:	Somewhat active and engaged	Fully active and engaged	Fully active and engaged	Fully active and engaged
	ERP Governance decision enforcement:	By IT Steering committee	By CIO	By IT Steering Committee	By CIO
	Decision-making responsibilities for IT investment prioritization	Shared	Shared	Shared	Shared

Section	Variable Description	Organization Case 1	Organization Case 2	Organization Case 3	Organization Case 4
Sustainment Design & Performance	Average percentage (%) change in annual budget for your ERP Sustainment organization in the years following ERP implementation:	I don't know	Increased between 0 and 10%	Decreased by > 10%	I don't know
	ERP Sustainment functions are provided: Business process design	Decentralized to Bus Units	Shared/COE	Centralized	Decentralized to Bus Units
	ERP Sustainment functions are provided: Functional application design	Centralized	Centralized	Centralized	Shared/COE
	ERP Sustainment functions are provided: Application development	Centralized	Centralized	Centralized	Shared/COE
	ERP Sustainment functions are provided: Application operations	Centralized	Centralized	Centralized	Centralized
	ERP Sustainment functions are provided: Infrastructure network & communications	Centralized	Centralized	Centralized	Centralized
	ERP Sustainment functions are provided: User role & authorization management	Centralized	Centralized	Centralized	Centralized
	ERP Sustainment functions are provided: Help desk	Centralized	Centralized	Centralized	Centralized
	ERP Sustainment functions are provided: End user training	Centralized	Decentralized to Bus Units & Shared/COE	Centralized	Shared/COE
	Organization achieved its defined objectives for implementing ERP:	Partially achieved	Achieved objectives	Partially achieved	Achieved objectives
	Organization implemented defined metrics to assess and manage the services provided by your ERP Sustainment organization?	No formal measurement processes in place	Yes, fully in place	No formal measurement process in place	Yes, Partially in place

Section	Variable Description	Organization Case 1	Organization Case 2	Organization Case 3	Organization Case 4
Sustainment Importance	Resource allocation and work task responsibilities for members of your sustainment organization staff:	Supports both sustainment and deployment	Fully dedicated to sustainment tasks	Supports both sustainment and deployment	Supports both sustainment and deployment
	Organizational reporting distance between your ERP Sustainment organization and your CEO or Agency head:	1 Level from CEO/Agency Head	3 levels from CEO/Agency head	4 levels from CEO/Agency Head	3 levels from CEO/Agency Head
	Level of importance for retaining current ERP skills/training within the core ERP Sustainment team:	Extremely important	Somewhat important	Extremely important	Somewhat important
	Average percentage (%) change in annual budget for your ERP Sustainment organization in the years following ERP implementation:	I don't know	Increased between 0 and 10%	Decreased by > 10%	I don't know

Section	Variable Description	Organization Case 1	Organization Case 2	Organization Case 3	Organization Case 4
Timeframe for Acceptance & Achieve Results	Deployment method for your ERP implementation:	Phased	Phased	Big Bang	Phased
	Count of Current Scope ERP Modules_SingleMultipleVendors	Implemented 15 modules	Implemented 25 modules	Implemented 12 modules	Implemented 21 modules
	Clearly defined objectives for implementing the initial ERP phase:	Yes	Yes	Yes	Yes
	Organization achieved its defined objectives for implementing ERP:	Partially achieved objectives	Achieved objectives	Partially achieved objectives	Achieved objectives
	ERP core team turnover compared to other IT workers has had:	Equal turn-over	Equal turn-over	Much lower turn-over	Equal turn-over
	Organizational change acceptance:	Change is accepted when communicated with sound rationale	Change is accepted when communicated with sound rationale	Extremely difficult	Extremely difficult
	ERP post Go-live stabilization and acceptance period following implementation was:	More difficult than expected	Difficult	Much smoother than expected	Smooth
	Importance of Organizational commitment to achieve organizational transformation:	Extremely important	Extremely important	Extremely important	Extremely important
	Please indicate the timeframe when an upgrade of your ERP system is planned:	Between 13 – 24 months	37 to 48 months	Between 25 – 36 months	No plans to extend

Section	Variable Description	Organization Case 1	Organization Case 2	Organization Case 3	Organization Case 4
Timeframe to Extend ERP	Count of Future Scope ERP Modules	No plans to implement additional modules	Plan to implement 5 modules	Plan to implement 2 modules	Plan to implement 9 modules
	New Software requirements ranked as reason to extend or upgrade your ERP implementation	Least important	Most important	Most important	2nd least important
	New Government regulations as reason to extend or upgrade your ERP implementation	2nd Most important	3rd least important	2nd most important	Most important
	Expiration of Software Maintenance agreement as reason to extend or upgrade your ERP implementation	3rd Least important	3rd most important	Least important	Least important
	Extension of Supply chain capabilities as reason to extend or upgrade your ERP implementation	2nd Least important	2nd least important	2nd least important	3rd least important
	Retention of competitiveness as reason to extend or upgrade your ERP implementation	3rd Most important	No response	3rd least important	2nd most important
	ERP Governance decision enforcement:	By IT Steering Committee	By CIO	By IT Steering Committee	By CIO
	Importance of Organizational commitment to achieve organizational transformation:	Extremely important	Extremely important	Extremely important	Extremely important
	Please indicate the timeframe when an upgrade of your ERP system is planned:	No plans to extend	37 to 48 months	Between 25 – 36 months	No plans to extend

Section	Variable Description	Organization Case 1	Organization Case 2	Organization Case 3	Organization Case 4
Relative Importance to achieve Transformation	Importance of Governance design to achieve organizational transformation:	Somewhat important	Extremely important	Somewhat important	Extremely important
	Importance of Organizational support for Governance operations to achieve organizational transformation:	Somewhat important	Extremely important	Somewhat important	Somewhat important
	Importance of Sustainment design to achieve organizational transformation:	Extremely important	Extremely important	Extremely important	Neutral importance
	Importance of Organizational support for Sustainment operations to achieve organizational transformation:	Extremely important	Extremely important	Extremely important	Somewhat important
	Importance of End-user acceptance to achieve organizational transformation:	Somewhat important	Somewhat important	Extremely important	Extremely important
	Importance of Organizational commitment to achieve organizational transformation:	Extremely important	Extremely important	Extremely important	Extremely important

APPENDIX J – PHASE B INTERVIEW ADDITIONAL QUESTIONS

- What are your organization's focus areas for improving ERP governance activities?
  - Current
  - Future
- What are your organization's focus areas for improving ERP sustainment activities?
  - Current
  - Future
- What are your organization's focus areas for extending ERP beyond its current state?
- How have your ERP governance, sustainment and extension activities contributed to organizational transformation since ERP implementation?
- What additional organizational transformation goals can be achieved as a result of implementing, governing, sustaining and extending ERP?

APPENDIX K – PHASE B CODING & FREQUENCY

Tree Nodes

Name	Sources
Extension	2

Name	Sources	References
Change Management	3	14
Enterprise applications	3	6
ERP Lifecycle	1	1
Implementation	1	3
Power user networks	2	4
Resistance to Change	2	7

Name	Sources
Governance	4

Name	Sources	References
Achieved Executive objectives	1	3
DoD 5000	1	1
Evolving Governance	2	4
Executive participation	1	10
Lessons learned	1	2
Organizational alignment	2	8
Personal accountability	1	5
Re-energizing executive sponsorship	2	7
Reporting	1	1
Vision & strategy	2	4
What is next	2	3

Name	Sources
Sustainment	4

Name	Sources	References
Budget constraints	1	6
Evolving training	4	8
Knowledge base	3	5
Process focus	3	22
Process optimization	3	25
Resource shortage	1	1
Unmet expectations	1	1

Name	Sources
Transformation	0

Name	Sources	References
Continuing transformation	3	7