THE US PUBLIC SECTOR AND ITS ADOPTION OF
SERVICE ORIENTED TECHNOLOGY

by

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DEDICATION

This is dedicated to my family, who have endured more years than I promised of “Dad hiding in his cave” (my study space). It is most particularly dedicated to my lovely and understanding wife Kate who, despite well-founded misgivings, stood by me in my insanity of taking on such an endeavor at my stage in life. Finally, I dedicate this work in remembrance of my brother-in-law Murdo, whose courage in face of disease inspired my determination to finish.
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ABSTRACT

THE US PUBLIC SECTOR AND ITS ADOPTION OF SERVICE ORIENTED TECHNOLOGY

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George Mason University, 2012

Dissertation Director: Dr. Wayne D. Perry

Information Technology (IT) provides public sector organizations the capability to provide real increases in organizational effectiveness by aiding in the efficient exchange of information. Adoption of advanced IT such as service oriented environments, Web 2.0, and bespoke systems such as Enterprise Resource Planning (ERP) promises to markedly improve that capability via presumed gains in efficiency. However, this presumed associated gain in organizational effectiveness may be stymied/enhanced by constraints or incentives, particularly as they may relate to information sharing. This thesis reports on research in this area framed within a case study environment. The dissertation addresses data collected and findings associated with a survey of public sector organizations. It provides, in some detail, the analytical steps involved in the method and reports findings.
Information sharing in the public sector, while similar in execution to the private sector, has a nuanced difference in terms of organizational goals. This thesis draws those differences and explains how they potentially impact the effectiveness of information sharing in federal organizations. As a case study it holistically examines several factors that may or may not contribute to or constrain information sharing effectiveness. In doing so, it addresses concepts such as e-gov (the public’s access to information held by the federal sector), privacy as a throttle to e-gov, non-hierarchical structures that may or may not enhance/diminish effectiveness, coupled with a report of the theoretical underpinnings. The broad research question is: “Do organizational and individual attitudes to information sharing have an effect on an organization’s implementation of advanced IT?” This thesis addresses the question through a case study analysis that includes surveys of two organizations and the use of the structured equation modeling (SEM) analytical technique.

The paper discusses the use of SEM techniques as a method for analysis, including the strengths and weaknesses discovered. It addresses, in some depth, the relationship of the method to the theory of information sharing effectiveness. The report will include postulated models such as the original Willem and Beulens (2007) factors, which include power games, trust, identification, lateral coordination, and incentives, as well as additional factors relating to IT in particular. It introduces exploratory changes made to the model to align the model with the data acquired. Further, it kneads multiple survey results to address the continuous nature (across samples) of the results and their
alignment with theory. Finally, it provides a level of analysis as to the efficacy of SEM in information sharing research.
CHAPTER 1: Introduction

It is well-recognized in both industry and academic circles that technology advances, particularly in the information technology (IT) realm, are occurring at a pace that occasionally defies our ability to understand. Moore’s Law is considered one of the ground truths of the IT industry. Its premise is that capabilities in technology, at a given price point, will double every 18 months (Schaller, Moore's Law, 1997). In industry, at least, the ability to react with agility to these changes is, although not universal, well-proven. This is amply demonstrated by the cases of Google, YouTube, Facebook, and most recently, Twitter, all of which have been wildly successful in a short period of time.

In the public sector, however, there often appears to be a disruptive tensions between government organizational structure and the process of implementing agile information technology systems. Such tensions are not normally attributable to management of such systems, although other tensions may exist. Rather, it is a constraint with apparent origins in the organizational structures of the public sector, manifested but not singularly attributable to repeated failures to effectively satisfy goals or meet deadlines in technology implementations (GAO, 2005). These IT failures, while sometimes traceable to management or budget lapses, may just as often be associated with factors inherent in the public organizations. In nearly all cases these failures result in additional taxpayer
dollars being spent without any increase in organizational effectiveness. Such a presumed waste of resources is in effect a “dead weight” on society. Thus, where management failures can be said to have efficiency outcomes, the more pronounced failures, which are arguably governance and policy rooted, can be said to reduce or decrease organizational effectiveness.

Policy Problem and Research Question

Public sector organizations can be presumed to be set up to enhance the public good, at least at some level. Where those organizations fail to be effective in their mission, there is a presumption of some reduction in the provision of the public good. Furthermore, there are often cost penalties to the public in terms of wasted resources and assets. More gravely, failure of a public sector organization to achieve its mission can result in tragedies such as the 9/11 attacks or the Virginia Tech massacre. One of the lessons learned in both of these tragedies was that failure to share information was a factor (Kaine, 2007; Kean & Hamilton, 2004).

This dissertation will investigate the effects of trust, power politics, organizational structure and other organizational framework characteristics on successful information sharing associated with the implementation of service oriented IT systems. In doing so it will characterize the potential impact of failure to implement efficient and, more importantly, effective information technology within public sector organizations. The thesis will accomplish this within the research vehicle of a case study that ties the
concepts of the literature with comprehensive organizational surveys further enhanced by selected interviews. Finally, this effort will assess the relationship of IT governance processes in potentially mitigating such failures.

Definitions

Information technology (IT), like many other somewhat obtuse disciplines, has developed its own set of definitions over the years. To provide a common understanding for the research effort, a set of high-level definitions is required.

Definition of “IT Systems”

Surprisingly, a common stand-alone definition of IT systems is very difficult to find. A relatively comprehensive (but not exhaustive) search of available literature did not discover a widely agreed on IT definition. Therefore, lacking such a definition, I will attempt to produce one that is useful for this research. Arguably, IT systems can be viewed as an amalgamation of the software (i.e., computer program code), hardware (computer and network devices), technologies (such as video display or printer), and people that enables distribution of information across a baseline of users and within a system boundary. The balance among the three components depends on the task the IT system will perform and the processes it will support. Such a balance is not an inconsequential dependency. Small tasks might argue for relatively distinct boundaries in hardware and software, while the organizational process might expand those boundaries significantly. By way of example, consider the task of processing personnel records. In terms of hardware and software, this process is essentially a data compilation and
management system with a well-defined boundary, the database itself. However, when one begins to consider processes such as the implementation of privacy laws that define how that data can be manipulated and safeguarded, the boundary of the system may expand considerably. Such an expansion might include new hardware and software to provide access controls. In the Virginia Tech tragedy, for example, poorly formed access control processes were a point of failure (Kaine, 2007). Thus, the IT system is defined by the whole of three components: technology, people and processes.

**Definition of Governance**

Governance is better defined than IT systems. The IT Governance Institute, a business-related organization dedicated to IT governance, defines governance as “consisting of the leadership and organizational structures and processes that ensure that organization’s IT sustains and extends its strategies and objectives” (IT Governance Institute, 2005). The concept of fitting in within an organization’s overall objective and goals is embedded in the framework surrounding this definition. Also, this definition does not impart a strong sense of boundaries, the presumption being that the “organization” is the boundary. Governance in this sense is not limited to management.

There is widespread literature in both the academic and popular press that addresses the many nuances of IT management. These “how to” paradigms are designed to describe the

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1 A further nuance is that, since the problem space is defined by the organization then defines its own governance rule set within legal and, in this case, federal guidelines
process for obtaining outcomes from an IT investment by managing well-researched business and IT technology factors that inform specific IT concerns.

IT governance, on the other hand, is arguably different in some very direct and sometimes nuanced ways. Weill and Ross (2004) make a very good analogy that helps define these differences:

“The difference between management and governance is like the difference between a soccer team running harder and practicing longer and the team stopping to analyze its composition and game strategy. An analysis may reveal that the team needs to add coaches or allocate different decision-making responsibilities among the team leaders. Similarly, extracting greater value from IT is rarely a matter of just working harder or longer. Achieving more value may require involving different people in IT decisions, designing new ways of making IT related decisions, or develop new techniques for improving IT decisions. Managers make hundreds of decisions per week -- some after careful analysis or others as part of the daily frenetic activity. Governance design and analysis requires stepping back from day to day decision-making, taking Einstein’s advice\(^2\) and focusing on identifying the fundamental decisions to be made and who is best positioned to make them.”

\(^2\) Extracted quote from Weill and Ross: “The significant problems we face cannot be solved by the same level of thinking that created them.”
IT governance addresses complexity and policy issues that are, in a sense, “overarching” in scope and are both affected by and affect larger organizational issues over the long term. Having introduced the rationale for the research, it now becomes necessary to define what it includes.
CHAPTER 2: Relevant Literature

This chapter examines the literature relevant to how organizational factors can influence information sharing with a focus on the Public Sector and within the frame of advanced IT. It does so mostly but not exclusively from the perspective of frameworks and structures as advocated by Yin, Argote, Fountain (Argote, McEvily, & Reagans, 2003; Fountain, 2001; Yin, 2003). These frameworks will help to focus the examination of past work that has addressed: information sharing within organizations and the associated governance models; the slightly narrower setting of information sharing within the public sector; the concept of intra organizational incentives and constraints to information sharing; and the impact to organizational IT efficiencies and effectiveness expectations as related to the implementation of advanced IT systems. The literature thus examined provides the basis for the research that this thesis reports. The research builds on this previous work to evaluate the presumed impact of organizational constraints and incentives on information sharing.

Given these boundaries this chapter is organized to reflect the frameworks with a section on governance related literature and the associated influences of an organization’s structure; how that structure is influenced by and influences information exchange within the organization; the relevance of the IT infrastructure to an organization’s goals; how
organizational rationality influences information sharing: and impact of constraints on organizational function. This section is followed by an examination of literature that relates organizational efficiency to Information Technology. In turn, another section examines the relationship in literature between organizational information sharing and effectiveness. Finally the chapter concludes by examining the work reported by Willem and Buelens as the basis for one of the methodological approaches to this thesis’s case stud approach.

Case Study approaches are inherently more challenging than methods that tend to rely on quantitative data exclusively in that the researcher is addressing areas that are not in some sense “controllable”. Yet, when executed well a case study tends to offer “richer” understanding of a phenomenon (King, et al., 1994, Yin, 2003). An idea of a rich analytical framework is particularly germane to the study of IT implementations, allowing for seemingly disparate factors and issues to be comprehensively addressed.

The frameworks by Fountain (the technology enacting framework) and Argote (an integrative framework) both provide methodologies for looking at information sharing processes (the how) and needs (the why). Yin, as is noted later, provides the case study framework.

Examining Argote et al’s integrating framework as being particularly useful to the discussion this thesis will focus on effectiveness of information sharing (analogous to
their Motivation discussion); efficiency of information sharing (analogous to their Ability discussion) and governance (analogous to their Opportunity discussion). In doing so the paper will postulate that governance\(^3\), effectiveness\(^4\) and efficiency\(^5\) of information sharing can be influenced by organizational constraints and incentives. The postulation is well supported by Davenport, Fountain and Willem and Beulens (Davenport, 2000; Fountain, 2005; Fountain, 2001; Willem & Buelens, 2007). They focus on factors such as: internal power games (either organizational or personal) within an organization; the impact of organizational structure; the influence of organizational and personal trust; and the degree to which both formal and informal information sharing processes are in place.

As this work uses a case study approach it is appropriate to frame the literature in terms of case studies that directly or tangentially address the above factors. In the discussion that follows the relevant literature will be examined from the perspective of governance, effectiveness and efficiency. While the examination will be focused on case studies, also included is literature that frames factors related more broadly to IT implementation processes. Specifically these factors will include attitudes of organization members and other organizational characteristics that may enhance or constrain organizational information sharing effectiveness.

\(^3\) Governance, as defined in Chapter 1 relates “leadership and organizational processes” that ensures an organization’s IT strategies and objectives are implemented.  
\(^4\) Effectiveness refers to the effectiveness of organizational outcomes enabled by IT processes and infrastructure.  
\(^5\) Efficiency is how well the IT system performs and adds to the organization’s efficiency.
Governance Related

As defined in Chapter 1 governance encompasses leadership and organizational procedures and processes that enable the organization to achieve goals and strategies. Governance is not a structure for management although it may address many of the same issues in different ways. It may be applied at the sub organizational level, organizational level or over multiple organizations (Weill and Ross, 2004). Pragmatically (and in theory) this includes organizational functions such the use of formal systems, the allowance for informal coordination and the development of lateral coordination methods (March & Simon, 1958; Willem & Buelens, 2007; Wilson, 1989). Argote et al’s (in terms of their opportunity framework) Anderson, Fitz-Gerald, the IT Governance Institute and Weill and Ross along with others address, in great depth, governance issues such as: organizational structure best suited to information exchange; management imperatives for successful IT implementation; and IT relevance to the organizational goals (Anderson & Science and Technology Policy Institute (Rand Corporation), 2003; Fitz-Gerald, Melbourne, & Carroll, 2003; IT Governance Institute., 2005; Weill & Ross, 2004). These articles and books build on the earlier works of Cyert, March, Simon, Wilson and others (Cyert & March, 1992; March & Simon, 1958; Simon, 1973; Wilson, 1989) to address concepts such as organizational rationality; the influence of information in organizational processes; and how organizational and personal constraints influence organizational function. Some of these articles and books are discussed more thoroughly below.
The Influence of Organizational Structure on Information Exchange

In the preceding paragraph this factor\(^6\) was addressed as a governance function. In the early days of information technology (IT) implementation technology was designed to facilitate a faster and more accurate execution of the existing organizational processes (Coleman, 2006; Krafzig, Banke, & Slama, 2005; Weill & Ross, 2004). However, as more formal studies of organizational structure and the influences that the structure had on information exchange developed recognition grew that changes in organizational structure might enhance information exchange. March was an early proponent of this concept and along with Cyert laid the research foundations for later work. In particular they addressed individual and organizational motivations and choices as a causes for structural change (Cyert & March, 1992; March & Simon, 1958). These choices and the motivations (such as better access to information that another office might have) that affected them led to studies on organizational efficiencies that changed the scope of IT within organizations (Costigan, 1978; Davenport, 2000; Markus & Robey, 1988; Rainey, 1979; Simon, 1973; Wolf, Enns, & American Federation of Information Processing Societies., 1971). In more recent work the theme has become more nuanced with arguments that the basic structure of organizations are no longer “influenced” by IT but that organizational change and structure are “driven” by the recognition of the capabilities of IT. Both Meyer and Pearlson explore the theme making the argument that the more traditional approach to IT governance makes less sense in the developing IT

\(^6\) The use of the work factor in Chapters 2 and 3 should not be confused with the use of the statistical term “factor” used later in this thesis. The use herein is follows Webster to mean “which actively contributes to a result”
systems, partially as a function of complexity (Meyer, 2004; Pearlson, 2001) with Meyer arguing for a more segmented approach. The approach recognizes that current and upcoming technological changes to a more “componentized”7 approach to IT systems will demand more tailored governance. Finally, Fountain (2001, 2007) advances the literature in this area with a series of articles and a book proposing the idea of a virtual state (and associated governmental organizations). Within the concept she argues that IT now drives the structure of organizations to the extent that organizations must account for and change to best leverage capabilities of modern IT. Thus the balance is changing between the historic understanding of organizational IT (where information technology is viewed as a tool to information exchange) to the more recent perception that IT becomes a driver to organizational structure. The literature is beginning to suggest that IT is becoming both a frame and boundary to organizational effectiveness.

**IT Relevance to Organizational Goals**

If IT is a frame and boundary to organizational effectiveness then how might it affect organizational goals? Does it contribute to either an increase or a retrenchment? In what might be described as the “business case” argument within governance is an area that is well examined from the perspective of management but less so from the perspective of governance. This is how well an organization’s IT system supports the organization’s goals. A fundamental question it is often ignored by the IT department (Bieberstein, 2006; Davenport, 2000; IT Governance Institute, 2005; Weill & Ross, 2004).

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7 The compentization reaches its zenith in the Service Oriented Architecture/Environment (Bieberstein et al, 2006, Krafitz, 2005).
Stability is a key ingredient to support as an IT system cannot overcome uncertain organizational environment or dysfunctional organization (IT Governance Institute, 2005; Weill & Ross, 2004). To the extent that an organization's structure is well defined, particularly as regards its boundaries, this will facilitate a stable IT system. This stability is a function of clear policies and relationships which lead to well-defined technical choices. Conversely and again returning to the definition of an IT system there may be times when limitations in technology, particularly as applies to applications and infrastructure, may require organizational realignment (Meyer, 2004; Pearlson, 2001). Two cases in point come to mind. First, the security of the network system may drive organizations to realign along internal network security boundaries. Anecdotally this has been the experience of some financial institutions, who in reaction, consolidate and merge certain functional sub organizations. Second, as discussed with respect to organizational facilitation of information exchange, organizational efficiency and effectiveness the effect may dictate a realignment of organizational resources to reflect the IT system reality, i.e. what the technology will support. The best example of the phenomenon may be the widespread realignment in most organizations of IT resources under the auspices of a Chief Information Officer (CIO). Finally, a measure of IT relevance is how well an organization can function without efficient IT. Davenport, Fountain, Sampler and Krazig address this from slightly different perspectives. Davenport (2000) addresses the issue almost entirely from the perspective of data

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8 For example, few organizations have reached the IT goal of allowing one’s credentials automatically control what information a person can access. This is an IT “efficiency” goal that reduces expenditure over time and place.

9 Over the past 15 years as an example.
sharing\textsuperscript{10} (such as personnel, pay and supply chain records) arguing that to not implement IT efficiencies has a detrimental effect on an organization's efficiency, its cost structure and its personnel motivation. Sampler (1998) relates the criticality of IT systems to industry's success by examining the separability and specificity of information. In the examination he argues that information can be separated from its source and repurposed to other uses and that in doing so it can be specified or tagged (see Chapter 3 for metadata tagging and fungibility discussion) for such re-use. Krafzig (2005) examines the technological effects of poor IT systems making the point that an organization IT infrastructure can reach a point of non-relevance to its goals when it fails to “keep up” with technology change. Finally, Fountain (2007) examines the governmental impact of restraints to information flow, a restraint that is often the result of an inadequate IT infrastructure. From this literature then it becomes clear that an efficient and effective IT infrastructure contributes both the technological but also the overall goals of the organization.

**Organizational Rationality**

If the organizational goals are aided and abetted by the efficient and effective use of an IT infrastructure how rational is an organization that having invested in IT declines to make best use of that infrastructure? If personnel are not trained to make best use of the infrastructure to include efficient information sharing was the IT investment a good

\textsuperscript{10} See Coleman, Hughes, Perry, 2009 for a comprehensive discussion on data tagging.
choice for the organization? If organizational process policies are not adjusted to foster information sharing within the framework of new IT capabilities (as was the case leading up to 9/11 (Kean & Hamilton, 2004)) are the organizations behaving rationally?

Governance relies on and assumes the rationality of organizational behavior (IT Governance Institute, 2005). March and later Cyert (Cyert & March, 1992; March, Simon, & Guetzkow, 1993) laid the basis for the discussion of organizational rationality expanding upon the premise of rational individual behavior\(^{11}\). If an organization acts rationally then it minimizes cost (either in money or some other debit to organizational resources) in its choice of outcomes (products in individual terms). A rational organization will have a set of “best practices” that define how it uses and shares information. The IT Governance Institute, Weil and Ross and to a lesser extent Davenport (Davenport, 2000; IT Governance Institute, 2005; Weill & Ross, 2004) discuss extensively best practices in IT to address what they are; how and why they are developed; and best approaches implementation. The Government Accountability Office (GAO) (2005) in a comparison of government and private sector CIOs\(^{12}\) attempts to map industry best practices to governmental implementation of IT governance. In a fairly complete analysis the report finds no one “best practice” for mapping industry practices to government, instead it concludes that a variety of practices may apply, depending on

\(^{11}\) Wolf (1993) in his discussion of x-efficiency, makes the point that x-efficiency is an extension of neoclassical economic theory of efficient use of resources as a rational choice. The rational consumer will pick the product that is most cost efficient for him avoiding choices that are either more expensive or inferior in quality.

\(^{12}\) Chief Information Officers
scope and scale of the IT enterprise to be governed. Of specific interest to this thesis was
that the private sector CIOs tended to have a wider area of responsibility to include
developing IT leadership skills and improving customer relations, both of which imply an
effort to address personnel attitudes. Wilson (1989), in a slightly contrarian view not
particular to IT, argues that Standard Operating Procedures (SOPs\textsuperscript{13} – a close analog to
best practices) can become so extensive that adherence to them constrains rational
thought, i.e. the established practice overtakes and constrains rational behavior of an
organization. By way of an example, a SOP that does or does not make efficient use of
the available IT infrastructure, particularly where it inhibits the effective sharing of
information, could be said to be an irrational SOP.\textsuperscript{14}

Consider the tensions brought to an organization by the ability to share information
accurately, reliably and at the speed of light. While on the surface the ability signals a
probable improvement to the organization’s effectiveness and efficiency it may in fact
have the opposite, potentially non effective/efficient, effect. March and Simon (1993)
address this non-rationality potential by observing that the organizations and people
within organizations often decide on courses of action as a result of an aggregate of
forces and influences as opposed to rationality per se. Cyert and March (1992), in
observations of firms take the discussion of non-rationality a step or two further in their
discussion of the need for a firm to address intra organizational influences not defined by

\textsuperscript{13} A standard operating procedure differs from a “best practice” only in subtle ways. Most importantly it
tends to be proscriptive/directive in nature while a “best practice” is advisory.
\textsuperscript{14} Anecdotally in the IT industry there are many examples of where lack of understanding or blind
adherence to a SOP has resulted in in-effective use of IT tools.
the presumably rational market. Wilson and Kingdon (Kingdon, 2003, Wilson, 1989) speaking of bureaucracies, talk in terms of governmental agencies reacting non-rationally and without a profit motive. Finally, Wolf (1993) discusses the idea of non-rational actions as a series of internalities that effect organizational behavior. Thus while presumptive theory would suggest rationality in an organization (ie the organization would always attempt to act rationally) a bevy of indications argue that rationality is only one of the factors in organizational behaviors.

Given the construct what theories support these observations? First one can postulate a series of incentives and constraints that motivate either individual or groups of actors to act and react irrationally, at least from the perspective of the rationale organization. The authors cited above and their successors discuss a variety of these irrational behaviors. Perhaps foremost of these from the standpoint of information sharing is the concept of information control as an aspect of organizational power. If I know something that you don’t, and if that information is somehow useful to the organization then I, in this sense either the singular of collective “I”, can leverage that advantage. Such an advantage can take, in ascending order in terms of importance to me, the form of reputation, value (as in who is best informed) or to influence the allocation of budgets (the non-market profit value). Thus, in terms of rationality what is irrational to the organization is perfectly rational to me either as an individual or a group of individuals.

Finally, Samuel (2005), in a contrarian aside, addresses trust as a basis for a “political culture” within organizations that engenders a “shadow organization” within an
organization. He argues that these shadow organizations really controls the efforts of bureaucracies. These shadow organizations are in a sense an antithesis to the efforts to rational governance. His argument is that personal relationships of trust dominate how organizations function and that the only true imperative is to fulfill those trust relationships. Thus the assumption of rational behavior in an organization governance structure may be not entirely supported by the actions and reactions of its personnel, sub-organizations and the potential for a shadow organization.

**Constraints on Organizational Function**

In the review above there have been several implicit (e.g. the shadow organization) and explicit (e.g. information control as an aspect of organizational power) constraints to organizational functionality. Several authors have written on the subject in terms of impact on organizations and impact on information sharing. Cyert and March (1992) explicitly discuss motivational factors (a constraint being motivational in that it changes behavior) in their discussion of organizational behavioral theory. Wilson (1989) talks to organizational and personnel behavior in his discussion of barriers to information flow within bureaucracies. He points out that control of information is a classic method for gaining and keeping power in a bureaucracy. He discusses the phenomenon in terms of organizational turf issues for both Senior Executives but also for middle managers making the point that the behavior is not limited to one group of personnel or sub-organizations. Kingdon (2003) expands on the discussion in his work on events that
change organizations. He clearly talks to the constraints that entities external to an organization (e.g. Congress, public interest groups, competing (in terms of budget) federal organizations) put on an organization. While he does not explicitly discuss information flow he does address implicit constraints to information flow (such as guarding budget details) that come about as a result of organizational externalities.

Fountain and Davenport (Davenport, 2000; Fountain, 2001) build on the discussion with a focus on IT. Davenport explicitly addresses constraints and incentives to the successful implementation of Enterprise Resource Planning (ERP). He does so by tying real world examples (case studies) of attempts to implement ERP. In his discussion of successful and less successful implementation efforts he highlights where organizational and personnel perception of constraints (either real or not) have changed organizational efforts to implement. Fountain (2001) in her Technology Enactment Framework\textsuperscript{15} distinguishes between outcomes and theory with regard to organizational implementations of IT. The framework allows for discussion of the power of implicit constraints on an implementation. It explicitly facilitates a discussion of what otherwise might be considered an imponderable (i.e. organizational “power games”) factor in implemented technology. While the framework has been widely presented it is not without its critics but also with its adherents. In particular Schellong (2007), has written a positive critique that adds to the framework by introducing non organizational players.

\textsuperscript{15} The Framework, in a nuanced difference from Argote (Argote, McEvily, & Reagans, 2003) in that it addresses outcomes instead of theory. It provides a methodology to characterize and categorize, from an result perspective, an implementation of technology. It allows for an analysis of how organizational constraints and incentives, both explicit and implicit, have influenced the actual implementation.
(e.g. the citizen). Arguably the work aligns with the efforts of Kingdon by widening the fields under consideration by Fountain. Clearly the Framework is not the only attempt to structure the common understanding of how IT governance works but it is an important and pertinent one. Returning to Fountain (2007) she builds on the framework to address the incentives\textsuperscript{16} that government information managers have to share information. The vehicle for the discussion is a case study of Grants.gov. She evaluated the processes used to integrate, from a diverse systems\textsuperscript{17} of existing and sometimes quite technologically outdated IT systems, to a single web site meant to serve all of the different agencies. While there were some difficult engineering issues to work out the issues that Fountain addressed (within her Framework) were the incentives for information sharing between agencies. As part of this she specifically addressed the conundrum for budget impacts and the organizational dis-incentives to share. Her conclusion was that there was a need for strong governance to address the diversity of approaches, opinions and incentives. Finally, Bock (Bock et al., 2005) addresses what is turning out to be a well-explored arena of motivational factors for knowledge sharing. Somewhat counter-intuitively, they found that anticipated extrinsic rewards can exert a negative effect on individuals’ knowledge-sharing attitudes. These finding points out that “assumed” relationships between person and organization are not always supported in individual organizations.

\textsuperscript{16} And constraints
\textsuperscript{17} The diversity came from different approaches to different IT systems across a group of independent agencies.
Governance, in terms of IT, is clearly a risk mitigator for implementation of IT systems (IT Governance Institute, 2005; Weill & Ross, 2004). Fountain was one case study that examined governance issues, there are others of note. Anderson (2003) was chartered by the California state government to determine best practices of the offices of the Chief Information Officer (CIO) of various states. Its usefulness in terms of this thesis is that it characterizes incentive and constraint structures that enabled or hindered CIO best practices such as a collaborative approach to IT leadership and the advantages of a centralized approach. Embedded in the discussion were the ideas of personnel empowerment (an incentive). As will be seen later the examination of best practice incentives and constraint structures provides a foundation for the modification of a survey instrument and acts as a guide to the interview process used in this case study. In similar vein Landsbergen (1998) reports another state-level effort that investigates many of the conceptual ideas in information sharing. The entry argument was an attempt to discover what barriers exist to sharing information both within a state and external to a state. While the focus of the study tends to examine the efficiencies of data sharing (an hypothesis testing measure in this thesis), in doing so it illuminates organizational change resistance points. These included political (the Kingdon argument above); organizational (trust being a key factor); economic (competition for resources such as budget); and technical (commonality of data standards, mentioned in Chapter 3). In what is arguably the source of most importance to the thesis, Willem and Beulens (2007) reports a case study that is used as a starting point for the surveys in this thesis. The work is largely drawn on a comprehensive survey of government intra-departmental knowledge sharing.
As such it is a “buildable exemplar” into broader organizational information sharing issues, discussing at some length the ideas central to this thesis. It is of such value that it stands as a model for a survey approach to information sharing. A limitation in terms of modeling the same approach in the US is that the bureaucracy studied is Belgian. While national bureaucracies tend to have great similarities, there are differences (not identified nor easily demonstrable) with the US bureaucracy.

Although in this particular literature Pouloudi (Pouloudi, Perry, & Saini, 1999) is not widely cited, in a broader sense he is very well-represented in the field of organizational change. In the study on an intranet-based corporate help desk he and his colleagues address many organizational factors (to include resistance to change) and their implicit and explicit relationship to the effectiveness of the help desk.¹⁸ These include organizational efficiencies/political efficiencies informing governance. In another valuable analysis Kwan (Kwan & Cheung, 2006) reports a case study of studies about knowledge management/knowledge transfer. The authors link studies (the study only reports links, not the strength of the links) to organizational/technical change factors involved with knowledge/information sharing. These links inform on the governance process by drawing relationships between change to the efficiency of information sharing.

¹⁸ The help desk is typically the IT Departments most important interface to the customer. As such data such as number of calls in a time period is often viewed as the IT systems most accurate success metric.
Unlike many of the case studies reported here, Fahey (Fahey, Vasconcelos, & Ellis, 2007) adopted a purely ethnographical approach. As a result, they provide insights that a survey-based approach would not, but more importantly, the discussion of method and analytical approach is particularly useful in terms of addressing patterns. This study is richer and potentially more valuable to the overall knowledge base. Importantly for the research, it comprehensively addressed the issue of trust.

Not unexpectedly there is a wealth of information on IT Governance. The IT Industry, while young when compared to other industries, has been blessed by robust development. Just as unexpectedly there is a dynamic governance literature that deals with the challenges and consequences of constraints and incentives to share information using the IT infrastructure.

Efficiency Related

Before proceeding further it is useful to define what is meant by efficiency. Efficiency in the case of IT implementation is defined as the degree to which an installed IT system meets goals for budget, timeline, and systems performance measures. These systems performance measurements might include the time to transfer an electronic file from one place to another or, measure customer satisfaction19 with a particular IT system (Krafzig, Banke, & Slama, 2005; Weill & Ross, 2004). This definition of IT system efficiency might be thought of as a more focused definition.

19 The survey used later in this research has aspects of customer satisfaction embedded in the question set.
In the reviewed literature, Cyert (1992) touches on efficiency in their discussion of organizational theory, describing it as a proxy for what they call “social psychological” factors. They relate efficiency as a well-studied area where the goal was to determine if organizational factors impact the delivery of a good. Wilson (1989), talking in terms of the specific area of procurement rules within federal organizations, argues that the rules are not meant to produce efficiency but to protect the procurement process from undue external influences. He identifies these rules as occasional constraints to efficiency, an argument that Kingdon takes up in his discussion of process efficiency and constraints imposed by outside forces (Congress, for example) that can be found in federal organizations. Fountain (2001), drawing on Wilson, further refines the theme of organizational irrationality in her discussion of five rationales for agency and cross agency inefficiency. These are: the organization budget will be reduced as a result; cross agency efforts (efficient) are antithetical to the federal culture of single agency rewards; learning how to use IT efficiently is not typically in the agencies budget; the agency organizational structure is not “ready” for cross organizational information sharing; and finally, that the symbiotic nature of agencies and their budgetary sponsor discourage information sharing.

Per Wolf (1993), the definition discussion above reflects what is a subset of what he would call technological or best practice efficiency. As we will see below however there
are elements of Wolf's x-efficiency\textsuperscript{20} in the way we make use of this technological efficiency. In his discussion of markets and non-markets he asserts that efficiency concerns will be similar across the types of organizations particularly as relates to implementation of IT systems. Assuming like for like systems parameters in terms of scope, complexity and requirements the hardware and the software associated with an IT system and the best practices associated with management of those systems will vary little (IT Governance Institute, 2005). Implementation of a local area network in support of an organization whether it be in a public or private organization requires the same types of hardware and software. As discussed this commonality of implementation may be influenced by organizational culture, goals and unique public sector externalities (such as political oversight). By way of example one can postulate that the presumed additional checks and balances of a bureaucratic acquisition system will slow down a public sector implementation when compared to a mirrored private sector implementation. Such additional time may translate to a less efficient implementation. Note that the presumed loss of efficiency has at its root organizational process differences not technology.

As will be discussed in more detail later in this thesis one of the nuanced thoughts inherent in information sharing is the dynamic between what could be considered traditional (or as before, technical) efficiency and Wolf’s (1993) X-efficiency. In the literature that follows the emphasis is on the latter, i.e. the synergistic efficiencies in

\footnote{Organizational efficiency gain brought about by advances in technology, management practices, and worker motivation.}
process, information delivery and personnel actions that are particularly reaped from IT systems (although they are not unique to IT).

There are several, though fewer than expected, resources that have been discovered that make the attempt to tie technological efficiency and its effect on bureaucratic imperatives (X-efficiency) which may include incentive and constraint structures. To an extent they overlap with IT Governance literature, the ones that are reported here have been selected because that overlap is less obvious. Helmstadter and Perlman (1996) attempt to tie Schumpeterian norms and technological progress together in an anthological work. As such it is somewhat of a “think piece” overview of what generally drives information intensive organizations. Creative Destruction\textsuperscript{21} is certainly one of the observed hallmarks of IT\textsuperscript{22}. It certainly lays anthological groundwork for the more detailed thinking on efficiencies that follows. West (2005) provides insight into the bureaucratic reaction to technology in general with the somewhat counterintuitive but empirically supported observation that most bureaucratic managers welcome change brought on by technology. This is a function of needing a catalyst to change. Having said that he makes the more intuitive point (along with Wilson and Kingdon) that bureaucrats, no matter how they welcome new technology, are constrained in how they produce efficiencies in their investments.

\textsuperscript{21} Schumpeterian term
\textsuperscript{22} Consider the concurrent destruction of old means of business and innovation brought on by the World Wide Web.
Willem (Willem, Buelens, & Scarborough, 2006) lays the basis for the follow-on (2007) study in her analysis of a British multinational company. Although this is not a study of a federal-level organization, there are clear similarities between this and her later work. Particularly noteworthy are the study’s relative emphasis on organizational productivity (effectiveness)/economic efficiency and the differences between formal and informal mechanisms. The examination of efficiency (and effectiveness) measures is useful to the determination of parameters used later in this thesis to help develop the main and sub hypotheses on information sharing effectiveness. Further she lays the groundwork for her discussion of informal and formal systems providing additional insight into her 2007 paper (Willem & Buelens, 2007)

The examination of efficiency was necessary to allow for the distinction between efficiency and effectiveness. In examining the difference between traditional efficiency and x-efficiency consideration the groundwork is laid to examine the differences between efficiency and effectiveness is the federal organizational IT implementation.

**Effectiveness Related**

Organizational outcomes are the true measure of effectiveness within a public sector organization (Kingdon, 2003; Rainey, 1979; Rainey & Bozeman, 2000; Wilson, 1989), i.e. did the organization meet its remit to serve the public as it was chartered to do? If it did not then one can presume that the organization is somehow subverting the will (intentionally or no) of Congress in funding that organization. Given the assertion the
effectiveness of an organization in achieving its mission becomes paramount and arguably its only measure of value. To the extent that IT contributes to that outcome the implemented IT system can be said to be effective. The important nuance is that effectiveness measures the organizational result of the IT system while efficiency measures how well did the IT system perform.

Somewhat unexpectedly in the search for relevant literature addressing public sector information technology’s support for organizational effectiveness an entirely subjective result\(^23\) was that there seemed to be a higher interest in this issue from overseas journals, books and institutions, at least until the keyword “federal” was added to the search string. As will be reported later the Willem and Beulens study (2007) provided the basis for this thesis’s methodology and is a Belgian study of Belgian institutions. While it is clearly an overstatement to suggest that overseas researchers are more interested in the area, the very subjective results of the review lend credibility to the idea.

Having said that the focus of the review is on the US public sector. In the wider scope of overall organizational effectiveness Thomas (1993) discusses the process of reorganizing in the public sector and the expectation associated with such reorganizations. He points out the frequent disconnect between the process of reorganization, which he argues emphasizes efficiency and effectiveness, and often unstated goals to address some of the

\(^{23}\) Based on a review of several hundred abstracts surfaced by the various electronic search engines. It appeared that the ratio was about 2 to 1. This recognizes of course that there may or may not have been some bias “cooked” into the search engines but there was no evidence to support that possible explanation.
motivational factors for the bureaucrat, an assertion supported by Wilson and less emphatically by Kingdon (Kingdon, 2003; Wilson, 1989). Lan and Rainey (1992) look across the organizational landscape (public, private and hybrid) to closely compare differences in organizational effectiveness. These differences include incentives and constraint structures. In the study they refute the idea of clear cut differences, saying instead that the effectiveness differences between organizations are much more nuanced. Rainey continues the theme in a series of articles examining the distinction in term of the civil service, public and private innovation and empirical research (Bozeman & Rainey, 1998; Rainey, 1999; Rainey & Bozeman, 2000). Narrowing the focus to the idea of a propensity to share information as a determinate of effectiveness Liao (Liao, 2006) in a paper on organizational learning draws on knowledge sharing as a factor in organizational effectiveness. It is particularly useful because it shows a statistical relationship between trust and knowledge sharing. Lin (Lin, 2007) uses a survey approach to analyze the motivational factors of employees to share information. It tends to focus on the survey results alone, with little emphasis elsewhere. It has some analogs to the works of Willem and Buelens in that it uses a SEM analytical technique, although the factors being examined are different. Most importantly it acknowledges and supports the differences between efficiency and effectiveness in sharing information. Bock and Kim (Bock & Kim, 2002) continues this focus on information sharing by addressing employee motivations for sharing knowledge. As with Willem and Buelens and Lin, Bock and Kim use SEM techniques, although the authors do not address the analysis directly by that term. Wasko and Faraj (2000) also focus on the motivations to share
information, but with a different approach from the studies above. Their emphasis is on those factors that inform a community approach to knowledge, not on personal motivations. This is an important point as it demonstrates that incentives and constraints on information sharing can be organizational. Jarvenpaa and Staples (Jarvenpaa & Staples, 2000) surveyed over 1100 respondents on attitudes towards the use of collaborative electronic media. While the base of the study reports heavily on information sharing, it enhances its value by including data gathering with regard to the use of the tools themselves. They specifically examine attitudes regarding information ownership and propensity to share, along with perceived information usefulness and the user’s computer comfort. The authors also relied on SEM techniques. Less focused on effectiveness than others Kolekofski (2003) reports on the attitudes of personnel towards information sharing. The study had a small but acceptable number of respondents to their survey. As with others, the study focused on the likelihood of personnel sharing information from the standpoint of the theory of reasoned action, the model of Fishbein and Ajzen (1975). The study was not as sophisticated as some of the others in that it relied on factor analysis alone for the data analysis. Rhodes et al. (2008) expand the motivational factors to include learning strategies, the degree of a trust culture, and flexible organizational structures to inform not only knowledge sharing but also innovation as a proxy for organizational performance.
Focusing on efforts that were particular to IT systems the majority of the discovered resources focused on e-government\textsuperscript{24}. However, in reviewing the literature it turns out, with an occasional exception, that most of the effectiveness discussions were in reality efficiency discussions on how to best deliver an e-government service, not on how e-government enhanced an agency’s overall mission. If an agency’s principal mission included communication with the public (e.g. the Government Accountability Office (GAO)) then increased communications brought be e-government clearly adds to the agency’s outcome.

West (2005) spends a great deal of his effort in discussing e-government, arguably his entire book is on the subject. Having said that in his Chapter 1 introduction he discusses the overall impact of IT on government. In that discussion he addresses the ideas of effectiveness being driven by the efficiencies of e-government arguing that the process change enabled by efficient IT provides the opportunity\textsuperscript{25} for effectiveness gains within an organization. In a somewhat concurrent effort Weill and Ross make a similar argument while somewhat presaging the West effort Fountain and Davenport propose similar effects of IT on organizational effectiveness (Davenport, 2000; Fountain, 2001; Weill & Ross, 2004). Subsequently Fountain (2007) refines the theme arguing that the institutionalized aspect of bureaucracies frame the effectiveness of IT, constraining it in some cases. Bock (2005) in a somewhat contemporary work confirms the constraint

\textsuperscript{24} E-government was a late 90s effort to facilitate citizens’ access to government. See West (West, 2005) for an extensive discussion.

\textsuperscript{25} A somewhat stronger evaluation that West quotes of Volti is that technological change inevitably drives effectiveness change.
arguing that forces internal to the organization but external to the efficiency of IT act to constrain the effectiveness of information sharing.

The Basis for the Replicated Study

Addressing the idea of constraints on information sharing Willem and Beulens (2007) argue that organizational characteristics have an influence on interdepartmental knowledge sharing. From the perspective of the thesis, this is perhaps the most significant of the literature discovered and reviewed, as the survey method employed by the authors is largely replicated in this work. Having said that it has some significant differences from the both the methodology and the orientation of the thesis. First, their study is of Belgian organization; second, is focused on knowledge sharing has opposed to the less encompassing information sharing focus of the research; third, their work looks at interdepartmental and organizational efforts while the research focuses on intra-departmental information sharing opportunities. One of the key points that they make is that as of 2007 they were very few studies of public sector organizational information sharing, a phenomena that appears to continue to this day.

Willem and Beulens in their development of the research question focus on kinds of coordination and those characteristics of an organization that can influence the success of each kind of coordination. They develop and support the concept of formal coordination, lateral coordination, and informal coordination. They make the point that formal coordination and lateral coordination are both forms of formal coordination with the
difference being that lateral coordination is not necessarily preplanned. In their discussion they frame expectations of the use of these coordination types in terms of public sector organizations being different than private sector organizations. From the perspective of the belgian public sector they postulate three types of public sector organizations. The first of these are innately governmental and what in United States would be called the federal level. The second they define as national public sector organizations such as perhaps the Belgian Red Cross. The third they describe as local public sector organizations such as a local hospital or school.

Furthering the distinction between formal and lateral coordination Willem and Beulens report knowledge sharing research that indicates that formal coordination is inherently restrictive of information sharing. The rationale discussed is that the rules surrounding formal coordination are deliberately restrictive to the sharing of information. Conversely lateral coordination, while done under the auspices of the organization, tends to involve a considerably less preplanned structure. They argue that the lack of preplanned structure allows and in some cases encourages information sharing. They point out that the looser structure allows for a more intense communications. The intense communications along with the looser structure enables discussions of more complex or complicated issues. Finally, the very informality of the discussions encourages more people to participate.

Willem and Beulens developed what they call contextual characterizations of organizations that either act as a constraint or an enabler of the coordination. These
include trust, identification, and power games. They expected trust and identification to act as enablers to information sharing. Conversely they expect power games to act as a constraint. They postulate that power games will increase with the use of informal or lateral coordination.

The result of the Willem and Beulens study was mixed. Counter intuitively formal systems and power games were not influential on knowledge/information sharing effectiveness in their sample. Trust, lateral coordination, informal coordination, incentives, and identification were.

Summary

This review has been very focused on what might be argued a subset of the much wider literature on information technology, information sharing, organizational imperatives and programmatic implementations within the public sector. The need to be focused is exactly a function of the broadness of the issues. As is illustrated in Figure 2-1 below the review literature broadly addressed the influence of governance, efficiency or effectiveness on the act of information sharing but do not by themselves cause information sharing. Some of the literature addressed all three at various levels. In addition all, to some extent of another, addressed the personal and intraorganizational interactions that either constrain or enhance information sharing. This was particularly
illustrated by the measured influences reflected in the Willem and Beulens (2007) research (see figure 2-1). Returning to the idea of a framework describing information sharing the strong presence of these factors or themes in the literature confirms their relevance to the overall research question to be examined in the chapters below.

Figure 2-1 Factor Influence on Information Sharing

26 As shown in Figure 2-1: Incentives, Identification, Trust, Informal Coordination, Lateral Coordination. This is admittedly very subjective. Yin addresses the subjectivity by noting that in the specialized case of pattern matching, the process of explanation building (i.e. do the results match or inform on the pattern) demands subjective results. A review of the case studies was conducted to help frame these issues for inclusion in this study. The results of the review are shown at APPENDIX 1. In the APPENDIX a scale of relative impact was developed. The scale is 1, 3 and 5 reflecting a lowest to highest scale of interest in a particular factor.
Finally, in terms of emphasis, one of the key distinctions that will be drawn in this thesis is the functional difference between efficiency and effectiveness. As shown in Figure 2-1 there is a relationship between them that can be causal. An efficient IT system can increase an organization’s effectiveness in both sharing information and in reaching its overall goal. Conversely, non IT influences and processes (such as effective governance) can increase an organization’s effectiveness in information sharing and overall effectiveness in its goal. The strength of all three can be decremented or enhanced by the Willem and Buelens identified factors. It is precisely these possibilities that will be examined in greater detail in the research reported below.

28 Other processes/influences might include personal trust, the effectiveness of an organization’s later coordination schemas, or how well individuals identify with their organizations
Modern IT systems have many attributes of interest to public sector organizations. Among these are speed of processing information, manipulation of large data sets, and dynamic and agile adaptability to user needs. With the increase in processing speed, the user of governmental IT systems can expect increases in efficiency, a presumption of cost savings over time, and a more effective organization. The ability to manipulate large data sets should provide an ability to correlate data in ways that will increase technical efficiency and, key to the public good, organizational effectiveness. Finally, recognition has been growing that a dynamic ability to adapt to user needs, both for internal governmental personnel and the wider public, is essential to organizational effectiveness. This last point has been one of the tenets of widespread e-government efforts. While arguments persist about the effectiveness and equity of implementation in e-government, what has emerged nearly universally is that e-government has improved the citizen’s ability to access government services (Fountain, 2007). Thus, efficiency, effectiveness, equity and the public good may be served by technology growth and agility.

In this chapter the research and thesis questions are developed centering on the idea that despite the ability of the IT tools sets to efficiently and effectively process information the presumptive gains of IT are often not realized in the public sector. The gains are often
offset by non IT organizational traits such as those outlined in Figure 2-1. The development of the research question and thesis leads to the statement of the hypothesis and sub-hypotheses. Finally, a conceptual framework\textsuperscript{29} is advanced to help those whose relative lack of familiarity with IT may impede their understanding of the relationship between IT capabilities and organizational information sharing. This understanding is a critical element of the development and understanding of the hypotheses.

As information technology continues its rapid change, a particular and potentially very promising approach to the exchange of information has been developed. Although it is not without its detractors\textsuperscript{30}, this approach for a service framework, called the service oriented environment (SOE), and its engineering framework, the service oriented architecture (SOA), holds the promise of greatly enhancing the efficiency of exchanging information within and between organizations. More than most IT developments, the SOE (a service framework) requires a compatible organizational environment to succeed (Krafzig, Banke, & Slama, 2005). The great strength of this technology, even when compared to existing information technology, is that it has the ability to make the transfer of knowledge nearly transparent (or fungible\textsuperscript{31}) in terms of efficiency. Conversely, this ability has been shown to be poorly used (Krafzig, Banke, & Slama, 2005).

\textsuperscript{29} Recall the frameworks addressed in the literature review.
\textsuperscript{30} SOA/SOE have to an extent been “over sold” and presume conditions (flexibility and desire to change business processes) that are not applicable in every organization. Frustration with implementation problems has led to naysayers. See Bieberstein et al., Service Oriented Architecture (SOA) Compass and Krafzig et al., Enterprise SOA.
\textsuperscript{31} Fungible in this sense means the propensity for data to be shared among different databases and applications directly, without needing to be changed in any material way. This is a widely understood term in industry.
Thus, gains in efficiency are not automatically mirrored by gains in organizational effectiveness.

The US public sector is not unique in recognizing this technology. Private firms make use of service oriented environments (SOE - A service framework) with varying levels of success and return (Bieberstein, 2006). However, unlike government, private firms generally have a directly measurable return on investment for these increased technological abilities. That measurement is, at some level, profit. When a profit cannot be made or confidently projected by the successful implementation of these technological advances, a company simply chooses not to implement them until the profit can be made. The interests of the company and its market are met. For the public sector, however, whose remit is to serve the public good, the measurement is not so clear cut. How does one measure a “missed opportunity” to provide better citizen access? What are the impacts to the public sector budget of not becoming more efficient? What are the impacts to the public in the organization’s not being effective in the role it was entrusted with? These questions are used rhetorically in this research as part of a public policy “frame setting.” For public sector decision makers, however, they reflect real decision points requiring real answers. Having said that, it is not the intent of this research to address these particular questions in any substantial way; they are illustrative only.
In the following paragraphs the paper will address the general research approach, which is case study–centric. From Yin (2003), the elements of a good case study design include: a study’s central question or questions; the proposition; the unit of analysis; the logic linking the data to the proposition; and the criteria for interpreting the findings. While the research will generally follow the Yin model, it will diverge from it slightly to better support the case being studied.

As addressed above, the rationale for a case study approach to the research has its roots in the complicated nature of the issues and the need for a qualitative approach. The combination of nuanced relations between human subjects and, by extension, the organizations they inhabit belies a quantitative approach. Thus, the principal research question and its components, listed below, are inherently qualitative.

1. Do Organizational Attitudes\textsuperscript{32} to Information Sharing Have an Effect on an Organization’s Implementation of a Service Oriented Environment?

My previous student research (Coleman, 2006, 2007b) has shown that there is evidence to support an empirical relationship between the structures and processes of federal organizations and the success of an IT implementation, particularly a service oriented environment (SOE – a service framework). Industry and government agree that the governance of the service oriented environment (SOE – a service framework)

\textsuperscript{32} Defined as either personnel attitudes or codified organizational processes.
infrastructures is turning out to be more difficult than the visionaries (of the benefits of SOE) first espoused (Bieberstein, 2006; Krafzig, Banke, & Slama, 2005).

In terms of benefits to organizations, a service oriented environment offers three great promises (or, as some might argue, hype). One, that the expense of maintaining and managing disparate software and hardware suites can be drastically reduced by centrally managed and provided applications and data. Two, that SOE will allow for dynamic combination and recombination of IT services and data that are extraordinarily responsive to the user’s needs. Three, that the technological unknowns are known (in the sense of little innovation is needed), and as such that it is more a matter of engineering development than technology breakthroughs.

All of these are important and all, to a lesser degree than advertised, are true. There is real potential for cost savings of several orders of magnitude, mostly due to the reduced need for software renewal and the associated licensing costs for each user (Bieberstein, 2006; Krafzig, Banke, & Slama, 2005). The ability to disaggregate data from applications and then recombine it for new independent services is powerful in the sense of adding value to previously unstructured data integration. Finally, as most of the technical unknowns relate to decision making on draft or developing standards, there is little in the way of new applications to be developed.

If, however, there are process or personal constraints to information sharing resident in the organizations attempting to implement SOE and its follow-on technology
improvements, then the effectiveness impact of such improvements will be decremented (Executive Office Of The President, Washington, 2009; Rhodes et al., 2008; Willem, 2010). This is a key concept in this thesis, one that forms the basis for the central hypothesis.

Given this evidence and to better define the question, one can ask the following additional questions.

1.1 What Empirical Evidence Suggests This Relationship?

Empirical evidence likely would show that a relationship exists between a change in organizational attitudes toward a technology implementation and a corresponding change in the public sector organization’s process. Further, the relationship is likely to be bi-directional, i.e., a change in organization processes is likely to lead to changes in attitudes to IT implementation (Davenport, 2000; Fountain, 2001, 2007; Weill & Ross, 2004) In addition these process changes are likely to be influential on successful implementation of new or changed IT systems (Davenport, 2000; Weill & Ross, 2004).

Key factors that further frame incentives or constraints to implementation and provide evidence of the relationship are process and organizationally oriented. These include but are not limited to: stakeholders in the process and their ability to impede business rules and process change necessary to implementation; lack of recognition of an implementation as an organizational goal, not just a goal for the IT department; and the ability for personnel involved to communicate clearly and continuously. For example,
Davenport (2000) addresses the idea of business process change, the reshaping of organizational changes to reflect the capabilities and expectations of radical IT infrastructure changes. In the discussion of critical success factors (CSF) for management of complex IT issues, Davenport and others often key in on the area of empowering personnel at all levels to contribute effectively to the effort. In particular, there is the concept of providing personnel with the tools (mechanical or process), incentives, and freedom from constraints that will allow for successful contribution. The concept begs the question of incentive structure versus incentives. In organizations, particularly those that have bureaucratic versus collegial or entrepreneurial cultures, there is a tendency to think of incentive structures as ensuring a method where everyone (or every sub-organization) is incentivized equally. Incentives, on the other hand, are personal and situational. If I am offered a meal as an incentive when I am not hungry or am trying to lose weight, then it is not much of an incentive. If however I am looking for a job promotion any help to meet that goal becomes an incentive. If that help comes from an advantage in knowledge (i.e. a positive information flow) then keeping that advantage by not sharing that same knowledge with other people within or without my organization becomes an incentive to not share. This personal\textsuperscript{33} incentive may become an overall organizational constraint as the organization as a whole does not benefit from the information (March, Simon, & Guetzkow, 1993; Rainey, 1999; Rainey, 1979; Wilson, 1989)

\textsuperscript{33} The same argument can be made for organization subunits and behaviors
For government the case is similar on the surface, but different in detail. The overriding interest of government (i.e., the incentive) is to get more service at similar or reduced cost (the increase in service being the “return” on the investment). Thus, although transaction costs go down in terms of per unit cost, there is no guarantee the overall expenditure to the government will be reduced. Business can plan on a threshold profit based on pricing of the unit cost and can then do a “what if” analysis to determine a range of pricing/implementation choices. Conversely, government cannot as easily predict a threshold of use, especially where the use of a service often depends on outside factors beyond the service’s control. This uncertainty and risk as to threshold become incentives to non-investment in the IT system.

Using the construct of a public organization as a bureaucracy, Rainey (1999) spends considerable time and cites several different authors to address the concept of bureaucratic rigidity (e.g., the constraining impact of stakeholders). He further breaks it down into discussions of possible causes, one of which is the concept that bureaucracies reflect the necessary organizational structures of the industrial age. Industrial age organizations needed a hierarchical structure to help define roles, responsibilities and measures of success. Rainey also discusses the research of some organizational development experts, which include such things as multiple independent actors within a bureaucracy, different interests of those actors, different legislative sponsors of those actors, shifting political objectives, and weak alliances between political and nonpolitical players. Further, he discusses bureaucratic management habits, such as the refusal to
delegate authority, as factors in bureaucratic resistance to change (Rainey, 1999). Finally, he discusses personal and institutional biases against change that are based on loyalty to an organization and tradition.

Fountain adds to the discussion by pointing out that traditional institutions tend to be organized vertically or hierarchically. If one defines innovative approaches as including information technology, then one of the points she makes is that a vertical structure is inherently a hierarchical structure and unable to as easily implement innovative technologies such as advanced IT. Since most funding structures within the federal government fall within that vertical model, the ability to fund information technology across organizational boundaries, albeit organizations that have complementary goals, and the ability to share information and make innovative approaches to old and/or new problems are limited (Fountain, 2001). This vertical or hierarchical orientation has proven to be a significant constraint on the ability of public sector organizations to change.

Rainey (1999) addresses the differences between public sector organizations and private business. Building upon the work of Wilson and others, he outlines several specific issues germane to IT implementation. From the perspective of a public sector organization he discusses the absence of economic markets for outputs, meaning that unlike in industry where there is a paying market to consume the output, in government the user of the service seldom pays directly. Importantly, he addresses the idea of diffuse goals and
performance metrics. By this he means that both personnel and organizations often have ill-defined goals and/or measurements by which to be judged. These ill-defined measurements may act as disincentives to information sharing in that personnel do not see the purpose of investing in information sharing – i.e., there is not clear personal gain in the act.

Finally, Rainey discusses the idea of political influences, specifically where political influences may result in efficient or effective solution sets not being implemented (Rainey, 1999; Wilson, 1989). Lan and Rainey (1992) address the idea of relative ineffectiveness in public organizations using a comprehensive “survey of attitudes” instrument. On the one hand, they refute the stereotype of rules-based goals in public sector organizations, i.e., “the goal is to obey the rules.” On the other hand, independent of goals, they find there is a stricter adherence to rule sets within the public sector organization. The apparent dichotomy suggests a basis for a lack of information sharing, because personnel may feel that sharing information is somehow “not allowed by the rule set.”

1.2 What Empirical Evidence Suggests Impediments to This Relationship?

If there is evidence to suggest a causal relationship between IT attitudes and implementation success, then a logical extension would indicate there are likely to be influences on that relationship that in some way constitute boundaries. There appears to be wide support for the theory in the works of Davenport, Castels and Fountain, and Rainey (Castells, 2006; Davenport, 2000; Fountain, 2001, 2003, 2007; Rainey, 1999),
among others. They found that a variety of factors had the effect of establishing constraints to information flow and effectiveness, including bureaucratic refusal to share information as a function of sub-unit power; lack of IT organization identity with the larger organization (i.e., sharing of organizational values and goals); lack of business clarity as to the expected outcomes; and concern for IT impact on budget. All of these factors (and more) appear to impact the successful implementation of IT initiatives.

Davenport (2000) addresses these issues in the context of evidence gathered in a survey of fourteen companies who implemented Enterprise Systems (the pre-existing IT framework within which Service Oriented Environment (SOE) and Enterprise Resource Planning (ERP) exists). He found that not all of the companies he surveyed had an implementation plan that was well aligned with the overall business plan. He also found that corporate culture is a large influence on successful implementation. In particular he addresses the ideas of: incentives to share data among personnel; and the organizational structures that allow such exchanges. He found that many of the surveyed organizations had notable deficiencies in this area.

In a discussion of such implementations, Skok and Legge (2002) focus on several issues that are germane to the SOE. Not surprisingly, these are not technology issues but instead are centered on process and organizational needs. As mentioned above, these issues

34 Non-transparency/fungibility of data
35 ERP will be discussed in more detail later but can be considered to be the amalgamation of software products that efficiently manage organizational (pay, personnel records, etc) data.
include: stakeholders in the process and their ability to impede business rules and process change necessary to implementation; recognition of an implementation as an organizational goal, not just an IT department goal; and the ability for personnel involved to communicate clearly and continuously. A key factor that Skok pulls from Davenport is the idea of business process change, the reshaping of organizational changes to reflect the capabilities and expectations of the radical IT infrastructure changes usually associated with ERP36.

A variety of government self-assessments exist that provide empirical evidence of a relationship, including a series of Government Accountability Office (GAO) reports on Department of Defense (DOD) IT business practices. In a report dated 2005, the GAO (2005) is critical of the DOD’s efforts to build a comprehensive approach to IT management. While the criticisms are wide ranging (in the sense of both technical and organizational criticisms), this thesis will address only the organizational related deficiencies. These include insufficient personnel planning (in the sense of both organization and workforce skills/workforce engagement); the lack of provision of a business transformation plan and structure; ineffective oversight at high levels; and a lack of not only top leadership but also key middle leadership (e.g., knowledgeable program managers and key subject matter experts – a theme found in the interview results below). As an illuminating case in point, GAO cites an interview in which a personnel manager

36ERP will be discussed in more detail later, but it can be considered to be the amalgamation of software products that efficiently manage organizational data (pay, personnel records, etc.).
related that DOD was advertising billets in IT management with a focus on engineering skills as opposed to hiring personnel with business process skills. The report also criticized heavy staff turnover as a contributing factor to the insufficient “right mix” of personnel.

1.3 What is the Boundary of This Relationship?

This is a particularly difficult question, the answer to which is driven by the availability of data. Generally, the boundary of the relationship is the border of the organization(s) itself, since this is generally the limit of the organization’s control over its service oriented environments (SOE – A service framework). However, boundary nuances exist that can be defined as the degree of penetration of IT systems within an organization; the training/skill set of the users of IT information; the availability of resources; the technical maturity of the systems; and the culture of an organization in terms of the “trust envelopes”\(^{37}\) that may exist, among other potential issues and factors.

Dallenbach says “boundary selection will largely fix the scope, direction, and focus of all subsequent analysis” (Daellenbach & McNickle, 2005). He writes extensively on the concepts of boundaries as limitations to systems, which, from the perspective of this thesis, are further defined as limitations to scope. Dallenbach looks at boundaries and the making of boundary judgments as the separation between the system being studied and

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\(^{37}\) A trust envelope as used here is a metaphor for describing sub-organizational/personal trust relationships. For example, I may trust my own inner circle sub-organization and select persons outside the organization, but I am less likely to trust everyone outside that “circle.”
the environment in which it resides (Daellenbach & McNickle, 2005). Dallenbach’s
glossary includes a definition of these boundary judgments as “critical assessment and
evaluation of the consequences on all stakeholders of: where to place the boundary
between the system and the relevant environment; and which aspects are part of the
relevant environment in which ones are ignored” (Daellenbach & McNickle, 2005). Such
a placement of the boundary between a system and its environment is an essential step to
define scope.

In terms of a government cost view, the overriding interest of government is to get more
service at similar or reduced cost (the increase in service being the “return” on the
investment). Thus, although transaction costs go down in terms of per unit cost (a SOE
expectation), there is no guarantee that the overall expenditure to the government will
change. In this case cost becomes a somewhat inflexible boundary, dependent on the
ability of government to budget for the services. Cost also influences the perspective of
personnel and organizational information sharing as IT systems cost depends on how that
cost in allocated thus driving the propensity to share. The thought process is “If my
organization solely bears the cost of an information system then my organization should
control the flow of information to and from “my” information system.”

38 The impetus to this idea is from Davenport’s analysis of corporate implementations but is also supported
in the federal sector by the analysis of Wilson. (Davenport, 2000, Wilson, 1989)
The Clinger Cohen Act of 1996 was a watershed event relative to governmental management of IT resources (Seifert, 2003). The Act broke new ground in terms of establishing clear mandates for IT management, partially in response to Congressional frustration with the perceived inability of the federal bureaucracy to keep pace in the IT world. The Act directed that each major governmental unit (departments, agencies and major organizational sub-units) establish the position of Chief Information Officer (CIO) as a direct report to the equivalent of Chief Executive Officer (CEO) in federal agencies and departments. The Clinger Cohen Act established a requirement for a new sub-organization within the federal bureaucracy and with it a presumptive boundary for all things IT within an organization. There are of course additional boundary issues, but the above paragraphs capture the issues associated with this thesis.
1.4 What Effects Are of Interest?

The service oriented environment, or SOE, and its implementation architecture, the SOA, hold the promise of increased technical efficiency in exchanging information. In its ultimate form a Service Oriented Environments (SOE – A service framework) should make all information within an organizational fungible. In reality, the technical ability of the IT system an organization has purchased imposes some limits to that fungibility. IT governance, if structured correctly, is likely to leverage the capabilities of the technology and provide for complementary processes and policies that allow for fungible distribution of information. The structure of a public sector organization, however, if true to historical form, is likely to be highly hierarchical and perhaps less welcoming of what is fundamentally horizontal information distribution. The hierarchy may lead to fragmented success at the intersection of technology and organizational process and policy.

The area that continues to drive SOE (a service framework) adoption is process uncertainty. The nature of SOE (A service framework) is that it is a transaction-based approach to service provision, which means that the service provided does not have to have persistence to be effective. A service may be discovered, used, and then closed down (from the point of that individual user) in seconds. The very beauty of the approach (from the software developer’s eyes) is that it requires no long-term commitment of software resources to be useful. If the user needs the service again, he or she or it (reaffirming that users can be other applications or machines) simply returns to the site where the service is offered and uses it again. Thus, indigenous to the SOE (A service
framework) is the fact that it changes its configuration on a moment-by-moment basis, as the demands of the user and service providers change. In engineering terms this is a highly efficient methodology, but in a bureaucracy this rapid change capability is not well-served by inflexible policies and practices. It is the practices associated with these policies (Wilson would say bureaucratic standard operating policies (Wilson, 1989)) that are areas of interest.

Returning to the previous discussion of the Willem and Beulens study (Willem & Buelens, 2007) recall they postulated and confirmed within their sample that attitudes did influence information sharing. Further their results indicated that lateral coordination, informal coordination, incentives, identification and trust were significantly influential in their results.

This research is primarily interested in those practices and proposes the following effects of interest. These are: the degree to which the efficient sharing of fungible information impacts organizational effectiveness; the impact of non-technical factors on the effectiveness of information transfer; the impact of the degree of organization coordination on IT governance issues; and how IT governance effects changes in information sharing within a service oriented environment.
Thesis Statement

Yin (2003) describes a proposition or thesis statement as a method for further “directing attention” to a particular aspect of a research question. In this proposed case study methodology, to illustrate the issues of interest, the argument is made for the following proposition.

Attitudes Toward Information Sharing Influence Successful Implementations of Information Technology

Information exchange within public sector organizations and in particular the federal bureaucracy has historically been well-structured and followed prescribed rule sets (Wilson, 1989). Early implementation of information technology attempted to make such processes more efficient at following those rule sets. As IT capabilities increased, opportunities surfaced for new ways of exchanging information that did not necessarily easily fall within those rule sets. Inevitably this led to pressures to change the rule sets (i.e., governance) to make better use of the information technology capabilities. At the same time, personnel within the organizations began to experiment with alternative processes, often outside of the existing governance structure, to make the best use of IT, particularly with regard to more efficient transfer or sharing of information. Arguably the effort to increase efficiency led to a “bending” of the organizational rule sets (i.e., governance) to facilitate IT efficiency gains. Given that these premises are true, it can be
inferred that attitudes toward the exchange of information within the organization acted as an enabler, or conversely as a constraint, to successful implementation of IT.

Given that these attitudes exist, what are their possible outcomes on the effective implementation of a service oriented environment (SOE- A service framework as a specific implementation of IT? Do these attitudes explain why a well-planned and technically well-executed implementation of a SOE fails to increase organizational effectiveness, or are they irrelevant to the attempted implementation?

**Hypothesis**

These questions lead to the following hypothesis statement:

- **H$_{info-null}$** - There is no relationship between attitudes towards information sharing in a public sector organization and the effective implementation of a service oriented environment.

- **H$_{info-alternative}$** - Variations in an effective implementation of a service oriented environment can be partially explained by attitudes towards information sharing.

Given this inclusive central hypothesis, one might speculate if there could be one or more supporting hypotheses. Consider the effects of interest discussed above. One of those is to consider how organizational IT governance can factor into the sharing of information, i.e., can governance mediate the impact on organizational effectiveness of the variations presumed in H$_{info-alternative}$? This leads to the following sub-hypotheses:
H_{gov-null} - A well-structured IT governance regimen cannot mediate the impact on organizational effectiveness of presumed variations in effective implementation linked to information sharing attitudes.

H_{gov-alternative} - A well-structured IT governance regimen can mediate the impact on organizational effectiveness of presumed variations in effective implementation linked to information sharing attitudes.

Key ideas are contained in this hypothesis and alternative. One is the concept of a “well-structured IT governance.” Weill and Ross (2004) go on at length about what constitutes a well-structured governance environment. Key indicators of a well-structured governance environment include criteria such as: management support and involvement at the highest organizational levels; iterative, achievable goals; and perhaps most importantly from the standpoint of this proposed research, the relationship of the governance structure to intraorganizational information flows.

In a similar vein, information technology has at its roots the idea of efficient information transfer. However, efficient information transfer does not necessarily guarantee the effectiveness of that information transfer (Wolf, 1993), a subtlety that is often lost in the conversation about information sharing effectiveness. The program manager in charge of an IT system implementation more often thinks in terms of systems efficiency than outcome effectiveness. To provide structure to the subtlety, the following sub-hypothesis is proposed:
H_{eff-null} - Information sharing efficiency is a sole indicator of information sharing effectiveness.

H_{eff-alternative} - Information sharing efficiency can be achieved without ensuring the effectiveness of information sharing.

These Hypotheses depend on a subtle understanding of the issues surrounding information sharing among individuals and organizations, in particular the relationship between technical efficiency and organizational effectiveness. In the section below this thesis addresses some of those subtleties.

**Conceptual Framework: SOE and Data Sharing**

As was previously addressed, a service oriented environment facilitates information sharing through a series of engineering efficiencies. Service Oriented Environments (SOE – A service framework) provide disparate software applications the ability to share information, in this case electronic data, in a common or fungible electronic format. Further, this electronic data format can be described by a series of attributes that are known in the parlance of the industry as metadata, or information about data. This metadata tagged information is quickly becoming the “lingua franca” of the software industry (Coleman, Hughes, & Perry, 2009; Rothenberg et al., 2005). By way of example, consider a software application that manages contact information for an individual. In the traditional, non-Service Oriented Environments (SOE – a service framework) approach, the contact manager software would need to have the data it manages on the individual’s computing device (e.g., desktop, laptop, or cell phone/personal digital assistant (PDA)).
The challenge to the approach is that the individual needs to manage the data to keep it current. Using the SOE approach, that requirement for individual management can be mostly automated. Consider Figure 3-1 below:

![Diagram of Data Fungibility](image)

**Figure 3-1 Example of Data Fungibility**

The central box in this figure represents the individual’s contact application. Beyond what may be found in a traditional contact application, the individual has specified that
not only does he want name, address and phone number, he also wants an embedded map to show the contact’s address. As an “aide-mémoir” he would also like the title of his contact’s latest published work of. The explanation that follows of how the process occurs is a high-level simplification of the information process.

In this Service Oriented Environments (SOE – A service framework) enabled automated application, most if not all of the data elements reside in a repository somewhere away from the desktop/laptop/cell/PDA. Assuming the repositories are connected to the Internet (or some equally distributed private network), then they could be located literally anywhere. The key is to find the information, and the way to do that is by using the metadata.

Looking again at Figure 2-1, you will see four potentially remote applications (the beveled square yellow boxes) that can supply components of the information. The metadata that describes what the repositories contain is indicated by the box. The key for the box indicates what each of the field labels “A”, “B,” et al. represents. The asterisk in a box indicates that this particular metadata field is not needed or reported by the repository. To explain how the process might work, the individual decides to look up contact information on a colleague who he wants to pop in on while driving through Boston on his way to a conference. He queries his contact application, searching for his colleague’s name. The application, while in the

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39 A non–gender specific use of “he”
process of responding, realizes that the contact information on that individual has not been updated for over a month and initiates its own queries to the four repositories. First, it passes to the identity verification system the individual’s public key and tells the system what other systems it is going to query so that it is ready to verify to the other systems the validity of the query. It then looks to the public contact management system (such as Linked) for an update to the contact’s address and phone number based on the verified public key of the individual. Based on the response, it then queries the geo information system for the latest map of the address area. Finally, it queries the paper archive\(^40\) system for the latest publication of the contact. It then presents the information for the individual to use. The passing of a query and the return of the information is considered a “service” in this paradigm, and the overall domain of the applications is considered an “environment.” This process is a simple example of what in most cases is a much more complicated process. However, it does explain the concept and reflects a real gain in capability to this user.

This hypothesized gain is clearly an efficiency gain for the individual based on the efficient exchange of data brought by this technology. The use of the metadata has made the exchange of information transparent to the user and, more importantly in this case, to the various IT applications involved. In this scenario multiple applications can make use of data based on the metadata. In the IT industry this data is considered fungible\(^31\) and carries with it the idea of the efficient exchange of information. Thus, in the IT industry

\(^{40}\) JSTOR is an example.
fungible data implies IT efficiency. For the organization, the markedly increased capability to electronically share data may lead to increases in effectiveness.

The goal of information technology is threefold. First, IT allows for enhanced manipulation of information. For example, a word processor allows a user to more efficiently compose a document by allowing for “on the fly” editing of the document as it is being written. The editing capability is an enhancement to the user’s ability to manipulate information. Second, IT allows for the efficient storage and retrieval of information. In simple terms, one computer hard disk can store and retrieve information that once took hundreds if not thousands of file cabinets to store. Finally, and most importantly for this thesis, IT enables the possibility of efficient information sharing by allowing electronic data to flow around an organization or indeed around the world at the speed of light. Information is seldom useful to an individual if it is not shared, and the technology associated with information is generally oriented to the efficient transfer of that information to another individual or entity. In terms of organizational investment in information, whether in monetary, expended time or other process terms, the key factor becomes how to share. Thus information technology investment is fundamentally associated with information sharing.

If an investment is made in information sharing, then factors that decrease the efficiency or the effectiveness of that sharing relative to the expected result reduce the return on that investment. If we postulate that a particular IT system (in this case a SOE system) is
principally oriented to the sharing of information, then these sharing decrements call into
question the rationale for such an implementation. The implementation becomes less
successful if these information sharing decrements are present.

If attitudes within an organization, either personnel or organization related, towards the
sharing of information constrain the efficiency of a particular IT system’s ability to share
information, the success of an IT implementation can be said to have been decremented.
If, as a result, the IT implementation does not meet the expected or projected increases in
the efficiency of sharing information, then the organization may not see the desired
increase in effectiveness that led to the original investment decision. In extreme cases,
failure to meet projected increases in information transfer efficiency can have a negative
impact on the original or baseline organizational effectiveness. For example,
organizations often reap reduction in personnel assignments in anticipation of expected
IT-related efficiency increases (Nowinski & Kohler, 2006; Thompson, 2000). If that
efficiency is not realized, then the effectiveness of the organization is assumed to be
reduced by the associated new shortfalls in personnel.

Wolf (1993) expressed the concept more generally and perhaps more eloquently by
talking in terms of types of efficiency. Efficiency in IT systems implementation generally
is defined as the degree to which an IT system implementation meets goals for budget,
time line, and systems performance measures. Per Wolf, (1993) this definition is a subset
of what he would call technological or best practice efficiency. Efficiency concerns will
be similar across the types of organizations, particularly as they relate to implementation of IT systems. Assuming like-for-like systems parameters in terms of scope, complexity and requirements, the hardware and software associated with an IT system and the best practices associated with management of those systems will vary little. Implementation of a service Oriented Environments (SOE – A service framework) in support of an organization, whether it is public or private, requires the same types of hardware and software. However, this commonality of implementation may be influenced by organizational culture, goals, and unique public sector externalities (such as political oversight). By way of example, one can postulate that the presumed additional checks and balances of a bureaucratic acquisition system will slow down a public sector implementation when compared to a mirrored private sector implementation. Such additional time may translate to a less efficient implementation. This presumed loss of efficiency has at its root organizational process differences, not technology.

As stated above, this technological efficiency can be argued to be most often associated with IT systems and management. However, X-efficiency, again according to Wolf, is that organizational efficiency gain brought about by advances in technology, management practices, and worker motivation. In the sense of this question, x-efficiency becomes a necessary but insufficient precursor to organizational effectiveness. Obviously, arguments can be made that postulate organizational effectiveness improvements not rooted in the X-efficiency, but these are generally the exception rather than the rule.
Unfortunately, there does not appear to be a well-structured theoretical framework for effectiveness that is analogous to that of Wolf and efficiency. The literature, where it does address effectiveness of IT systems, tends to focus on efficiency as a measure of effectiveness (Weill & Ross, 2004). Thus it becomes necessary to carefully build an effectiveness definition. Effectiveness in this case study is defined as the degree to which an organization’s goals in implementing an IT system are met (Weill & Ross, 2004). In many if not most cases, these organizational goals are exogenous to the IT manager’s budget. For example, an IT system may be judged to be effective in systems performance measures but may not meet organizational goals. In such a case, the IT system implementation would be judged to be ineffective.

Finally, consider organizational indicators that do not map “cleanly” to either efficiency or effectiveness, but are nevertheless evidence of organizational dysfunction. The works of Cyert and March, March and Simon, and Wilson (Cyert & March, 1992; March & Simon, 1958; Wilson, 1989) address the ideas of anomalous behavior of organizations. These behaviors include but are not limited to actions such as coordination breakdown, frequent meeting schedule change, and budget impasse (Cyert & March, 1992; Wilson, 1989). Other behavioral anomalies might include such things as more frequent requests for human resource counseling, lack of organizational productivity, frequent discord in meetings, or a lack of intraorganizational trust. All three sets of authors would argue that these behaviors are evidence of organizational dysfunction, with March and Simon
specifically labeling such behaviors as irrational, i.e., not benefiting the goals of the organization. While many factors (as defined by March and Simon) might account for this nominal irrational behavior, other authors such as Davenport, Fountain, and the IT Governance Institute (Davenport, 2000; Fountain, 2001; IT Governance Institute, 2005) have related these behaviors to failures in information technology effectiveness. As stated previously one of the rationales for having information technology in the first place is the transfer of information. Therefore, a failure of the technology can be inferred to have at least a partial root in an information transfer failure. Both Davenport and Fountain address in some detail the relationship between organizations’ cultural propensity to share information and IT systems’ success. Wilson, March and Simon in the introduction to the latest edition of Organization, Wilson and Allison (Allison & Zelikow, 1999; March & Simon, 1958; Wilson, 1989) were among the foundational authors on the role of information sharing in organizations. Subsequently, there has been an abundance of authors, such as Bock, Constant, Kolekofski, Lin, Marouf and others (Bock et al., 2005; Bock & Kim, 2002; Constant, Kiesler, & Sproull, 1994; Kolekofski & Heminger, 2003; Lin, 2007; Marouf, 2007) who have added to the discussion of organizational information sharing.

This chapter has stated the research question and provided analysis of why the question is relevant to IT systems implementation; postulated the hypothesis and the supporting hypotheses; and provided a conceptual framework for the research. At this point an examination of the methodology is necessary.
CHAPTER 4: Methodology

The Case Study Approach

This research uses the case study methodology as advocated by Yin (2003) to enable a multifaceted analysis of the phenomenon hypothesized above. The strength of the approach is the ability of a case study to bring empirical evidence gathered in a “real life” circumstance within a set of systems and analytical boundaries. This study is designed as a comparative case study. Survey data on attitudes of organization members will be aggregated for each organization which, when combined with interviews and literature reviews, will provide a triangulation of data to support or reject the research hypotheses.

Central to Yin’s discussion of case study methods is the concept that multiple methods of data collection and analysis are more robust than a single approach. He argues that the multiplicity of data collection methods is often judged as superior to single sources of data. He then offers a graphic (his figure 4.2, page 100) that distinguishes between a successful triangulation and an unsuccessful effort. Reproduced from Yin below is the somewhat simplistic view of what might entail a successful triangulation. Note that the categories reflect sources of what he calls evidence that supports/does not support the “fact” in question.
This case study largely adopts the triangulation approach illustrated above, but varies from it in detail. Structured interviews of public sector IT professionals are combined with surveys of appropriate public sector organizations. Such a diverse approach to evidence gathering is expected to provide sufficient aggregated richness for both a qualitative and hopefully quantitative measure of the validity of the hypothesis and sub-hypotheses. The essentially qualitative nature of this analysis requires an understanding of the units of analysis.
Variables and Sources

This research focuses on two broad types of evidence, as shown in Figure 4-1. First, the research focuses on documentary resources and the units associated with those sources. The data here tends toward either explicit measures of past specific phenomena or patterns from documentary resources. It should be noted that these presumed measures of success are organization-specific.

The second type variable involves survey and interview data collected from individuals who are part of public sector organizations. In this case the data unit is the organization itself, with the measurement units being an aggregation of personnel responses. The aggregated responses are combined to form statistical factors about an organization. These organization-based factors act as points of analysis and comparison between organizational units.

To better understand the units evaluated, a short mapping of the elements of the hypotheses is indicated. Consider the elements of $H_{\text{info-alternative}}$ – Variations in an effective implementation of a service oriented environment can be partially explained by attitudes towards information sharing. “Variations in an effective implementation” can be measured in the interview process (see Appendix 3 for the Human Source Research Board (HSRB) approved interview question set) in terms of whether an attempt at implementation was successful or not in increasing organizational effectiveness. The measure of success depends on the goals of the effort, which may include quantitative
measures such as budget or network performance statistics, but it is also likely to include a highly subjective user evaluation response, where the person being interviewed is reporting on his or her organization. The measurement is set against the background of public sector attitudes toward IT use discovered in the survey process. The interview process, as outlined by Yin, looks for key indicators of success drawn from preparatory archival or documentary review. The explanatory portion of the hypothesis “partially explained by attitudes towards information sharing” can be measured/supported in terms of the strength of the statistical factors from a modified replication of the Willem and Beulens (W&B⁴¹) survey and triangulated by information/data gained in the interview process along with any documentary patterns discovered.

By way of example, W&B postulate that “power games” should have a negative impact on knowledge sharing effectiveness (see proposition P₃b in the discussion of the survey approach below). The hypothesis being tested in this research postulates that power games will also have a negative impact on information sharing⁴². The propensity for this relationship in public sector organizations will be measured by a survey of selected organizations. The degree to which the propensity may or may not be prevalent across a wider number of organizations will be supported qualitatively in the interview process. In addition, a review of archival records and documents will provide another confirmatory view of the breadth of the hypothesized effect across US public sector organizations. For

⁴¹ For convenience, Willem and Beulens will be referred to subsequently as W&B unless ambiguity results.
a graphic representation of the process for the “incentives” factor, see Figure 4-2 below.

Note: Archival records were not pursued as the survey results and literature review were deemed adequate.

Figure 4-2 Yin Influence Tailored to Incentives
Thus, while no one measure (survey or interview) or document review maps an
evidentiary element completely, in aggregate they allow for a validity judgment as to
whether a W&B factor is influential on information sharing. Figure 4-2 above models a
specific example of Yin’s triangulation method. However, since it does not address the
specific measurements of success, a further discussion of the proposed process is
indicated. Consider the relational diagram below:

![Dependency Diagram](image)

Figure 4-3 Dependency Diagram
Figure 4-3 identifies two categories of independent sources of variable information: interview results and survey results. Together these inform the dependent variable of information sharing effectiveness. Effectiveness is defined as the measure of real organizational goals achieved compared to the stated organizational goals in the implementation of an IT system.

Given that the interview and survey processes are methods of data collection, what are the metrics that can be used to show this relationship? Consider the tables below:

<table>
<thead>
<tr>
<th>Table 4-1 Measurement of Efficiency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Independent Variable</td>
</tr>
<tr>
<td>-----------------------</td>
</tr>
<tr>
<td>Technical Performance</td>
</tr>
<tr>
<td>Technical Performance</td>
</tr>
<tr>
<td>Budget Performance</td>
</tr>
</tbody>
</table>

<sup>43</sup>Questions:
52. If I use the system I will spend more time on routine job tasks.
53. If I use the system I will increase the quality of output of my job.
54. If I use the system I will decrease the quantity of output for the same amount of effort.
If we recall the conceptual discussion of Wolf and x-efficiency, we see marked in the “Independent Variable” column in Table 3-1 selected indicators of efficiency. “Selected” means a representation of possible factors that are not all inclusive, i.e., further factors may be discovered that are associated with a particular implementation. The “mapping” parameters are metrics that inform the factors.

<table>
<thead>
<tr>
<th>Table 4-2 Measurement of Governance</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Independent Variable</strong></td>
</tr>
<tr>
<td>Governance Performance</td>
</tr>
<tr>
<td>Governance Performance</td>
</tr>
</tbody>
</table>

44 Note that “factors” as described here are not necessarily the same as statistical factors described in subsequent paragraphs on survey methodology.

45 Questions: 16. Inter-unit committees are seldom set up to allow units to engage in joint decision making. 17. Task forces (project teams) are seldom set up to facilitate inter-unit collaboration on a specific project. 18. There are people with a coordinating role whose specific job it is to coordinate the efforts of several departments for purposes of a specific project. 19. Decision making in our organization is characterized by participative, cross-functional discussions in which different departments, functions, or divisions get together. 20. There are people with a process responsibility whose specific job it is to exchange knowledge and information related to a specific process. 21. Information and experiences are seldom shared in meetings or during teamwork. 22. Formal procedures determine how we work together with the other unit. 23. Information is mainly held in and exchanged through a large number of reports and formal documents. 24. In general, our work is not subject to a large number of rules. 25. The information that is required to do my job is laid down in procedures, goals and rules. 26. Our direct supervisors decide how we should execute our tasks. 27. Communication with other units occurs via the unit heads. 28. Knowledge and information exchange between units is the responsibility of the unit heads.
Table 4-2 uses the same approach to provide a measurement of governance in this research. Of note, the questions are reflective of both lateral coordination and formal systems endogenous variables.

Table 4-3 Measurement of Effectiveness

<table>
<thead>
<tr>
<th>Independent Variable</th>
<th>Data Source</th>
<th>Measurements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Organizational Goal for IT Systems Performance</td>
<td>Survey</td>
<td>Questions 47, 48, 49, 50&lt;sup&gt;46&lt;/sup&gt;</td>
</tr>
<tr>
<td>Organizational Goal for IT Systems Performance</td>
<td>Interview</td>
<td>Leadership perceptions on meeting effectiveness goals to include ease of sharing, access</td>
</tr>
</tbody>
</table>

Table 4-3 above repeats the process with regard to selected indicators of effectiveness. The “Independent Variable” columns show performance goals, while the “Measurement” column indicates measures of performance.

<sup>46</sup> Questions:
47. To what extent did you receive knowledge that enabled you to see new ways of performing current tasks within your organization.
48. To what extent did the cooperative projects with the other units prevent you from performing new or existing tasks as a result of acquired knowledge.
49. The available knowledge improves your effectiveness in performing your tasks.
50. The available knowledge improves my unit’s overall effectiveness.
In summary, the variables are organizational measures of efficiency, governance and effectiveness in sharing information. The data was collected from two organizations.

Data Collection

What is most noticeable about the data above is that the parameters are subjective; there is no easily derived quantitative measure. This subjective aspect necessitates an overlaying structure for the collection of the data. This thesis uses two such structures, selected interviews and selected survey instruments, that will inform the collection of data.

Selected Interviews

The interview question set (see Appendix 2 for the George Mason University HSRB approved question set) is grounded in the theory underlying the research question, a method that adds to the richness of a case study. As is normal in a somewhat open ended interview, the expectation is that the discussion will tend to gravitate to the subset of the topics that are most germane to the individuals being interviewed. In previous course work (Coleman, 2007), one interview was conducted with mixed but positive results. The process diverged to a degree from the prepared questions, yet yielded valuable information reflecting the organizational priorities of the senior IT executive being interviewed. Given this success, the process was extended to the executives of the organizations to be surveyed as a further enrichment.
A Survey Approach

Yin and King (King, Keohane, & Verba, 1994; Yin, 1993) both address the role of a survey in a case study analysis as usually being limited to one case study area, and further address its usefulness as a confirmatory or explanatory tool within a case study. In other words, a survey does not make up the case study, but instead tends to support, refute or explain what the wider case study shows. For this aspect of the research effort, the intent is to build on the results of one particular case study by Willem and Buelens (referenced subsequently in this document as the W&B study).

The Willem and Beulens study entitled Knowledge Sharing And Public Sector Organizations: The Effect Of Organizational Characteristics On Interdepartmental Knowledge Sharing (Willem & Buelens, 2007) is a 2007 Belgian study by Annick Willem and Marc Beulens of Ghent University. The purpose of the study was to examine public sector organizations for specific characteristics that “increase or limit interdepartmental knowledge sharing.” They surveyed in excess of 90 different public sector organizations with a sample of 358 responses. Their results were somewhat mixed but did show central factors that were influential on knowledge sharing. More importantly from the standpoint of this research effort, they developed a well-supported methodology for assessing knowledge sharing in a public sector organization. This research replicated the W&B methodology, in particular their developed and collated questions, which were modified to reflect the research intent.
This modified replicative effort includes all of the questions in the W&B study, plus some questions sourced from peer reviewed literature intended to address respondent attitudes to IT. There are two key modifications. One, the survey was centrally accessible via a commercially provided web site (QuestionPro.com) for ease of access and collection. The survey was distributed electronically to a group of respondents who are employees or contractors of the US public sector. In a departure from the W&B study, the survey was not distributed by what they call the snowball effect, but by agreement from organizations to distribute it to specific delineated employee groups. The distribution approach used was to pick a large agency or a group of agencies and request that management either distribute or allow access to distribute the survey across a subset of the agency’s(ies’) population. The demographic questions embedded in the survey allowed for analysis by gender, age groups, broad education levels, and management responsibilities. The QuestionPro web site allows for data collection of several thousand individual queries. Two, the W&B study had two dependent variables they were interested in: knowledge sharing effectiveness, and knowledge sharing intensity. For the purposes of this thesis and considering the other data collection methods to be employed, the analysis was narrowed to focus on areas within their study that are more closely aligned with the hypothesis, i.e., information sharing effectiveness.

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47 i.e., the survey is distributed to a set of individuals who are then asked to further distribute the survey to a next set of individuals who may be either qualified or interested in the subject who would in kind distribute the survey further.
The Willem and Beulens study developed ten propositions to direct the reader’s attention to their areas of interest. In a similar way, this research focused on a subset of those propositions to help test the proposed hypothesis and sub-hypotheses. By focusing within the W&B study, it was envisioned that testable clarity would be gained. Specifically, the following propositions from pages 587 and 588 of their study (Willem & Buelens, 2007) will be examined:

“P1b – The more use of lateral coordination, the more knowledge sharing in cooperative episodes.

P1c – The more use of informal coordination, the more knowledge sharing in cooperative episodes.

P1d – There will be an interaction between lateral coordination and informal coordination, such that in the presence of both the positive effect on knowledge sharing in cooperative episodes will be stronger.

P2a – The more trust in the other parties, the more knowledge sharing in the cooperative episode.

P2b – The more identification with the organization, the more knowledge sharing in the cooperative episodes.

P3a – The more power games, the less knowledge sharing in the cooperative episodes.”

The W&B study supported each of the above propositions using a specific question set that amalgamated into the specific factors of lateral coordination, informal coordination, formal coordination, trust, identification, and power games. They also added what they
consider a “control variable” factored as incentives, and an additional variable label of “knowledge sharing effectiveness”\(^\text{48}\) . In Table 4-4 below, these factors are mapped to questions that Willem and Beulens (along with Venkatesh) (Venkatesh et al., 2003; Willem & Buelens, 2007) asked by specific question number. These numbered questions are available in Appendix 3.

<table>
<thead>
<tr>
<th>Factor Name</th>
<th>Question Numbers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power Games</td>
<td>3, 4, 5, 6, 7</td>
</tr>
<tr>
<td>Identification</td>
<td>8, 9, 10, 11</td>
</tr>
<tr>
<td>Trust</td>
<td>12, 13, 14, 15</td>
</tr>
<tr>
<td>Lateral Coordination</td>
<td>16, 17, 18, 19, 20, 21</td>
</tr>
<tr>
<td>Formal Systems</td>
<td>22, 23, 24, 25, 26, 27, 28</td>
</tr>
<tr>
<td>Informal Coordination</td>
<td>29, 30, 31, 32, 33</td>
</tr>
<tr>
<td>Incentives</td>
<td>34, 35, 36, 37, 38, 39</td>
</tr>
<tr>
<td>Effectiveness of Information Sharing</td>
<td>46, 47, 48, 49, 50</td>
</tr>
<tr>
<td>IT Outcome Expectations</td>
<td>51, 52, 53, 54, 55, 56, 57</td>
</tr>
</tbody>
</table>

Focusing back on the propositions, one can relate more directly the central ideas that W&B were testing to the proposed hypotheses of this proposal. The first two propositions address lateral coordination and informal coordination, which in their study were shown to be statistically significant influences on knowledge sharing effectiveness; these two propositions will test both the central and sub-hypotheses. Specifically, both informal

\(^{48}\) Addressed in this thesis as “Information Sharing Effectiveness”
coordination and lateral coordination can be considered proxies for governance. Weill and Ross specifically address (although with different verbiage) both sets of influences as tools for successful governance. Proposition P2a addresses the idea of personal and organizational trust, which in W&B’s study proved to have the strongest influence on knowledge sharing effectiveness and knowledge sharing intensity. Trust for this effort is likely to significantly inform the central hypothesis, but it may not be as strong a factor in the sub-hypotheses. The fourth proposition in the list addresses the idea of organizational identity as a factor in information sharing. In the W&B study, organizational identity was equally as strong as lateral and informal coordination as an influential factor in effectiveness. Finally, the last of these propositions, power games, had an indirect influence on knowledge sharing but was not statistically influential on either knowledge sharing effectiveness nor intensity. This is a factor that may vary in US public sector organizations, with the likelihood of the most influence on H_info and H_gov.

The QuestionPro service was used for several reasons. Data collected can be imported into the SPSS statistical package, including AMOS for SEM, the technique used by W&B. Respondent information is safeguarded because data is retained only as long as the survey is active. Deleting the survey results in all information being deleted. After seven days, the backup information is deleted too. Access to the data, as proposed in the Human Source Research Board (HSRB) application, was limited to myself and Professor Wayne Perry using a user ID and strong encryption password. In addition, QuestionPro’s data
Structural Equation Modeling (SEM)

The W&B study used SEM as its principal analytical tool. To reduce process and tool selection as a source of variance, this research used the same approach and tool set (the SPSS/AMOS statistical software). The SEM methodology has two complementary approaches. One is to develop and test a hypothesized path model; the second is to use the power of multivariate regressions to explore a path relationship. Development and testing of a model is done graphically within the AMOS program by postulating (drawing) factor relationship paths. Using the Willem and Buelens SEM model as a base, their factors and associated path relationships were remodeled graphically in AMOS. The AMOS software program then used these graphical relationships to build a group of simultaneous maximum likelihood regressions. These regressions output a covariance matrix of the data. The matrix was then tested against the postulated (based on the originally drawn data) covariance matrix with the goal, by iterative calculations, of minimizing the difference. The subset of the hypothesized drawn model that provides for the minimum difference in the covariance matrixes is the optimal model of the path relationships.

To test this covariance difference, various SEM experts have developed a variety of model fit parameters. These tests for model fit have matured over time, with some tests
optimized for a particular type of model or collected data set (Byrne, 2009; Maruyama, 1997; Schumacker & Lomax, 2004). AMOS incorporates many of these fit measurements. Four of these were chosen (RMSEA, Pclose, CFI and the Chi Square ($\chi^2$) probability) as the model fit parameters (Byrne, 2009). The Root Mean Squared Error of Approximation (RMSEA) is a test of the postulated model covariance matrix against the matrix of the gathered model. It is supported by the Pclose measure, which measures the probability of the postulated model matrix being “close” to the data-supported matrix. The next test is the Comparative Fit Index (a small sample size adjusted variation of the Normed Fix Index (NFI), the widely accepted comparative fit index (Byrne)). Finally, the $\chi^2$ probability simply shows the probability that the Chi squared measurement is statistically significant, a necessary but not sufficient measure. The choice of these four parameters is based on a consensus of recommendations from the literature (Byrne, 2009; Maruyama, 1997; Schumacker & Lomax, 2004), which are themselves based on a much broader literature review.

Using the model developed for the pilot study (see Figure 4-4)\(^{49}\), the AMOS software settings were revised to estimate means and intercepts (account for missing data in the sample). This necessitated disabling modification indexes and bootstrapping. Modification indexing is a capability of the program to suggest model fit improvements. Bootstrapping is a process to reduce model iterations. Neither is applicable when using

\(^{49}\) The pilot study model reflects the model developed by Willem and Beulens (2007) which shows their postulated influences and the variables (questions) associated with them. Note that “power games” and “formal systems” has been added back to this model (as opposed to that of Figure 2-1) to allow the pilot activity to fully evaluate the Willem and Beulens influences.
AMOS’s Missing Data Algorithm. Note in the figure and the ones that follow that the boxes marked as Var xxx (where xxx is a unique number) are observed variables.

Figure 4-4 -Pilot Study Graphical Model

postulated to influence the endogenous variables (named in the ovals). Please see Appendix 3 for the question set to show variable number mapping. These variables, in a second order relationship, then are postulated to influence information sharing effectiveness (ISE) (the central oval). In the analysis, power games are represented as PG, identification as ID, trust as TR, lateral coordination as LC, incentives as IN, informal coordination as IC, and formal systems as FS.
An initial SEM model using the same toolset that W&B reported (AMOS) was developed to attempt to replicate their results. The SEM methodology has two complementary approaches. One is to develop and test (support) a hypothesized path model; the second is to use the power of multivariate regressions (the mathematical method) to explore a path relationship. Their SEM model was applied in a confirmatory mode to the results of the pilot survey using the same toolset. By “their model” it is meant the results shown in their figure 1, limiting this paper’s hypothesized AMOS model to those influences that W&B found to be significant.

Validity Analysis

Given the definition of data units and data collection methodology, the next step according to Yin (2003) is to discuss criteria for interpreting the findings. In the paragraphs below, this thesis will provide an approach for the analyzing the validity of the approach, drawing upon both Yin and Daellenbach (Daellenbach and McNickle, 2005). Yin on his page 34 discusses construct validity; internal validity; external validity; and reliability as common criteria for successful qualitative design. From Daellenbach the study will use classic systems analysis and operational research techniques to help refine those areas that do not neatly follow the Yin criteria.

Viability of Approach

This paper proposes four criteria that Yin (pp. 33-39) outlines for successful design.
Construct Viability

The key to demonstrating construct viability is to determine if the criterion being examined is sufficiently “operational.” To do this, Yin recommends that the researcher be able to show a valid change measure. As mentioned previously, there is a hypothesized dependency between IT implementation and facilitated sharing, a presumption that change in one sphere will necessitate change in another. For this thesis, the measures (proxies identified above) can be presumed to reflect a change from the previous status quo as IT-enabled information sharing is a relatively new phenomenon in organizations. This is admittedly a bit clumsy but is supported by the Daellenbach (Daellenbach and McNickle, 2005) concept of systems boundaries. The old pre-IT paradigm of information sharing was based on written text, spoken word, and manually compiled and presented databases. In the capabilities presented by modern IT systems, the boundaries of information sharing have been greatly expanded, which of itself is noteworthy. The proxies chosen, while admittedly subjective, are compelling in relationship to the propositions in that coordination implies a change of approach, while facilitated implies making information sharing less bounded by constraint.

In addition, the use of a replicated survey instrument to gather support data will provide the opportunity to test differences directly. The W&B study looked at Belgium’s public sector organizations. The focus of this work was to look at US public sector organizations. Factors such as national organizational culture can drive differences in survey results. In addition, by carefully choosing organizations with fundamentally
different missions (e.g., the Justice Department vs. the General Services Administration), the opportunity exists for drawing additional distinctions that were not present in the W&B study. The change is the difference in missions and how they might influence organizational goals. If the replication effort is successful in highlighting such differences, then Yin’s construct validity can be said to have been achieved.

Internal Validity
Yin is careful to emphasize the multifaceted nature of internal validity checks. In this section he lists some checks that he later (in his Chapter 5) expands upon. These checks are: pattern matching, explanation building, logic models, and addressing rival explanations. This thesis relies on pattern matching and explanation building. Logic models (as supported by survey results and as enhanced by some of the techniques from Daellenbach) are used as the rival explanation analysis. Thus this thesis appears to meet the internal validity model.

External Validity
For a case study to have external validity, it must provide an analytical as opposed to a statistical model according to Yin. He carefully makes the point that external validity for a case study is heavily dependent on the analytical support of theory. In this case study there is a clear link between the data being evaluated and theory. Even a quick review of

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50 For a comprehensive definition of External Validity as it applies to a case study please see Yin (2003) pp.33-39.
the various case studies reviewed in literature show that the theory is supported by a variety of past research. In particular, the use of a replicated survey approach that has been peer reviewed and published lends presumptive external validity. According to Yin (pp. 37-38), for case studies this reproducible analytical technique is more instructive than population statistics. In particular, and as will be shown in Chapter 5, trust and lateral coordination are factors that generalize analytically between multiple studies.

Reliability

Yin’s discussion of reliability (recently reinforced by Banks) centers on the idea that a follow-on researcher could repeat the results based on the case study notes and techniques (Banks, 2011; Yin, 2003). In general this case study approach builds on previous efforts, which were outlined above. In doing so this study addresses many of the same reliability issues those studies address, while also introducing some new ones. In particular, the techniques to be documented include:

Discovered Patterns

The pattern information addressed above is not conclusive but is instructive. Not surprisingly, when one considers the nature of the case studies found, there is a strong bias to organizational efficiency, personal motivations, quantitative indexing, and mission accomplishment. This pattern, while one would want it to be stronger, is indicative that researchers in information sharing favor these proxies to inform information sharing.
Replicated Survey

In the data collection section above, this thesis replicated a survey instrument previously used by Willem and Buelens (Willem and Buelens, 2007). As Yin shows, a survey instrument is one of a variety of techniques that can be used within a case study. An interesting observation based on previous review of case studies is that the “new” questions that W&B used are addressed in one form or another in other survey instruments. This offers some assurances of reliability in that the theory links are demonstrated in other work. The technique used in this paper is substantially the same as W&B’s, with three important exceptions. One, the survey was conducted online, which a review of the case studies above indicates is a growing technique for survey developers and users. This online aspect in itself aids in reliability because it allows for easy portability of the survey questions while at the same time making the collection and analysis of the data more timely. Second, the online nature of the survey allowed it to be easily targeted to subgroups (as demonstrated in the pilot) of the population. Third, the addition to the W&B study of questions drawn from previous peer reviewed work that address the degree of respondent comfort with IT technologies allows for comparison on yet another confirmative plane. The process of reproducing and building on previous work has recently been given additional credence in the work of Banks (2011).

The following three chapters display the methodological results, addressing the associated survey data (Chapter 5); the interviews and the associated analysis (Chapter 6); and an analytical, case study–based summary (Chapter 7).
CHAPTER 5: SEM Survey Analysis

The analysis that follows is largely broken into three sections reflective of a case study approach. In the first section, the analysis of a pilot study addresses the initial efforts to refine and mature the survey process. It explains the relationship between the survey process used in this research and that of the W&B study (Willem & Buelens, 2007). It addresses the framework for a survey, the relationship to the W&B efforts, the similarities, and the differences. It also provides an initial analysis of the data collected from a US public sector organization. The second section provides an analysis of a survey of a federal organization as the main focus of the research. The analysis of the federal organization data was more extensive, reflecting a matured understanding of the SEM process and the nature of the survey results. The understanding was driven by the need to introduce parsimony into the analysis as a function of a smaller (when compared to the pilot study) sample size. It provides the first reliable indication of the validity of the alternate hypothesis and allows for the rejection of the null. Finally, the third section revisits the pilot study data to apply the more sophisticated processes to the larger sample developed for the federal organization. It provides yet more evidence to reject the null hypothesis.
As the analytical process across the three sections is highly repetitive, the description of the administration of the process is truncated in the second and third sections.

**Pilot Study (Study 1) Results**

One of Yin’s strong recommendations within the framework of a case study where a survey is to be used is that a pilot survey should be conducted to validate the survey approach and determine what, if any, changes to the survey are necessary. With this in mind, a modified replicative survey of a major division of a public sector organization was arranged. Some pertinent constraints were part of the arrangement. First, the invitation to take the survey had to make clear that the survey was entirely voluntary and was not to be time charged against any billable work. Second, potential respondents were to be told that the research the survey supported was not part of the organization’s core research. Third, the potential respondents were told that previous small number tests of the survey indicated that the average time to take the survey was less than 20 minutes.

With these caveats in mind, the initial survey was e-mailed (see Appendix 4 for email template) to categorical email lists on June 24th, 2009. A categorical email list means the organization had pre-existing email address lists categorized by organizational unit and personnel grades. It should be noted that these lists originated from and are maintained by the human resources department. The categorization was specifically requested by the organization’s Executive Vice President to facilitate an analysis of the responses by organizational unit. As a result, 28 separate surveys were administered by email, which was the same survey duplicated for each survey category. The organization’s employee
population at the time of survey initiation was 2515. From that population, 603 overall responses comprised the initial statistic set, of which 407 were judged useful. The judgment of “useful” was based on an analysis of response sets: if the respondent answered less than 85% of the questions or ignored one or more class of questions, then the response was removed.

The statistics were analyzed for survey bias, with no reportable bias noted (Coleman & Perry, 2011). An initial SEM model using the same toolset that W&B reported (the AMOS software from IBM) with the same question set (see Appendix 3) was developed to attempt to replicate their results. The SEM methodology has two complementary approaches. One is to develop and test (support) a hypothesized path model; the second is to use the power of multivariate regressions (the mathematical model) to explore a path relationship. Their SEM model was applied in a confirmatory mode to the results of the pilot survey. The analysis indicated that application of the W&B model to the pilot data set yielded only three endogenous influences on information sharing effectiveness. These were lateral coordination (a proxy for governance\textsuperscript{51}), incentives, and informal coordination. For a more complete discussion of the statistics and results, see Coleman and Perry’s *Information Sharing Effectiveness and Organizational Impact in the Federal Sector* (Coleman & Perry, 2011).

\textsuperscript{51} Lateral Coordination does not address the entire governance process but is a statistically significant subset of possible governance processes in both the pilot and federal organization survey results.
What is not clear from the above discussion is that a set of survey questions from W&B (Appendix 3), the set mapped to a factor entitled “knowledge intensity,” is not reflected in the above analysis. The theory of this research does not require that metric, so it was not included in the pilot survey analysis. Another modification to the W&B study that is reflected in the question set but was not central to the pilot survey analysis is a set of questions designed to elicit attitudes towards information technology itself. This is an enhancement to the W&B study and is reflected in the federal organization and pilot study revision sections that follow.

Federal Organization Study (Study 2) Results

A federal organization was identified by its parent organization as a potential unit for survey. The parent had been contacted using the George Mason HSRB protocols, and this researcher was then placed in touch with the identified federal organization. As a matter of scale, the parent organization is relatively large while the identified organization is medium-sized.

The study included a survey conducted from July to August 2010 using the QuestionPro service and process described in the previous section. George Mason University Human Subject Research protocols were observed and implemented in the survey instrument as outlined in the pilot study section. These protocols included consent of the respondent, the protection of anonymity of the respondent, and the overall protection of the gathered data in a secure storage repository. The survey was terminated on August 22, 2010. The
data was extracted from the web server and consolidated in one file on August 23, 2010. Following this, a series of data massaging steps were undertaken. Included in these efforts was removal of all individual records where consent was not given but data was entered anyway (a refinement of the software midway through the survey reduced the number in the final results). Also included was recoding (reverse scoring) to invert the responses for the 21 questions that were phrased in a negative manner (to avoid respondent acquiescence bias). Those records that had more than 15 (25%) questions unanswered were removed as incomplete responses\textsuperscript{52}. As a result of these data massaging efforts, the original raw response of 145 was reduced to a working sample of 131. This is considered a small but adequate sample (Schumacker & Lomax, 2004). The actual percentile rate is unavailable as the organization distributed the survey without assistance or report back.

**Federal Organization Demographics**

As with the pilot, this survey incorporated a series of demographic questions (replicated from the pilot study) to include age range, gender, and management responsibility levels and education levels as reflected by certificates and degrees. The intent was to compare the survey responses with limited statistics provided by the organization. Two challenges arose. One, the management responsibility response choices did not map well with the organizational statistics (the organization had job grades that were not scaled according to the usual Government Service (GS) grades). Two, some of the requested information was

\textsuperscript{52} This criterion is more demanding than that of the pilot study. The research judgment was that the responses were more fragmented and less normal than the pilot, necessitating a higher standard.
considered personally identifiable information (PII) by the organization and could not be shared with those without a demonstrable need to know. The one statistic that could be reliably used, gender, was a good fit to the sample data and is shown in Figure 5-1 below.

![Figure 5-1 Federal Sample versus Organization Percentages – Gender](image)

Given the size of the organization, the sample statistic is a remarkable fit to the overall organization. In addition, some additional evidence of sample to organizational fit can be gathered. In the pilot study, two charts of organizational responsibility were addressed, and the match of responses to known grades was mapped and showed good alignment. The analysis was made possible by the method of survey distribution, in which the survey
was distributed by known grade levels and the responses were aggregated by grade level. In the pilot study, reported grade levels were analyzed and showed a propensity to under-reporting of responsibility levels. With this in mind, consider Figure 5-2 below.

![Figure 5-2 Comparison of Federal Population Responses – Reported Grade Level](image)

On its surface, this figure seems to indicate that there may have been some distribution bias, and that may have been the case. On reflection, however, it becomes less clear cut. First, as seen in the pilot study, there is a propensity to under-report responsibilities that may have skewed the results. Second, and importantly for this statistic, an unknown percentage of contractual personnel (i.e., non-federal employees who function as adjunct staff) were part of the survey. Since contractors have no inherent management
responsibility within government, it is logical to assume they would not report a grade of senior manager or middle manager and they are likely to have reported under the junior trainee/manager aggregate. To expand the information in Figure 5-2, the two reporting options of “Work Group” and “No Consistent Responsibility” made up 40% of the sample\(^53\). This ambiguity may affect the applicability to the general population.

The last statistic reported for this sample is years of service, shown in Figure 4-3 below.

\[\text{Figure 5-3 Federal Organization Years of Service}\]

\(^53\) Relying on Civil Service grade alone is less tenable in terms of surveying federal organizations.
Due to a lack of understanding of the federal organization’s human resources (HR) department\(^5\), the years of service information was provided in categories that did not align with the survey. As a result, the years of service categories (1-5, over 5) are aggregated from six overall categories from the survey and three from the HR department. The survey sample statistic is very highly skewed across the six categories, with a relatively large standard error of 1.2 (on a scale of six).

Given the ambiguity of the results when comparing sample demographics with the federal organization reported demographics, the parent organization was contacted for assistance with the overall organization. Specifically, education, age, and years of service demographic information was requested and provided. Looking at these statistics in order, we start with workforce education.

\(^5\) There was evident personnel change and disruption within the federal organization’s HR department, with the result that the request for demographic information was passed through several people before being answered. When a follow-up to clarify was requested, the HR department declined to engage further.
In Figure 5-4 the parent organization is indicated in blue, the sample demographics in red, and the normed sample in green. There is some disparity in the blue and red columns, but, except for the MS column, the percentages are within plus or minus 10%. The MS column shows around 20% disparity. In the education demographic area (along with age and years of service), there was a numerical difference between the overall sample size and the number of respondents to the demographic questions. As the demographic responses were at the end of the survey, one can reasonably presume
“survey fatigue” as an explanatory factor. In any case, for education there was a difference of 20 respondents who did not fill in the education question.

If they had responded, how might that affect the distribution comparison between the sample and the parent organization? This cannot be demonstrated, but in the interest of narrowing the disparity we can conduct an analysis that distributes the 20 respondents in a way as to model a best case scenario. As an example, the 20 non-respondents were distributed to HS and ASSOC categories (10 each) and the results were recalculated. By doing this, the HS and ASSOC differences are reduced. The result is called the “normed” sample, and although it brings sample and parent numbers closer in the HS and ASSOC categories, it also increases the difference\(^55\) in the BS and MS areas. However, when looked at broadly, it softens the argument that the demographics are out of sync.

Accordingly, given the idea of a “normed” distribution for education, there is not a strong indication of large differences (sample versus parent) in any category.

In a similar way, age was analyzed for demographic disparity.

\(^{55}\) The change is a function of increasing the denominator value in the percentage calculation.
In Figure 5-5 the age distributions are reasonably well-matched, with the cohorts of 30-46 and 47+ showing slight disparity. Again, modeling the best case distribution results in the disparity becoming even slighter, such that age does not indicate a strong disparity between the sample and the parent organization. The distribution for years of service, however, showed less clear cut results. See Figure 5-6 below.
Initially, the demographic would seem to indicate a large disparity between the sample and parent organization within the ≤ 1 and the > 20 categories. However, a possible explanation is that the federal organization experienced large growth (in the range of 300 additional personnel) in the past two to five years. That growth may have skewed the sample, or it may just be that this particular sample had an inordinate number of relatively new personnel.

56 As of the survey date
Sample Generalizability

A goal in social science research is that the sample reflects the population, a goal that is often referred to as External Validity. This is different from the discussion of External Validity (a case study assessment as advocated by Yin) discussed in Chapter 4. For the purposes of the demographic discussion this thesis will refer to this assessment as generalizability.

Trochim and Donnelly, drawing from Cook, Campbell and Shadish define external validity as: “External validity refers to the approximate truth of conclusions that involve generalizations, or more broadly, the generalizability of conclusions. Put in everyday terms, external validity is the degree to which the conclusions in your study would hold for other persons in other places and at other times” (Trochim & Donnelly, 2001). Note the use of the term “generalizability” in the quote. In addition Best et al address the idea of generalizability specifically in internet based surveys making the point that the anonymity of the survey makes generalization difficult but not impossible (Best et al., 2001).

Trochim and Donnelly, in their discussion say that there are really two ways to approach the issue of generalizability. One is to assert that the sample is representative of the population in that it is a “fair” sample, i.e. drawn in non-biased way. Best et al specifically identify this approach as problematic as it is difficult to know if the personnel
being surveyed have a technology bias or internet accessibility problem\(^{57}\). The second approach is to adopt what they call a proximal similarity model. The basic idea is to model the sample as being similar to the population along an axis (gradient) of similarity. They provide, as example gradients: people, place, time and settings. For the federal organization survey three of these recommended gradients were controlled\(^{58}\) with the only people gradient (i.e. the demographics) being non-controlled.

In terms of generalizability key inherent threats to the sample’s generalizability include: uncertainly surrounding the contractor personnel’s self-assessment regarding the demographic questions; the unwillingness of the Federal Organization to provide some of the requested data; and the mismatch (with respect to the usual GS grading structure) between grade assignments.

At the beginning of this demographic assessment this thesis reported the difficulty in obtaining demographic material from the surveyed organization. The difficulty necessitated going to the parent organization to obtain larger organization demographics, many of which did not map cleanly into the survey data. The lack of a clean mapping introduces risk in asserting that the sample reflects the population. While there are mitigating factors that were discussed this problem is a threat to the assertion of sample generalizability.

\(^{57}\) In the Federal Organization survey an accessibility problem is not likely, all but very few personnel were known to have access to the corporate intranet.

\(^{58}\) “Controlled” in this case means that all of the sample had essentially the same work environment (an office settings) and that the survey was conducted in a fairly narrow time frame of a few weeks.
A detailed discussion of the grade mis-match would narrow the list of organizations in the public sector that might be identified as the surveyed federal organization. For this reason a detailed discussion of the differences of the federal civilian grade structure and the more widely applied civil service (GS) grades must be avoided to protect anonymity of the organization. What can be said is that the grade structure comparisons made are broadly in sync. However, the subtle differences in grade skill sets might introduce a threat to the generalizability of the respondent sample results to federal organization population.

The surveyed organization does not appear to keep good demographic records of its contractual workforce. This, while unfortunate for this research, is understandable, the role of a contractor is considered to be as an augment to the civilian workforce, easily hired and fired. As reflected by conversations with the federal organization Human Resource department the government has not yet seen a need for the data.

The demographic information for the federal organization discussed in this section on federal organization demographics may be considered sub-gradient measures of generalizability. In this case three demographic statistics are well-aligned between the sample and the organizations (the federal organization and its parent). Gender was strongly aligned, as was age. Education level, especially if one allows for the favorable
distribution\textsuperscript{59} of the non-responders, was also well-aligned. In the case of years of service, both the sample versus the federal organization and the sample versus the parent organization had procedural issues. The disparity in the demographic cannot be dismissed, and the factors surrounding the collection of the demographic and the possible impact of organization growth make these demographic measures uncertain\textsuperscript{60}. Finally, the management responsibilities demographic is highly subjective, indicating a fairly high degree of uncertainty.

The decision point for this demographic/generalizability assessment is whether or not the sample reflects the population. Given this demographic analysis and despite well founded concerns for generalizability, there is no unimpeachable indication of disparity and relatively strong (age and gender) indications of sample validity. Some ambiguity remains and there is a possibility the sample is not a good reflection of the federal organization at large. Given the discussion on the potential for impact of the contractor population and the unknowns (generalizability threats) associated with their influence on the population there is a small risk that the sample is not generalizable to the population. However, based on the discussion above there is a larger probability that it is generalizable.

\textsuperscript{59} As was discussed in the demographic analysis and in this section allowing for a favorable distribution introduces risk to generalizability of the sample to the population. As was also discussed this risk was deemed not large.

\textsuperscript{60} Introducing risk to the overall generalizability of the sample to the population
Federal Survey SEM Analysis

In the initial run\(^6^1\) of the W&B model, the results were not satisfactory in terms of model fit nor the statistical significance of the endogenous variables on information sharing effectiveness. In a series of additional runs of the model, several settings adjustments were made as recommended by various software dialog boxes to allow the software to converge on an iterated model that best fit the sample data. These adjustments included adding error terms (a constraining function) to some of the endogenous variables and adjusting fixed weight regression terms for a selection of the observed variables (questions from the survey). These efforts allowed the model to converge to an over-identified model, a desired state in the structured equation model process. However, these software runs did not converge fully.

Because the runs did not fully converge, the next step was to enable a function of AMOS that has the program try to identify unidentified models. The model ran and converged, but the resultant model fit parameters indicated a poor fit. See Appendix 6 for further detail.

At this point it is necessary to discuss the literature research on the relationship between model parsimony and fit. Schumacker suggests that for each observed variable included in a model, there should be between 5 and 10 respondents to obtain a good or reasonable

---

\(^6^1\) “Run” refers to the execution of the AMOS software package on a given exploratory/confirmatory model.
fit. Thus, a model that has (at this stage) 37 observed variables should have a sample size of between 185 and 370. (Schumacker & Lomax, 2004) The sample size obtained in the survey results is 131, indicating that a reduction in observed variables of at least ten$^{62}$ is necessary. In addition, Byrnes suggests there should be at least 2-3 observed variables per endogenous variable (Byrne, 2009).

By this point it was becoming clear there was no “easy path” to a good fit of the model. The process that had been used was to let the tools indigenous to AMOS try to enhance the fit, which turned out to be lengthy and not particularly informative. Obviously, other metrics needed to be addressed to improve the fit. Up to this point, the model had been restricted to one that roughly replicated both the pilot evaluation and the W&B approach. In the pilot study, the intent of the fit evaluation was more to demonstrate and validate the methodology than to obtain a good model fit (although the pilot study model at this point had an acceptable fit). The pilot study fit process had a decided advantage because the sample size (n=407) was much more in line with the literature guidelines for an adequate sample size (for the number of observed variables) than the current sample size (n=131). Because the model would require a great reduction in observed$^{63}$ variables and their associated endogenous$^{64}$ variables, the decision was made to introduce the full model supported by the survey instrument, so that the reduction process would include the entire survey results. Recall that the survey was a replication of the W&B survey with

$^{62} 5 \times 27 = 135$

$^{63}$ Observed variables $≡$ the survey questions answered on a 1-5 Likert scale, exogenous to the model.

$^{64}$ Endogenous variables $≡$ dependent latent variables informed by the questions, factors in a factor analysis model.
the addition of variables to evaluate the actual influence of the IT systems themselves. Thus, IT outcome expectations (ITOE)\(^65\), IT complexity\(^66\), and IT social factors (IT SF)\(^67\) were introduced to the model.

The next approach in the analysis was to look at the statistical significance of the influence of each observed variable on an endogenous variable. One of the first results of the approach was to observe that none of the observed variables on IT SF (variables 62-65) were significantly influential on this endogenous variable. This led to a review of the survey result data, which identified nearly 20 of the 131 sample respondents where the respondent did not answer these questions. While the AMOS-embedded expectation maximization process imputes data, a reasonable speculation may be that the degree of missing data was too high for the algorithm to properly adjust. The observed variables for IT complexity exhibited a similar degree of missing data, but conversely had some statistically significant influences on the endogenous variable.

Over the next several iterations, a series of “removing from the model” and “adding back in” tests of the endogenous variables were undertaken (See APPENDIX 6: for a fuller description). With each iteration, the observed variables for one or more (but never more than two) specific endogenous variables were subjected to a specification search while “holding” the other endogenous variables constant. This process was also guided by

\(^{65}\) ITOE ≡ how well does the IT system that I have help me in my work? ==> IT efficiency.
\(^{66}\) IT complexity ≡ Is my IT system hard to use?
\(^{67}\) IT SF ≡ Do my colleagues support the use of the IT system?
looking at the statistical significance of each variable’s influence on ISE. This analysis indicated the need to remove power games (PG), informal coordination (IC), and identification (ID) from the model. Then, each of the remaining endogenous variables (ITOE (an IT efficiency proxy)\textsuperscript{68}, trust, lateral coordination (a governance proxy)\textsuperscript{69}, and incentives) was tested alone and conjunction with each other. In the process, a pattern emerged where certain observed variables (14, 20, 47, 48 and 52) routinely were identified by a specification search\textsuperscript{70} as candidates for removal. In some instances the model fit worsened, but in most cases removal of these observed variables improved the fit.

One of the techniques employed to increase model parsimony was to evaluate the remaining observed variables for their kurtosis levels and the statistical significance of those levels. Kurtosis is a parameter of a variable’s response distribution that measures the distribution for adherence to a normal curve. The variation may indicate a wide (flat) distribution or a narrow (peaked) distribution. Since structured equation modeling “expects” a normal continuous distribution, deviations from this normal curve will influence model fit, i.e., increase the covariance associated with the model. The purpose

\textsuperscript{68} This and subsequent referrals to ITOE will contain the linkage to IT efficiency to reinforce the concept of ITOE as a measure which includes a substantial efficiency component.

\textsuperscript{69} Weill and Ross in discussing IT governance emphasize the role of repeatable process for IT governance. Lateral coordination provides such processes vis a vis information sharing. Thus lateral coordination, in terms of information sharing is a proxy for successful IT govenances. This and subsequent referrals to lateral coordination will contain the linkage to governance to reinforce the concept of lateral coordination as a governance measure.

\textsuperscript{70} Specification Search is an automated AMOS tool that assists in the evaluation. See Appendix 6 for further information.
in measuring kurtosis (K) and the statistical significance of the kurtosis (K/standard deviation >1.96 indicating P<.05) is to predict whether that variable may be a cause of a poor fit. A statistically significant kurtosis value would be an indicator of poor fit, i.e., that the variable responses were significantly non-normal. An example of a statistically significant high kurtosis distribution is shown in Figure 5-7 below. The columns reflect the response distribution, while the overlaid black lines reflect the normal curve for the individual question. “We are evaluated as a team” has a statistically significant kurtosis value, while “Cooperation as a unit…. of our organization” has a low, non-significant value.

**Federal Organization**

<table>
<thead>
<tr>
<th></th>
<th>Kurtosis</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>We are evaluated as a team</td>
<td>-0.923</td>
<td>0.018</td>
</tr>
<tr>
<td>Cooperation between units is one of the strategic objectives of our organization</td>
<td>0.018</td>
<td>0.018</td>
</tr>
</tbody>
</table>

Figure 5-7 Kurtosis Levels
These two variables are influential on incentives. In deciding which of these two variables to include in the analysis, “We are evaluated as a team” (var34) was removed while “Cooperation as a unit…. of our organization” (var38) was retained. This type of analysis was continued for all of the remaining endogenous variables. The results of this analysis are shown in Table 5-1.

Table 5-1 Table of Kurtosis and Z Values

<table>
<thead>
<tr>
<th>TRUST</th>
<th>Var12</th>
<th>Var13</th>
<th>Var14</th>
<th>Var15*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kurtosis</td>
<td>1.34</td>
<td>.002</td>
<td>-.569</td>
<td>.879</td>
</tr>
<tr>
<td>Z value</td>
<td>.802</td>
<td>.934</td>
<td>.979</td>
<td>.767</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>LATERAL COORDINATION</th>
<th>Var16*</th>
<th>Var17</th>
<th>Var18</th>
<th>Var19</th>
<th>Var20</th>
<th>Var21</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kurtosis</td>
<td>-.646</td>
<td>-.04</td>
<td>.452</td>
<td>-.557</td>
<td>.220</td>
<td>.535</td>
</tr>
<tr>
<td>Z value</td>
<td>1.46</td>
<td>.09</td>
<td>1.12</td>
<td>1.26</td>
<td>.495</td>
<td>1.22</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>INCENTIVES</th>
<th>Var34</th>
<th>Var35*</th>
<th>Var36</th>
<th>Var37</th>
<th>Var38</th>
<th>Var39</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kurtosis</td>
<td>-.923</td>
<td>-.019</td>
<td>-.728</td>
<td>.247</td>
<td>.018</td>
<td>-.334</td>
</tr>
<tr>
<td>Z value</td>
<td>2.08</td>
<td>.043</td>
<td>1.63</td>
<td>.556</td>
<td>.04</td>
<td>.752</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ISE</th>
<th>Var46</th>
<th>Var47</th>
<th>Var48</th>
<th>Var49</th>
<th>Var50*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kurtosis</td>
<td>.497</td>
<td>-.172</td>
<td>-.951</td>
<td>.131</td>
<td>1.071</td>
</tr>
<tr>
<td>Z value</td>
<td>1.107</td>
<td>.383</td>
<td>2.118</td>
<td>.291</td>
<td>2.37</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ITOE</th>
<th>Var51*</th>
<th>Var52</th>
<th>Var53</th>
<th>Var54</th>
<th>Var55</th>
<th>Var56</th>
<th>Var57</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kurtosis</td>
<td>.39</td>
<td>-.531</td>
<td>.099</td>
<td>-.151</td>
<td>.929</td>
<td>.479</td>
<td>.827</td>
</tr>
<tr>
<td>Z value</td>
<td>.86</td>
<td>1.17</td>
<td>.217</td>
<td>.33</td>
<td>2.05</td>
<td>1.06</td>
<td>1.83</td>
</tr>
</tbody>
</table>

Note: ISE – information sharing effectiveness, ITOE – IT outcome expectations

The Z values listed here are the results of dividing the kurtosis value by the kurtosis standard deviation. This value is evaluated against the criteria of $Z > 1.96$ to provide a
probability $P < 0.05$ as an indication of statistical significance. The kurtosis values that were significant are marked in red in Table 4-1. Also marked in red are those variables that are excluded by virtue of their continuous status in the previous evaluations as variables whose removal increases model fit. Finally, those variables marked with an asterisk are those whose regression weight was set to one to achieve model identification. The reader will note that in some cases these fixed variables do not have the highest kurtosis value. This reflects those model iterations where actual testing indicated that these variables should be fixed. The result of this analysis was that all of the remaining endogenous variables had their observed variables reduced to three. Figure 5-8 below reflects this result. Note that in the following analysis, the numbered variables were removed from the figures to show them more concisely. The observed variables associated with each endogenous variable do not change from those listed in Figure 5-8 for the remainder of the federal organization analysis\textsuperscript{71}.

\textsuperscript{71} For this and subsequent figures, a reminder of the ITOE functional equivalency is inserted to provide the perspective that ITOE is a proxy for IT efficiency in this thesis.
It is perhaps useful here to draw the reader’s attention to ITOE. The observed variables that inform on ITOE include four of seven questions that relate directly to the efficient use of IT systems. The remaining variables address proxies for efficiency. Thus, in general, ITOE may be considered a proxy for IT efficiency in this and subsequent discussions.

At this point, a series of model reductions were conducted (see Appendix 6 for the step-by-step detail) by adding and removing the endogenous variables and evaluating model fit after each iteration. The observed variable boxes become static at this point and have been removed for ease of viewing.
Figure 5-9 Lateral Coordination and ITOE

Figure 5-9 shows the first of two good fit models. The RMSEA value of .054 is a good fit and is significant, and the CFI value is excellent. Notably, the Chi squared value is statistically significant, which given the sample size is an indication of a very strong fit. Finally, Figure 5-10 shows the best of the models (in terms of model fit).
The RMSEA value of .028 indicates an excellent model fit, as does the CFI value of .992. In addition, the RMSEA value is highly significant and the Chi squared significance indicates excellent model fit. Model fit indicates that the model in Figure 5-10, and to a lesser extent the one in Figure 5-9, reflect the sample data. Finally, in the last two figures the relative regression weight for each factor has been reported. These regression weights are of interest now that the models are shown to fit.

At this point, further modification of the models was no longer necessary given the research goal of gathering evidence to support the rejection of the null hypothesis. Recalling the model fit parameters for RMSEA, CFI and CHI-S (RMSEA<.05,
There are two clear instances (reflected by Figures 5-9 and 5-10) where endogenous variables have a statistically significant influence, as reflected by the weighting on each influence arrow, on information sharing effectiveness.

Table 5-2 Federal Organization, Tabulations of Fit and Influence Strength

<table>
<thead>
<tr>
<th>Configuration</th>
<th>RMSEA</th>
<th>Pclose</th>
<th>CFI</th>
<th>CHI-S</th>
<th>ITOE Strength</th>
<th>LC Strength</th>
<th>TR Strength</th>
</tr>
</thead>
<tbody>
<tr>
<td>ITOE, TR, LC, IN</td>
<td>0.094</td>
<td>0</td>
<td>0.841</td>
<td>0</td>
<td>-0.264</td>
<td>-0.259</td>
<td>0.276</td>
</tr>
<tr>
<td>ITOE and LC</td>
<td>0.054</td>
<td>0.409</td>
<td>0.975</td>
<td>0.099</td>
<td>-0.228</td>
<td>-0.484</td>
<td>N/A</td>
</tr>
<tr>
<td>ITOE and TR</td>
<td>0.028</td>
<td>0.709</td>
<td>0.992</td>
<td>0.325</td>
<td>-0.298</td>
<td>N/A</td>
<td>0.451</td>
</tr>
</tbody>
</table>

Note: all of the strengths are statistically significant, at least at the P<.017 level.

As shown in Table 5-2 above, the data collected and the methodological technique of structured equation modeling indicates that for this particular organization, at least two of the postulated influences do influence the organization’s information sharing effectiveness. Lateral coordination (a governance proxy) and ITOE (an IT efficiency proxy), when combined, indicate a negative influence on information sharing effectiveness. In the same way, trust and ITOE offer a net positive influence. If we return to the propositions adopted from the Willem and Buelens study, it is apparent that both

72 For the trust and ITOE combination, the TR strength was P<.001 and ITOE strength was P<.004. For the LC and ITOE combination, the LC strength was P<.001 and ITOE strength was P<.017.
$P_{1b}$—lateral coordination and $P_{2a}$—trust are supported for this sample. Finally, when all four endogenous variables are modeled together, the model fit is at the low end of moderate (based on recognition that the parameters are not accepted “good fit” standards and are not significant).

The negative influence of ITOE (an IT efficiency proxy) shown in both Figure 5-9 and Figure 5-10 is a somewhat surprising outcome in the sense that one might expect an improved IT outcome (efficient use of IT) result to support information sharing. However, this outcome aligns with recent research (Rees & Hopkins, 2009; Wang & Haggerty, 2011; Xu, Kim, & Kankanhalli, 2010) that suggests as persons become more dependent on their IT resources, they become less inclined to share information through person-to-person processes. This would seem to suggest that for both trust and lateral coordination (a governance proxy) processes, when combined individually with ITOE (an IT efficiency proxy), ITOE becomes a constraint (negative influence). When ITOE (an IT efficiency proxy) is viewed along with incentives, it is a positive influence that may be explained in theory by the view that incentives are neutral to interpersonal relationships, i.e., the organization decides what form they may take and would apply them equally. Thus, in the case of the federal organization, ITOE tendencies towards reclusiveness in direct contact may not be mitigated by applying processes to encourage contact, such as lateral coordination (a governance proxy) would enable. Rather, the organization might use incentives, applied to an individual or subgroup, to encourage information sharing.
This result is supported by the Wolf theory on X-efficiency and the more generalized theory in Chapter 3 that efficiency does not always improve effectiveness.

**Pilot Study (Study 1) Revised**

Comparing the results discussed above to the pilot study is complicated by at least one inadvertent inconsistency in the approach. Recall that the purpose of a pilot is partially to test methods. One of the discrepancies found as a result of the pilot survey analysis was that the question set (the observed variables) had some unintended consolidations. As Banks (2011) would predict, this resulted in some challenges in performing a like-for-like comparison of the models. Before addressing the difficulty consider the revision process for the pilot data.

The pilot study information data was evaluated again, applying the lessons learned from the analysis of the federal organization. While the sample data remains the same, the treatment of missing data was revised to conform to the process used in the federal organization survey. Thus, the AMOS missing data process was applied to the 407 sample responses instead of the original simple imputation method. These sample responses were adjusted for reverse scoring before being evaluated by AMOS.

The revision of the pilot study data analysis was performed much more efficiently. The intent in this analysis was to look for commonalities between the two efforts. Given this, the W&B study model was used as the start point and, because only ITOE (an IT
efficiency proxy) was found to be significant in the federal organization study, only ITOE was added to the base model for the revised analysis. The addition of the endogenous variable resulted in a small decrement to the model fit when compared to the base pilot study. When the indicators of statistical significance of the endogenous variables on ISE were examined, the following variables were found to be not statistically significant in this particular model: power games, informal coordination, and identification. Because these variables were also found to be not significant in the federal organization study, they were removed from the Pilot Study model.

Based on the importance of the kurtosis analysis in the federal organization study, a similar analysis was conducted on the pilot study data. The results are outlined in Table 5-3 below.

73 The variables were not “needed” in the sense of testing the research hypothesis; sufficient evidence was developed with the chosen variables. In addition, they would have been superfluous to the model in terms of the variable to sample size argument.
Table 5-3 Pilot Study Revision

<table>
<thead>
<tr>
<th>TRUST</th>
<th>Var 12</th>
<th>Var13*</th>
<th>Var14</th>
<th>Var15</th>
</tr>
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<tbody>
<tr>
<td>Kurtosis</td>
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<td>.223</td>
<td>-.038</td>
<td>1.19</td>
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<tr>
<td>Z value</td>
<td>3.58</td>
<td>0.92</td>
<td>-0.16</td>
<td>4.91</td>
</tr>
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</table>

<table>
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<tr>
<th>LATERAL COORDINATION</th>
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<th>Var19</th>
<th>Var20*</th>
<th>Var21</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kurtosis</td>
<td>-.568</td>
<td>.042</td>
<td>.609</td>
<td>-.608</td>
<td>-.267</td>
<td>2.109</td>
</tr>
<tr>
<td>Z value</td>
<td>-2.34</td>
<td>0.17</td>
<td>2.51</td>
<td>-2.51</td>
<td>-1.10</td>
<td>8.71</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>INCENTIVES</th>
<th>Var32</th>
<th>Var33</th>
<th>Var34*</th>
<th>Var35*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kurtosis</td>
<td>-.789</td>
<td>-.643</td>
<td>-.797</td>
<td>.851</td>
</tr>
<tr>
<td>Z value</td>
<td>-3.26</td>
<td>-2.66</td>
<td>-3.30</td>
<td>3.52</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ISE</th>
<th>Var40*</th>
<th>Var41</th>
<th>Var42</th>
<th>Var43</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kurtosis</td>
<td>.250</td>
<td>.167</td>
<td>1.44</td>
<td>.818</td>
</tr>
<tr>
<td>Z value</td>
<td>1.02</td>
<td>0.68</td>
<td>5.89</td>
<td>3.36</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ITOE</th>
<th>Var44*</th>
<th>Var45</th>
<th>Var46</th>
<th>Var47</th>
<th>Var48</th>
<th>Var49</th>
<th>Var50</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kurtosis</td>
<td>.301</td>
<td>-.635</td>
<td>.027</td>
<td>-.123</td>
<td>.528</td>
<td>.266</td>
<td>.242</td>
</tr>
<tr>
<td>Z value</td>
<td>1.24</td>
<td>-2.62</td>
<td>0.11</td>
<td>-0.50</td>
<td>2.16</td>
<td>1.09</td>
<td>1.00</td>
</tr>
</tbody>
</table>

Note: ISE – information sharing effectiveness, ITOE – IT outcome expectations

The kurtosis values that were significant are marked in red in Table 5-3. Those variables marked with an asterisk are those whose regression weight was set to one (based on kurtosis value) to achieve model identification. In the special case of incentives (which all had significant kurtosis values), the highest kurtosis value (Var35) was removed and the remaining three variables were kept. The rationale for doing this was based on the federal organization results for incentives, which was one of the stronger endogenous variables. In addition, the original pilot analysis results suggested the value of retaining the incentives endogenous variable in the analysis. The result of the screening effort was
that all of the remaining endogenous variables had their observed variables reduced to no more than three. Using this as a basis, reductions were performed similar to those done for the federal organization model (see Appendix 7). These results were tabulated and are presented in Table 4-4 below.

### Table 5-4 Pilot Sample Revised

Tabulations of Fit and Influence Strength

<table>
<thead>
<tr>
<th>Configuration</th>
<th>RMSEA</th>
<th>Pclose</th>
<th>CFI</th>
<th>CHI-S</th>
<th>ITOE Strength</th>
<th>LC Strength</th>
<th>TR Strength</th>
</tr>
</thead>
<tbody>
<tr>
<td>ITOE, TR, LC, IN</td>
<td>0.088</td>
<td>0</td>
<td>0.840</td>
<td>0</td>
<td>.086</td>
<td>.372</td>
<td>0.189</td>
</tr>
<tr>
<td>ITOE and TR</td>
<td>0.037</td>
<td>0.722</td>
<td>0.987</td>
<td>0.097</td>
<td>.298</td>
<td>N/A</td>
<td>.222</td>
</tr>
<tr>
<td>ITOE and LC</td>
<td>0.029</td>
<td>0.831</td>
<td>0.993</td>
<td>0.189</td>
<td>.122</td>
<td>.598</td>
<td>N/A</td>
</tr>
</tbody>
</table>

Note: all of the strengths are statistically significant at least at the P<.027 level

Note: ISE – information sharing effectiveness, ITOE – IT outcome expectations

In Table 5-2, the data collected and the methodological technique of structured equation modeling indicated that for this particular organization, at least two of the postulated influences do influence the organization’s information sharing effectiveness. When

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74 For the trust and ITOE combination the TR strength was P<.027, ITOE Strength P<.002. For the LC and ITOE combination, the LC strength was P<.001 and ITOE strength was P<.003.
combined, lateral coordination (a governance proxy) and information technology outcome expectations (ITOE an IT efficiency proxy) indicate a positive influence on information sharing effectiveness. In the same way, trust and ITOE offer a net positive influence. If we return to the propositions adopted from the Willem and Buelens study, it is appropriate that both P_{1b} – lateral coordination and P_{2a} – trust are supported. Finally, accounting for all four endogenous variables modeled together, the model fit is at the low end of moderate (based on recognition that the parameters are not accepted “good fit” standards and are not significant).

Curiously for the pilot study the influences are positive, but for the federal organization they are negative. An explanation that cannot be ruled out is the effect of the sample size. While the process of reducing model variables has allowed the devolved model to fit, fundamentally the size of the sample along with the potential for the sample data to be non reflective of the population could be an explanatory factor. There may also be other explanations or rationales. During the analysis of the federal SEM model, the argument was made that ITOE (an IT efficiency proxy) might often have a negative effect on information sharing effectiveness. The rationale is that people become so focused on the new capabilities a successful IT implementation brings (increased efficiency of a new system), they lose sight of the need for interpersonal communications. As a result, the presumed diminished interpersonal communication results in an overall net negative effect of ITOE (an IT efficiency proxy). In a like manner, lateral coordination (a governance proxy) presents a similar negative effect, while trust presents a positive one.
A postulation that is not at odds with the theory is that lateral coordination as a function within the organization is so poorly executed that attempts to engage in lateral coordination draw reflexive push back from either individuals or the organization, to the extent that it becomes a negative influence. Wilson, in his discussion on constraints, points out that workers will often reject process improvement (in this case IT efficiency) if it appears to involve ill formed extra effort (Wilson, 1989). In addition, the contracting function of the organization, which requires protection of bidder information, may provide the “excuse” for employee rejection of lateral coordination (a governance proxy) efforts. Conversely, the public sector (pilot study) organization is known for its attempts to foster lateral coordination, and so it’s positive influence on information sharing is not unexpected. The question to be addressed (in Chapter 7) is whether these two apparent inconsistencies are germane.

**Governance**

Returning to the Chapter 1 definition of governance, both formal systems and lateral coordination may be considered part of an organization’s overarching methods to implement governance. When reviewing the observed variables that inform governance, lateral coordination includes six questions (16,17,18,19,20,21) that strongly reflect governance best practices as outlined by the IT Governance Institute (2005). In a like manner, questions 22 through 28 of the question set (formal systems, see Appendix 2) either act as a proxy or are influential on governance. As mentioned above, formal

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75 Cronbach alpha value of .804
systems (FS) was not a statistically significant influence on information sharing effectiveness within the SEM analysis. Looking at these questions independent of the SEM environment and reviewing them together for a Cronbach’s alpha value, the result was .120, indicating poor reliability. Reviewing the questions individually indicated that several were highly skewed (34) or bimodal (23, 25, 26, 27). All of these are indicators of disparate views on governance and tend to support the lack of SEM convergence within the FS factor. Thus there are mixed results from the survey with regard to governance overall.

**Efficiency**

Willem and Beulens did not postulate efficiency; the only questions that touch on the subject are questions 34 and 38 (incentives). However, Venkatesh (2003) did with ITOE (an efficiency proxy): three of the seven questions (52, 53 and 54) are directly aligned with efficiency of the IT system under discussion. The other four questions (51, 55, 56 and 57) had somewhat more nuanced interpretations. While it was not the sole intent of Venkatesh to measure efficiency this work adopted the ITOE set of questions as an efficiency proxy measure. The survey results, based on the respondent answers, loaded most significantly on the efficiency related questions. Recall that the SEM analysis above had the best model fit using questions 51, 53 and 54 from the ITOE question set, in other words two clear efficiency responses and what that could be interpreted by the
respondents as either efficiency or effectiveness\textsuperscript{76} questions. Not too surprisingly when one considers that both SEM and Cronbach’s alpha both use measures of covariance as the basis for calculation the reliability, the Cronbach’s alpha value for these three questions is .733, a marginally\textsuperscript{77} acceptable reliability measure. When these three question responses were reviewed individually, the respondents agreed that the IT system enabled them to be more time efficient and made their product of a higher quality. Importantly, these three question set results were normally distributed and uni-modal. The series of additional checks support the reliability of ITOE as a measure of efficiency.

These results are for the federal organization only and are supported later in this research by the interviews. Significantly, no interviews were conducted during the pilot, thus inclusion of the pilot survey results for governance and efficiency would not be germane in the broader analysis.

**Summary**

This chapter first validated the methodological approach by discussing the pilot survey implementation approach, its limitations and results. In doing so the pilot survey instituted a closely parallel effort to that of the Willem and Beulens (2007) study. It then discusses the results of the federal survey whose smaller sample size dictated a maturation of the SEM analytical approach. The matured approach was then re-applied to

\textsuperscript{76} The nuanced difference between efficiency and effectiveness, particularly as relates to IT, are often lost on the population as a whole.

\textsuperscript{77} Field (Field, 2009) referring to Cortina (Cortina, 1993) argues that this is an acceptable level when inter correlations are relatively high which is the case here.
the pilot study to evaluate those sample results resulting in a more consistent (and repeatable) set of analytical outcomes. Finally, to examine the possibility of survey bias in the two principle influences (Governance and Efficiency proxies) the individual variables (survey question data) were examined for Cronbach’s alpha inconsistencies.
CHAPTER 6: Interview Reporting and Analysis

This chapter presents and discusses the results of a series of interviews of the federal organization’s leadership. These interviews are part of a case study triangulation effort, and they bring to the study information garnered from the organization’s implementation of enterprise resource planning (ERP)\textsuperscript{78} information technologies and a service oriented architecture (SOA)\textsuperscript{79}. In addition, they provide specific insight into some of the survey and allow for an enhanced interpretation of the results. The raw data of the interviews and the associated interview notes are in Appendix 8.

Interview Analysis

Before getting into the specifics of the interview analysis, a further word is necessary about the nature of the federal organization. This discussion is constrained by the need to protect the identity of the organization, whose primary mission is to procure electronic systems. The federal organization’s agreement to participate in the survey and in the interviews was predicated on the anonymity of the results. In the discussion of the results of the interviews, care has been taken to avoid providing information that might result in

\textsuperscript{78} ERP is an approach to collating and sharing information within an organization. Several companies offer software packages that implement the approach.

\textsuperscript{79} SOA is an approach to building enterprise level IT systems. The key characteristic of SOA is that it separates software applications from a particular hardware suite, allowing for increased data efficiency/fungibility.
the organization’s being identified. Specifically, the titles of the interviewees have been changed to Chief Operating Officer (COO), Deputy Chief Operating Officer (DCOO), and Chief of Staff (COS). The Chief Science Officer was engaged\textsuperscript{80} to provide an interview but declined. Similarly, care has been taken to avoid identifying characteristics of the organization itself. What can be said is that it is a medium-sized organization that is a subunit of a larger federal organization and also has subunits of its own. The boundaries within this organizational structure are clear with regard to the task that the federal organization performs, but they are less clear in terms of budget and organizational priorities. For example, the federal organization is provided a defined budget for its task, but it may be directed as to how to expend a portion of that budget.

Relative to the demographics of the interviewees, two of the individuals have master’s degrees and the third has a bachelor’s degree. All of the degrees are technical, and the interviewees all reported their degrees were relevant to the work. None of the interviewees had been specifically trained in the technologies of enterprise resource planning (ERP) or service oriented architectures (SOA).

The interviews were conducted using a George Mason University Human Resource Board approved question set (Appendix 2). All interviewees signed a George Mason University Human Research Board informed consent form (Appendix 9). As a practical

\textsuperscript{80} The DCOO specifically recommended that the CSO be interviewed. The interview was scheduled and deferred several times before the CSO became non-responsive.
matter, the time constraints of the interviewees acted as a limiting factor to either an
expansive answer or follow-on questions. The interviews were conducted on the
organization’s premises in June 2011. It should be noted that the interviewees were all in
their positions as of the time of the survey.

The interview was broken down into three general sections. The first section gathered
demographics about the interviewees and information about the nature of the
organization, and assessed the organization’s IT maturity model. The second section
consisted of a series of questions with regard to ERP that can be categorized as:
engineering imperative to implement; management imperative to implement; business
incentives; personal incentives; and lessons learned. The third section repeated the
question set, but this time with a focus on service oriented architecture/service oriented
environment (SOA/SOE).

**Interview Basis**

The first series of questions addressed a generalized approach to IT management
indigenous to the federal organization. It consisted of a series of questions with regard to
IT organization and who was the final decision maker within the organization for IT. The
interview then moved on to questions about the IT maturity model that is used, and
whether or not there had been an independent assessment or a self-assessment of IT
maturity.
Two of the interviewees considered that their organization’s IT structure was centralized to the organization, while the third person considered it to be hierarchical, or extending beyond the organization to senior and junior organizations. With regard to the question of who is the final decision maker for IT, two of the interviewees considered that person to be extra-organizational, and one considered it to be a person in one of their subordinate units. The “odd person out” was not the same for the two questions. The apparent split in opinion can be explained in terms of organizational boundaries and the structures themselves. Consider the nature of modern IT. As discussed earlier, one of the organizational effectiveness gains promised by the technology is that the data being processed by the IT infrastructure becomes more fungible as the technology matures. This fungibility inherently breaks down organizational barriers by enabling transfer without specific transfer protocols or applications (strengthening an organization’s governance – see Weill and Ross). One of the results of the technology is that organizational boundaries become situational, dependent on the type of information being shared. Fountain mentions this in her discussion of law enforcement agencies sharing data in ways that blur the distinctions between local and national jurisdictions (2001). This phenomenon may, in part, explain the split in opinion.

A series of questions was asked with regard to the interviewees’ understanding of the organization’s IT maturity model. IT maturity models are “best practice” assessments that, dependent on the model used, assess various organizational and performance

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81 For reasons of technical compliance
metrics. The intent of the questions was to assess the interviewee’s understanding of the IT system maturity in terms of the actual technology (enabling IT efficiency) and the effectiveness of its use. The interviewees were in wide agreement that the models were not in use, which might be an indicator of a relatively immature implementation and less than optimal governance structures. Another explanation may be that the organization is influenced by other factors, such as direction from the parent organization.

One of the themes that came out of the interviews was a sense that the functional boundaries between the service oriented architecture/environment, enterprise resource planning, and the more generalized IT modernization effects were blurring and becoming less distinct. The interviewees did not instinctively make this distinction, preferring to talk in more general terms, even with ERP and SOA being segmented in the interview process. This may reflect the technical blurring of lines between the technological approaches that has occurred in recent years (Dwyer, 2006; Fountain, 2007; Mayer-Schönberger & Lazer, 2007). This is reflected in the similarity of responses, not between themselves necessarily, but between ERP and SOA.

Finally, in terms of IT management, a series of questions was asked to determine the interviewee’s self-assessment of the maturity of their management efforts in strategy, IT architecture, IT system data sharing, agility, and employee knowledge of IT systems. While these questions focus on management they also inform governance, with agility and strategy being the most informative. One interviewee made specific comments on
frustration with having less control of the organization’s IT strategy than needed to be
effective. Two of the three interviewees self-assessed their management as mature, while
the other self-assessed it as immature across the categories. Interestingly, the person with
the lowest management assessment was the person with the least technical job. A
possible explanation of the dichotomy may be a lesser understanding of the processes and
the technology involved.

The sections that follow report on a thematic analysis that was conducted to address
enterprise resource planning/customer relationship management (ERP/CRM) and then
SOA/SOE. Several common themes emerged that are addressed in detail in these sections
and in summary in Table 6-2 and in Table 6-3.

**Enterprise Resource Planning (ERP)/Customer Relationship Management (CRM)**

Enterprise resource planning (ERP) and customer relationship management (CRM) are
two of the common tool sets in the industry. ERP encompasses a series of software tools
that are developed principally for an organization to track its Human Resource (HR) data,
but are also used to manage its logistics data, payroll and financials. CRM encompasses a
similar set of tools whose focus is providing a database of information on the
organization’s customers. Both tool sets share the common approach\(^{82}\) of using a
sophisticated database to store the information they gather. The sophisticated databases

\(^{82}\) Which was the rationale for including both in the interview question sets.
can be vehicles for either sharing or constraining organizational information workflows. While these databases are developed for ERP/CRM, they can also be used for the Service Oriented Environment (SOE – a service environment).

The federal organization that was surveyed and whose senior members were interviewed has been implementing an ERP system. Conversely, although there were anecdotal reports of the use of a CRM system, there was no organization-wide implementation. As a result, there will be no further reports on CRM. On the other hand, ERP is in various stages of implementation within the organization. Many organizations have found that an ERP implementation often comes with minor to moderate organizational process change. This is because ERP expects certain process alignments and data formatting (i.e., is the data in Word, Excel or PDF forms) to align with the ERP software application programming code. Organizations often find that the trade space in implementing Enterprise Resource Planning (ERP) is either organizational process change or more money to fund ERP software application customization. Such customization might include data formats to support non-mainstream (as opposed to mainstream programs such as Microsoft and Adobe) programs such as might have been developed by the organization before the implementation of ERP (Davenport, 2000; Fitz-Gerald, Melbourne, & Carroll, 2003).

The first series of questions under this broad category related to the engineering imperative to implement Enterprise Resource Planning (ERP), and as a result were
generally asking about improvement in efficiency within the organization, not necessarily improvements in effectiveness. With regard to an eased workload for the engineers, there was clear uncertainty within the interviewees. The Chief Operating Officer (COO) said “ask them,” the Chief of Staff (COS) said “no,” and the Deputy Chief Operating Officer (DCOO) said it was “unclear.” When asked about improved quality of work, it was fairly clear that the three interviewees understood differently the issue of organizational boundaries with regard to information technology. Two of them were clear that the ERP system did assist in the quality of work, while a third, the DCOO, felt it did not (Recall from the discussion above that the DCOO felt the organization was more hierarchical than centralized, indicating a focus on the wider boundary brought about by the nature of the IT infrastructure.) Finally, with regard to the impact of the ERP on engineering efforts, all of the interviewees agreed that the impact was anything but small. There was a strong sense in all three interviewees that the engineers were not able to get sufficient information from the system.

When asked the next question, about the management imperative to implement an ERP system, the COO made a comment that exposes an important policy issue. The COO commented that the organization did have an imperative, but it was sometimes stymied by the parent organization. The policy issue this exposes is, to the extent that the federal organization is bound by parent organization rule sets, it is less able to establish the

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83 The organization’s Chief Technology Officer (CTO) was repeatedly asked to participate and originally accepted the invitation, but was unable to complete the interview. After several weeks of attempting to complete the interview, it became clear the CTO would not be available. The CTO in this organization acts as the Chief Information Officer (CIO).
necessary IT process and organizational boundaries. The literature suggests this is neither an uncommon nor an intentional effect, as there is often unintentional neglect in evaluating and changing these constraining rule sets, i.e., a clear governance issue.

In response to the question addressing the impact of ERP on engineering effort satisfaction, all three interviewees indicated there was an impact. The COO commented that although the implementation was still in progress, the mechanics of the implementation were getting better, and the “learning curve” was being dealt with. The nuance for the policy maker is that some of the small mistakes and difficulties encountered are not driven by policy issues.

Next the interviews addressed business incentives to an effective implementation. Broadly speaking, these business incentives reflect organizational goals. The first question asked if there were incentives to the organization in terms of organization and sub organizational budgets. Both the COO and the DCOO were somewhat strident in their responses, keying in on the need for physical efficiency, speed in transition, and budgetary transparency as efficiency factors for the implementation of ERP. Interestingly, the COS took an opposing view, that the need for efficient management of data would drive an ERP solution, no matter what the budgetary considerations were. For the question of whether or not the ERP implementation had both a personal and organizational level in terms of controlling use of information, all of the interviewees agreed that it did, particularly as it related to the transparency of information.
For the question of whether there are personal incentives to the implementation of ERP, only the COO agreed with the comment that if you had use of the ERP suite then you were likely to be more efficient and effective. The implication is that given the ERP tools, your performance is going to be better and you are more likely to be compensated highly.\textsuperscript{84} For the question of whether there are incentives for Enterprise Resource Planning (ERP) implementation in terms of a particular person’s career, the other two interviewees agreed with the Deputy Chief Operating Officer (DCOO) who commented that the impact would come from enhancement of an individual’s customer relations outcomes. With regard to personnel evaluations, the consensus was that ERP implementation was not reflected in the personnel evaluation process directly, but that it was reflected in a diminishment or reduction of interpersonal communication skills. Finally, in terms of personal incentives, both the COO and the DCOO agreed that ERP implementation was an incentive because the personnel who learned the system would become intrinsically more valuable.

For the ERP category, the interviewees were asked to provide lessons learned with regard to constraints in management, budget, personnel processes, or any other areas. Looking at constraints in management, the COO discussed the difficulty associated with resistance to change. The COO’s perspective was that during the transition from a legacy system to Enterprise Resource Planning (ERP), one cause of resistance was that not everybody had

\textsuperscript{84} There was no empirical evidence in any of the research to support this claim.
the same workplace tool sets\(^{85}\) and were thus on an unequal playing field. With regard to constraints in budget, the COO commented there was resistance to change based on an individual’s budget, i.e., the classic “power game” dilemma. The DCOO had a slightly different perspective and addressed the idea that an ERP implementation would distort what is colloquially known in the federal government as a “color of money” distribution\(^{86}\). The DCOO’s view was that money typically identified for buying “things” might need to be reassigned to buying “services” instead, and that this would be viewed as a threat by the budget managers involved. These concerns and constraints are largely governance issues. All of the interviewees agreed that constraints to personnel processes existed. The COO commented that it was necessary to engage employees in the use of ERP, to capture their attention and commitment. The DCOO commented that lack of the appropriate skill set in the workforce was a constraint that was likely to continue. ERP, while it has been being implemented for some time, continues to mature in technology, and the federal government’s ability to keep up with the changes is limited. Such a lack of an appropriate skill set within government personnel forces the government to hire currently skilled contractual support. This focuses attention on the use of contractors for inherently governmental activities\(^{87}\) when the government workforce is not sufficiently

\(^{85}\) One tool set was more efficient than the other.
\(^{86}\) Money distributed within the federal government is often specifically earmarked for certain types of purchases and specifically prohibited for use for other types of purchases. It is possible to have sufficient dollars in your budget to purchase “things” but not have permission to use that same money to purchase “services.”
\(^{87}\) A sometimes pragmatic decision where contractors do the work necessary for a decision and the government employee makes the decision. Anecdotally, the trust relationship between government and supporting contractor is strong enough that the government personnel approval is effectively a “rubber stamp.”
skilled. The question, in turn, leads to the governance and policy question of what technology or procurement functions must remain “inherently governmental.” This skill set shortage also raises the question of efficiency versus effectiveness. Contractors may be more efficient, but are the government employees more effective since they allow the organization to do its core functions? These are all organizational constraint governance issues.

Finally, the interviewees were asked to address any other lessons learned they thought might be pertinent. The Deputy Chief Operating Officer (DCOO) responded that, as a great fan of the Clinger Cohen Act (which was designed to encourage the establishment of a Chief Information Officer (CIO) structure within an organization (see Seifert (2003))), the greatest challenge to ERP implementation was IT governance. The assessment is not surprising, as this theme is brought out in a variety of works, including Fountain and Weil and Ross (Fountain, 2001, 2003; Weill & Ross, 2004). Significantly, these works address in part power games, formal systems breakdown, and lateral coordination (a governance proxy). The Chief of Staff (COS) said in a surprisingly frank statement that “failure of an IT implementation (in the federal government) has become an institution,” meaning that failure is so commonplace we should expect it to happen as opposed to its being an exception. The COS further observed that one reason for resistance to change was the process of implementation often intruded on the work efforts of the organization’s personnel, a potential contributor to resistance to change. The COS
also asked the question “how does Facebook do it?” rhetorically comparing the federal government’s efforts to commercial success.

None of these lessons learned stand on their own as an overarching constraint on a successful implementation. However, they are indicative of both constraints on information flow and organizational IT governance.

**Service Oriented Architecture (SOA)/Service Oriented Environment (SOE)**

Service oriented architecture (SOA) in the IT domain remains a goal with the expected benefits of: reduced cost as a function of hardware consolidation; more efficient data accessibility as a function of common data standards; and more efficient information dissemination as a function of centralized application management. SOA has to some extent become a buzzword in the IT industry. A companion management and service framework for information technology has emerged, called the service oriented environment (SOE) (Krafić, Banke, & Slama, 2005). The interviewees were asked a series of questions with regard to SOA that mirrored the questions asked about Enterprise Resource Planning (ERP). Many of the responses were very similar to ERP; those similar responses will not be addressed in this section.

For the question addressing the engineering imperative to implement, all of the interviewees agreed that such an imperative existed. The COO observed that SOA means

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88 This was more true in the recent past than perhaps it is now. SOE/SOA have to some extent been supplanted by Web 2.0 and “cloud computing.”
many different things to different people. This lack of common understanding acts as a constraint to the implementing organization’s authority because personnel trying to do the implementation may be working to different understandings. In a similar manner, the COS commented that the approach to the implementation by the federal organization was often naïve and badly thought out.

The next questions asked were about the ease of workload, a presumption of improved quality of work, and the potential impact of SOA on engineering efforts. All the interviewees agreed that SOA increases efficiency by easing the workload and improving the quality of work of the engineering workforce. They were less sanguine, though, that their engineering workforce was satisfied with the results. The DCOO commented that the prevalence of legacy systems had the effect of forcing kludged solutions and inefficient workarounds. Implicit in his statement was the idea of cost benefit – workarounds that may be made efficient, but the cost may make them impractical in constrained budgets.

With regard to management imperatives to implement Service Oriented Architecture (SOA), all three interviewees agreed that SOA tended to ease the workload of management personnel by increasing access to organizational data. The explicit shared assumption appeared to be a presumption of high data “stovepiping”89 within the federal

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89 Stovepiping is a commonly understood industry term ((Weill & Ross, 2004) referring to the tendency of programs or organization to not share data.
organization. When SOA was addressed within the framework of an improved quality of work, the Deputy Chief Operating Officer (DCOO) was less sure. The comment was that the data management aspect of SOA had not been adequately addressed.

The business and governance incentive to provide an SOA was less clear. Two of the interviewees agreed there were budget incentives for an SOA. The DCOO commented that in the current budget and technology climate, non-SOA approaches within the federal and parent organizations tended not to get funded by Congress. The implication is that some of the decisions on technology implementation are, in effect, “handed down” from the federal organization’s parent organization by unclear governance approaches. Only one of the interviewees responded that there was a positive incentive to implement in terms of organizational use and control of information. The DCOO explained that since the use of SOA could make an organization’s information more accessible (the positive effect of lateral coordination (a governance proxy)), the processes of the organization became more transparent and there was fear in some circles of losing control (power games impacts). Conversely, all the interviewees agreed on the incentives for organization and sub-organizational influences.

For the question of personal incentives, both the Chief Operating Officer (COO) and Deputy Chief Operating Officer (DCOO) agreed there were personal incentives in terms of personal compensation. The COO remarked that learning and implementing SOA made government personnel more attractive to commercial entities, potentially raising
their compensation. With regard to a career in government, both the COO and DCOO agreed that implementation of SOA provided an incentive, with the DCOO commenting that the career enhancement is in the person’s performance in customer outreach. The DCOO addressed personnel evaluation in terms of customer outreach, but also in terms of organizational transparency. To the degree that organizational transparency is informed by lateral coordination (a governance proxy), there is a link between personnel evaluations and lateral coordination efforts.

Addressing the overall lessons learned in terms of constraints for SOA, the DCOO and COS agreed there were management constraints. The COS pointed to the lack of understanding by budget masters as to what an SOA was, which led to difficulties in obtaining the necessary funds to implement the SOA. The DCOO returned to the boundary issues surrounding the implementation of a new IT environment, observing that where the SOA crossed organizational boundaries, the impact of the organization’s legacy IT systems became a constraint and a governance issue. These constraints included a reduced efficiency of the new IT system and a reduced effectiveness brought upon partially by intraorganizational disputes. In terms of budget constraints, all of the interviewees agreed there were budget constraints to implementation. The DCOO best expressed the thoughts of all, commenting that it was difficult to show the long-term
return on investment in SOA from the perspective of effectiveness\textsuperscript{90}. The observation reflects the discussions in Chapter 4 of efficiency versus effectiveness. With regard to whether there were constraints in the personnel process and implementing SOA, two of the three interviewees agreed there were. The DCOO commented that documentation of personnel skill sets and publishing that data in the personnel records was essential. Finally, in terms of any other lessons learned, the DCOO addressed a timeline of implementation, observing that the length of the implementation cycle led to frustration, which in turn led to a plethora of “good ideas.” These “good ideas” often had the effect of changing the implementation process midstream, causing further frustration and new “good ideas.”

In summary, one of the consistent themes in the interviews was that organizational boundaries have an effect on the implementation of both Enterprise Resource Planning (ERP) and Service Oriented Architecture (SOA). The effect centered on the idea of data fungibility. Both control of data and the way data is used were recognized by the interviewees as core to the success of the implementations. In addition, the following concepts were agreed in the interviews:

- implementation of Enterprise Resource Planning (ERP) was impacted by both personal and organizational constraints on information sharing
- the use of ERP would enhance a person’s career opportunities

\textsuperscript{90} In his words “organizational outcomes”. It is interesting to note that all three interviewees had a common understanding of the difference between technical/personal efficiency and the desired organizational outcome of increased effectiveness.
• implementation of ERP would impact the budget in terms of transparency of the information
• implementation of ERP would impact on personnel processes
• there was an engineering imperative to implement SOA
• Service Oriented Architecture (SOA) had the potential to ease the workload of the engineering staff
• SOA had the potential to ease the workload of management personnel
• SOA provided the capability for influencing outcomes with the federal organization’s parents and subordinate organizations
• concerns for the budget constrained the implementation of SOA.
CHAPTER 7: Case Study Summary

In previous chapters this thesis has provided an analysis of the various data gathered in the research. In Chapter 2, the relevant literature was analyzed. In Chapter 5, the survey data was addressed in terms of the W&B survey, the pilot survey, the federal organization survey, the public sector revision of the pilot study, and governance and efficiency issues. In Chapter 6, the interview results were analyzed. Returning to Yin and as outlined in Chapter 4, it is now necessary to bring these disparate analyses together.

Melding the Data

Before the overall particulars of the data are addressed, it is useful to address the potential for error in the data collection. The interview analysis result is partially based on a coding of the participants’ responses. For the surveys, however, it is necessary to consider the possibility of type I and type II errors.

Survey Error

SEM as an analytical process is different from more traditional statistical analysis in that it assumes the null of the postulated model fitting the sample data, i.e., that the null hypothesis is true. Under SEM, type I and type II are really “apples and oranges” error sets. Type I looks at error associated with how the SEM model influences outcomes. Type II measures the efficacy of the SEM method itself.
Type I error is low across the chosen model sets. The maximum type I error (in this case the statistical probability that the value of the influences of an exogenous variable on an endogenous one is a false positive) has a probability level of .017 for the federal organization and less than .027 for the public sector (pilot). Type II error is more difficult to measure, especially in light of the SEM technique. Recall that the model fit parameters used in SEM are essentially measures of the covariance differences between the postulated model and the data collected. As such, they are good indicators of the likelihood of type II error since they measure the efficacy of mathematical processing that the model does. In other words, the possibility for error lies in whether or not the incremental processing method drives the covariance differences to the lowest possible value. Type II error would occur in the situation where the mathematical method calculates a lowest value, but the model is not a true reflection of the data. In SEM this potential for error is addressed by the practice of using multiple fit indices. For a more expansive discussion of fit indices, see Appendix 10.

**Survey Summary**

Since we have considered the possibility of type I and type II errors in the survey results and have shown that these errors, while possible, do not appear to be probable, it is instructive to look at the differentials between the federal organization study and the revised public sector information. From Table 7-1 below we see in both organizations there is a significant effect of ITOE (an IT efficiency proxy) on information sharing effectiveness when combined with either trust or lateral coordination (a governance
proxy). In the case of the public sector organization, that effect is positive. In the case of the federal organization, that effect is negative. Chapter 5 addresses the idea that ITOE could be a negative influence in information sharing effectiveness based upon research that indicated that information technology can have the effect of making personnel more reclusive. This increasing reclusiveness can provide an explanation as to why ITOE has a negative effect, since that person-to-person component of information sharing diminishes as the technology gets better.

Lateral coordination when combined with ITOE has a positive effect in the public sector organization. However, it has a negative effect in the federal organization. The rationale for this effect is not clear. A method based explanation could be the differences in the associated sample, i.e., the size and composition of the samples were so different as to provide markedly different results. If we return to the idea of diminished personal contact as a function of the superior IT, the premise that lateral coordination (a governance proxy) should offset this diminished personal contact apparently is not true for the federal organization. This apparent “cultural” difference may be the focus of future research.

A reasonable explanation of this phenomenon may lie in the work of Wilson, who argues that the bureaucratic structure of federal organizations is so ingrained that federal organization personnel are less capable of sharing information than their nonfederal counterparts, especially as relates to less formal communication channels. Willem and
Beulens (2007) touch on this in their discussion of what constitutes lateral coordination, i.e. a system having structure but outside the formal system process. Kingdon (2003) would support Wilson’s idea adding that the likely political constraints imposed by forces exogenous to the federal organization’s structure have some negative effect on the organization’s lateral coordination effectiveness. This might take the form of “fiefdoms” within the organization being aligned with an exogenous organization. Kingdon’s potential view also aligns with the observation that the federal organization has a function of safeguarding contractual information; it may be that even miniscule increases in lateral coordination (a governance proxy) will have the effect of raising reactive barriers or enforcing organizational boundaries. As mentioned in Chapter 2, Wilson would argue that this reaction highlights worker constraints, i.e., that personnel reaction to change is sufficiently sensitive to provide often irrational push back.

Trust when combined with ITOE (a IT efficiency proxy) has a positive effect on information sharing effectiveness for both the federal organization and the public sector organization. The positive influence of trust (see Table 7-1 below) is in agreement with the W&B study and other literature.

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91 A phenomena that Wilson specifically postulates (Wilson, 1989)
92 A “reactive” barrier in this case would be that of a person or group of personnel pushing back against lateral coordination efforts in order to stay aligned with the exogenous forces. As a possible example consider that federal contracting officers are anecdotally know to consider themselves a “breed apart” from the rest of the federal workforce.
In summary, given these influences of ITOE, trust, and lateral coordination, there is strong evidence to suggest that these factors, whether viewed as constraints or incentives, do have a verifiable and significant influence on information sharing effectiveness in both organizations, i.e. public sector and federal organizations.

Table 7-1 Comparison of Federal Organization and Public Sector Results

<table>
<thead>
<tr>
<th>Configuration</th>
<th>RMSEA</th>
<th>Pclose</th>
<th>CFI</th>
<th>CH-I</th>
<th>ITOE Strength</th>
<th>LC Strength</th>
<th>TR Strength</th>
</tr>
</thead>
<tbody>
<tr>
<td>ITOE, TR, LC, IN</td>
<td>0.094</td>
<td>0</td>
<td>0.841</td>
<td>0</td>
<td>-0.264</td>
<td>-0.259</td>
<td>0.276</td>
</tr>
<tr>
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<td>0.409</td>
<td>0.975</td>
<td>0.099</td>
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<td>0.325</td>
<td>-0.298</td>
<td>N/A</td>
<td>0.451</td>
</tr>
</tbody>
</table>

**Federal Organization**

**Public Sector Organization Revised**

<table>
<thead>
<tr>
<th>Configuration</th>
<th>RMSEA</th>
<th>Pclose</th>
<th>CFI</th>
<th>CH-I</th>
<th>ITOE Strength</th>
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<td>0.993</td>
<td>0.189</td>
<td>.122</td>
<td>.598</td>
<td>N/A</td>
</tr>
</tbody>
</table>

Note: ISE – information sharing effectiveness, ITOE – IT outcome expectations

Finally, external to the SEM analysis, the survey addressed the sub-hypothesis issues of governance and efficiency. The W&B factor of formal systems, a proxy for governance, was not statistically significant in SEM, and when evaluated separately it yielded no notable results. The result tends to re-enforce the previously noted uncertainty around governance. In terms of efficiency, however, the survey did yield three areas (observed
variables 51, 52 and 53\textsuperscript{93}) where the sample population indicated that implementation of IT would improve their efficiency.

**Interview Data**

Chapter 6 discussed several themes that emerged in the analysis of the interviews. There was the overriding theme that the fungibility of data had resulted in blurring the organizational lines in terms of implementing either ERP or SOA. Implicit in this blurring is the concept that non-organizational methods might be necessary to address organizational intersection points, e.g., that forms of lateral coordination (a governance proxy) might be necessary. In terms of the specific questions formed for the interviews, the unanimously agreed themes are summarized in Table 7-2 below.

\textsuperscript{93} See the Observed Variables section in Chapter 8
### Table 7-2 Unanimously Agreed Themes

<table>
<thead>
<tr>
<th>Unanimous Agreement</th>
</tr>
</thead>
<tbody>
<tr>
<td>that implementation of ERP was impacted by both personal and organizational constraints on information sharing</td>
</tr>
<tr>
<td>that the use of ERP would enhance a person's career opportunities</td>
</tr>
<tr>
<td>that implementation of ERP would have impact on the budget in terms of transparency of the information</td>
</tr>
<tr>
<td>that implementation of ERP would have impact on personnel processes</td>
</tr>
<tr>
<td>that there was an engineering imperative to implement SOA</td>
</tr>
<tr>
<td>that SOA had the potential to ease the workload of the engineering staff</td>
</tr>
<tr>
<td>that SOA had the potential to ease the workload of management personnel</td>
</tr>
<tr>
<td>that SOA provided the capability for influencing outcomes with the federal organizations parents and subordinate organizations</td>
</tr>
<tr>
<td>that concerns for the budget constrained the implementation of SOA</td>
</tr>
</tbody>
</table>

When reviewed, some of the unanimously agreed themes “stand out” in terms of the results of the survey. The impact of ERP on career opportunities and personnel processes is clearly linked to the survey response on incentives. That SOA had the potential to ease the workload of engineering staff and management personnel is an efficiency issue addressed in the survey in ITOE (an IT efficiency proxy). In the interview areas addressing lessons learned for both Enterprise Resource Planning (ERP) and Service Oriented Architecture (SOA) there were several mentions of governance issues (intraorganizational coordination, implementation speed, coordinated transition, and resistance to change, among others). Less clearly, the theme that SOA provided the
capability for influencing outcomes in parent and subordinate organizations is linked to
the idea of data fungibility. As discussed in Chapter 3, data fungibility, by easing the
process of information sharing, is one of the precepts for lateral coordination (a
governance proxy).

Table 7-3 below addresses the majority agreed themes.

Table 7-3 Majority Agreed Themes

<table>
<thead>
<tr>
<th>Majority Agreement</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>that ERP implementation has impact on the organization’s quality of work</td>
<td></td>
</tr>
<tr>
<td>that ERP implementation has impact on the organization’s ability to influence the</td>
<td></td>
</tr>
<tr>
<td>federal organization’s parents and subordinate organizations.</td>
<td></td>
</tr>
<tr>
<td>that ERP implementation provided personnel with personal incentives</td>
<td></td>
</tr>
<tr>
<td>that concerns for the budget constrained the implementation of ERP</td>
<td></td>
</tr>
<tr>
<td>that SOA was impactful on the organization’s ability to manage its budget</td>
<td></td>
</tr>
<tr>
<td>that there were personal incentives for the successful implementation of SOA</td>
<td></td>
</tr>
<tr>
<td>that there were career incentives for the successful implementation of SOA</td>
<td></td>
</tr>
</tbody>
</table>

Again, there are clear links to the survey incentives question in the themes of ERP and
SOA implementation providing personal incentives along with the SOA-related career
incentives. The theme that ERP implementation impacts the organization’s quality of
work is a reflection of efficiency. In a similar manner, the theme that ERP implementation impacts the organization’s ability to influence the federal organization’s parent and subordinate organizations is a governance issue. In summary, several of the themes clearly reflect ideas brought forward in the survey.

**Literature Support**

One of the methodologies for understanding the sense of the relevant literature is to assign a qualitative index to the information within the literature (see Appendix 1 for the categorization results). This categorization is fundamentally a pattern matching exercise as advocated by Yin. A pattern, reflecting the discrete emphasis of individual volumes of the literature, establishes a framework to assist in assessment of the discovered data. Fountain, in her Enactment Frameworks and Weil and Ross, in their Governance Design Frameworks (Fountain, 2001; Weill & Ross, 2004) both use pattern based frameworks as analysis tools. Given the understanding of attitudes the survey reflects for the federal organization along with the insights provided by the interviews, the question becomes how do these attitudes align within a literature based framework for analysis?

Mission accomplishment was one of the pattern elements drawn from the literature (literature in this section refers to the works addressed in Appendix 1). Within the framework there were several different interpretations of what mission accomplished actually meant. In many cases, it referred to organizational goal achievement. In some cases it referred to a subset of the organizational goal, such as accomplishment of a particular project or initiative. Embedded in this literature element is the idea of outcomes.
and their effectiveness. It seems reasonable (based on Venkatesh (2003)) to argue that Information Technology Outcome Expectations (ITOE- an IT efficiency proxy) can be viewed as a measure of mission accomplishment. In terms of survey results, the influence of ITOE supports the literature patterns and aligns well within the analytical framework.

In a similar manner, personal attitudes to sharing can be viewed as being inferentially aligned with lateral coordination (a governance proxy). Certainly lateral coordination addresses some of the same ideas, as was reflected in the literature and grouped in the personal attitudes to sharing category. The literature discussion included the idea of interpersonal trust between individuals (not the same as organizational trust per se); the idea of willingness to work outside the rules; and the idea of personal reward for doing so. Again, in terms of survey results, the influence of Lateral Coordination supports the literature patterns and aligns well within the analytical framework. Finally, though less strongly the organizational trust results of the survey support the literature pattern of a strong emphasis on organizational trust.

Triangulated Case Study Analysis

As discussed in Chapter 4, a major component of a case study is to bring different avenues of enquiry together to focus on a research question. This thesis has developed two major approaches to such a triangulation effort. First, a series of interviews were conducted with senior personnel in the federal organization. From those interviews, personal and organizational incentives were addressed as factors in information sharing.
Second, two surveys of two public sector organizations were conducted. The survey results indicate that the factors of trust, lateral coordination (a governance proxy), ITOE (an IT efficiency proxy), and to a lesser extent incentives influenced information sharing effectiveness for both organizations.

Returning to the hypotheses this case study was designed to address, this thesis will address the gathered evidence for each.

Repeating the principal hypothesis from Chapter 3:

\[ H_{\text{info-null}} \] – There is no relationship between attitudes towards information sharing in a public sector organization and the effective implementation of a service oriented environment.

\[ H_{\text{info-alternative}} \] – Variations in an effective implementation of a service oriented environment can be partially explained by attitudes towards information sharing.

The literature review (see Appendix 1 for specific literature), particularly as relates to lateral coordination (a governance proxy) and ITOE (an IT efficiency proxy), lays a framework suggesting a relationship between some attitudes about organizational structure and processes and effective implementation of information sharing. Similarly, the interview results also support incentives as a factor in information sharing effectiveness and effective implementation. Finally, the survey results strongly suggest that, in addition to the above, trust and ITOE (an IT efficiency proxy) are attitudes that influence the effective implementation of SOEs (service frameworks). Thus, \( H_{\text{info-null}} \) should be rejected, supporting the acceptance of \( H_{\text{info-alternative}} \).
In a similar manner this thesis applies the data gathered to the governance sub-hypotheses:

\[ H_{\text{gov-null}} \] – A well-structured IT governance regimen cannot mediate the impact on organizational effectiveness of presumed variations in effective implementation linked to information sharing attitudes.

\[ H_{\text{gov-alternative}} \] – A well-structured IT governance regimen can mediate the impact on organizational effectiveness of presumed variations in effective implementation linked to information sharing attitudes.

The evidence gathered in this area of the research was not as clear as for the principal hypothesis. In the survey, the governance proxy of formal systems (FS) yielded non-statistically significant results, and a more traditional analysis of the FS responses was inconclusive. However, accepting lateral coordination as a proxy for governance does yield statistically significant influences. These influences, which are positive (mitigating) in the public sector organizations are negative in the case of the federal organization. As discussed in Chapter 5 there are a variety of potential reasons for the disparity to include social reclusiveness, organizational inertia, and sample size or the potential for the sample being skewed. The interview results strongly supported the influence of governance, but not in a well-structured, nor mitigating way. Fundamentally, there are mixed, countervailing indications in the research results. Thus, while the desired clarity is not present there is insufficient evidence to reject \[ H_{\text{gov-null}} \] and to accept the alternate.
Finally, addressing the efficiency sub-hypothesis:

\[ H_{eff-null} \] - Information sharing efficiency is a sole indicator of information sharing effectiveness.

\[ H_{eff-alternative} \] - Information sharing efficiency can be achieved without ensuring the effectiveness of information sharing.

While the literature review again lays a framework suggesting that organizational efficiency is a focus of the literature, there is no corresponding set of patterns emphasizing either technical efficiency or economic efficiency. Conversely, there were several efficiency-related questions in the interview question sets with regard to Enterprise Resource Planning (ERP), Service Oriented Architecture (SOA), and lessons learned that addressed this sub-hypothesis. In particular, there was unanimous agreement that SOA had the potential to ease the workload of both the engineering and management staff, and a majority agreement that ERP increases the quality of work, all of which are proxies for efficiency.

Finally, three questions in the ITOE (an IT efficiency proxy) group were responded to positively in terms of less time, more quality, and more quantity of individual output. The result is an indicator of increased efficiency as a response to improved IT systems for the Federal Organization. Conversely there were negative values for the ITOE (an efficiency proxy) influence on Information Sharing Effectiveness in the Federal Survey. While the explanation for these differing outcomes may lie in the previously addressed social effects of technology, the outcomes are divergent. Thus, although less robust than desired
and with concerns for this assessment, there is sufficient evidence overall to reject $H_{\text{eff-null}}$ in this case and support $H_{\text{eff-alternative}}$.

In summary, the evidence supports both the principle alternate hypothesis ($H_{\text{info-alternative}}$) and the efficiency alternate hypothesis ($H_{\text{eff-alternative}}$). The evidence to reject the governance null hypothesis ($H_{\text{gov-nul}}$) while present, is not sufficient.
CHAPTER 8: Conclusion

The process of using a multi-method case study approach on this complicated problem is well-supported by the outcomes. It is admittedly a case study in which one of the methods used (i.e. survey analysis) dominates the result, but this does not lessen the impact. The process of using a survey and SEM as an analytical technique to elicit information on an organization’s information sharing effectiveness has proven itself over three different public sector organizational surveys, with only slightly\textsuperscript{94} different results. This effort was complemented by a series of interviews that uniformly support that incentives, both personal and organizational, were constraints on information sharing. In addition, the literature (see Appendix 1) shows a pattern indicating that human factors do influence an organization’s overall effectiveness. Based on these indicators there is sufficient evidence to reject the null for the main hypothesis and the efficiency sub-hypothesis. These rejections allow for acceptance of the main thesis of this research that personal and organizational attitudes\textsuperscript{95} toward information sharing influence successful implementations of information technology.

\textsuperscript{94} The results differ predominately in sign, i.e. positive versus negative.

\textsuperscript{95} From the survey and as is discussed below: trust, incentives, support to lateral coordination and support for ITOE.
Methodology

The methodology of a personnel survey with a structured equation modeling analysis has the potential to develop\(^{96}\) into a proven technique for analysis of IT implementation constraints and incentives. While a subset of the survey questions used for this thesis requires refinement, the consistent results in the question sets for lateral coordination (governance), trust, ITOE (IT efficiency), and to a lesser extent, incentives confirm that the research approach is effective. Having said that, the process of gaining a federal agency’s permission to survey their staff was difficult. In this particular organization (there were others that failed), four agencies out of a grouping of five that were approached refused, citing impact on personnel workload or other factors. If one ascribes to the motivations for bureaucratic information withholding described by Wilson and others (Allison & Zelikow, 1999; Kingdon, 2003; Wilson, 1989), then this reluctance may take on a different nuance. If the nuance is accurate, then the small sample size of this research may represent more the norm than the exception as agencies guard their information. Thus, a comprehensive understanding of the SEM variable refinement process used here becomes critical to apply correctly. Additional improvements in the data refinement process also should be explored, including: relying less on the modeling tool and more on theory; statistical intuition (i.e., moving sooner to a more parsimonious observed variable set); the use of standard statistical techniques (such as the statistical significance of the kurtosis values of the observed variables), and as mentioned above, a better constructed question set for the survey (such as fewer, more focused questions).

\(^{96}\) If applied correctly
The temptation to rely solely on the embedded tools of the computer software set must be avoided if SEM is to be applied effectively.

With regard to the interviews, one wishes that more persons would have made themselves available. Such availability would certainly have enriched the results and might have exposed or clarified the research interpretation. However, the interview results, coupled with a traditional approach to data analysis of the responses to the ITOE (an efficiency proxy) questions, provided evidence to support rejection of the efficiency sub-hypothesis \( H_{\text{eff-null}} \) and to provide a correlation to the main survey data model results.

The question set needs refinement as a result of this research. During the interviews there was some feedback (body language and the occasional asking for a repeat of the question) that indicated the interviewees possibly found the questions at odds with what they expected or had knowledge regarding SOA. Having said that, the approval constraints of the HSRB then in place made timely adjustment impractical.

Finally, the process of literature review and the characterization of the documents into patterns of information to establish an analysis framework obviously suffers from some very subjective evaluations. The key to the validity of such efforts was a willingness to reject some discovered literature from the analysis for lack of clearly aligned patterns. All reviewed documents were kept and, based on a high level review, approximately a
quarter were rejected on this premise. So, while the framing process may not be entirely satisfactory, it does have a degree of fidelity.

**SEM Results.**

The influence of the factors of lateral coordination (a governance proxy), trust, incentives, and ITOE (an IT efficiency proxy) on information sharing effectiveness is not counterintuitive and is largely in line with organizational theory. Public sector organizations within the US, including post “open government,” remain fundamentally bureaucratic organizations (Allison & Zelikow, 1999; Coleman, 2006; Wilson, 1989). As such, these organizations tend to rely on the above factors to become and remain effective. The relatively poor impact of incentives compared to the others (in terms of model fit) may be a function of sample size or the related high kurtosis values in the federal organization survey. These high kurtosis values may be an indication of a less than effective question set or possibly a function of contractor personnel having different incentives, as well as adequate sample size. It may also be that this particular organization has not done a good job in implementing incentives (Klitgaard, 2005).97

It is counterintuitive that power games was not a significant influence on information sharing effectiveness in all of the surveyed organizations. Wilson, Wolf and to a lesser extent Allison both argue strongly that power games is highly influential in bureaucratic

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97 For an interesting discussion of incentives in federal organizations, please see Klitgaard’s *High-performance government: structure, leadership, incentives.*
organizations, and that one of the methods of gaining and holding power is to control information. Yet, the empirical evidence gathered in this research does not directly support that argument. The Willem and Beulens study does also support the concept that power games is influential on trust and lateral coordination, but there remains in their work no statistically significant support for a direct influence path from power games to information sharing effectiveness.

The following considerations need to be made with regard to the apparently disparate results between the federal organization and the public sector organization, in which lateral coordination (a governance proxy) when combined with ITOE (an IT efficiency proxy) has a negative effect on information sharing effectiveness (see Table 7-1 below). First, the model that incorporates ITOE, TR, LC, and IN together is a marginally acceptable fit, and although it is indicative of progress to a good fit, there is sufficient uncertainty in both models that it should be discarded for comparison. Second, in the federal organization model the influence of ITOE is negative when combined with either trust or lateral coordination. This outcome aligns with recent research by Rees, Wand and Xu (Rees & Hopkins, 2009; Wang & Haggerty, 2011; Xu, Kim, & Kankanhalli, 2010) suggesting that as persons become more dependent on their IT resources, they become less inclined to share information through person-to-person processes. Thus, for both trust and lateral coordination (a governance proxy) processes, when combined individually with ITOE (an IT efficiency proxy), ITOE becomes a constraint (negative
influence). The dichotomous result is that for the public sector organization, ITOE is a negative influence. This dichotomy will be addressed later.

Table 8-1 Comparison of Federal Organization and Public Sector Results

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Federal Organization

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</tr>
</tbody>
</table>

Public Sector Organization

Note: ISE – information sharing effectiveness, ITOE – IT outcome expectations.

Trust\(^{98}\), when combined with ITOE\(^{98}\) (an IT efficiency proxy), is a positive influence on information sharing effectiveness in both survey models. Intuitively that makes sense, since the more I trust an individual or organization, the more likely I am to provide them with information I might consider sensitive or otherwise not generally shareable with the public. Lateral coordination (a governance proxy), however, is different; it is negatively

\(^{98}\) See subsequent Observed Variable section for discussion of the individual variables associated with this exogenous variable.
influential in the federal organization model, but positively influential in the public sector model. What might explain the difference?

Lateral coordination\textsuperscript{98} measures the degree to which organizations have or encourage cross-organizational teams, task forces and committees, i.e., discussions with peers without informing superiors. It also measures whether or not the organization has established roles (either organizational or personal) that encourage cross-organizational information exchange.\textsuperscript{99} At various times in my work career this researcher has been a participant observer (see Agar (Agar, 1996) for a practicum on participant observation)\textsuperscript{100} in both the public sector organization and the federal organization reported in this thesis. This researcher’s observation is that the public sector organization makes a consistent, proactive and effective attempt to enable lateral coordination (a governance proxy) through committees, internal information exchange conferences, and with senior leaders acting as champions. Conversely the federal organization does not. In addition, the public sector organization characterizes itself as a “knowledge management organization” in its publicly released information\textsuperscript{101}, while the federal organization has, as one of its objectives, a mission to conduct acquisitions through competitive contracts. As a result, the federal organization is constrained in its mission to safeguard corporate information it might receive in that process. The constraint can be argued to be a factor that limits

\textsuperscript{98} Ironically, the implementation of SOE encourages lateral coordination through the effective use of metadata (see Coleman, Hughes and Perry).

\textsuperscript{99} At various levels and different time periods, but never in a position of organizational leadership nor as an information sharing advocate.

\textsuperscript{101} Knowledge management is an adjunct role for the organization, according to its publicly released information.
lateral coordination (a governance proxy) in the federal organization. Still, the results indicate that for every lateral coordination effectiveness increase in the federal organization, there is a corresponding decrease of .484 in the organization’s information sharing effectiveness.

Based on a variety of anecdotal experiences and more formal studies, the role of lateral coordination (as a subset of knowledge management) in the IT industry is well-recognized in successful information sharing (Fountain, 2001, 2003; Weill & Ross, 2004). It was a motivating factor in the Willem and Buehns study. However, there does not seem to have been, until this thesis, a structured evaluation of this and other similar constraining or enabling factors in the US public sector.

Finally, as discussed earlier, there is clear evidence that incentives do play a role in the successful implementation of either Service Oriented Architecture (SOA) or Enterprise Resource Planning (ERP). While incentives were not a reportable factor in the results of the survey, the federal organizations interviews consistently validated its importance.

**Observed Variables Analysis**

The following analysis lends detail to the variables used in Figure 4-8 and as discussed above. The detail includes, for each set of observed variables used, an analysis of the mean of the survey responses. The analysis provides an enhanced nuance to these
conclusions in that it allows for a partial examination of the potential root issues underlying the SEM analysis. Recall that these question sets were identified in the SEM analysis process by examining the model fit and were further parsed by an evaluation of normality using kurtosis values. Based on this, the probability distributions of the observed variables used have a higher degree of normality than the observed variables in general. Thus these observed variables reflect model fitting and are not reflective of separate statistical processes such as ANOVA. Understanding how these observed survey question sets were chosen can add insight to the overall results.

The first of the endogenous variables examined is Trust. Observed Variables 12, 13 and 15 are associated with Trust. Of the three variables only variable 13 had a below 3.0 mean value of 2.69. As 3.0 indicates neither agreement nor disagreement the 2.69 value can be characterized as mild disagreement. Conversely the values for variables 12 and 15 were also not much above 3.0 (3.74 and 3.52 respectively) indicating only mild agreement with the statements. Trust when combined with ITOE (a IT efficiency proxy) in the SEM analysis had .481 positive weighting on information sharing effectiveness and was the best model fit for the federal model. Note that variable 13 deals with organizational trust while variables 12 and 15 are centered on personal trust.

Given these weighting estimates there is evidence to suggest that the federal organization would want to focus on organization trust issues as an objective to increase its information sharing effectiveness. Such a focus should examine organization
impediments to organizational trust (such as application of Non-Disclosure Agreements in a less than discriminate manner) and the associated process and policy implications. The effort should examine Federal Acquisition Regulation (FAR) policies associated with safeguarding information. The analysis should ask whether or not the regulations have been interpreted correctly. By correctly is meant that the regulations have not been too broadly interpreted (as was highlighted for other regulations in the 9/11 report) to preclude sharing of information that was not restricted by the FAR.

Variables 12 and 15 assess personal interactions and may be reflective of the extent of personal trust between personnel in different sub-units of the federal organization. As before, the mean values are not too far from the neutral 3.0 response and are below 4.0 (agree) position. These variable means provide evidence that the sample population weakly agrees with the statement. In other words, the evidence suggests that there is a degree of personnel intra sub-unit trust. The organization should consider steps to improve on personnel trust between individuals and between personnel within subunits of the organization. While not significantly influential in the sample, identification and power games are theoretical influences/outcome of personnel trust (from the W&B study). The organization might profit from another, broadly applied survey centered on these factors. This new survey might elicit better information with regard to the methods for increasing intra - personal and intra – organizational trust.
Lateral coordination (a governance proxy), when combined with ITOE (a IT efficiency proxy) had a negative influence on Information Sharing Effectiveness of -0.484. This result is not quite as good a model fit as when Trust and ITOE were combined. Earlier it was observed, from the perspective of the SEM modeling, that the negative influence may have been driven by the impact of ITOE (recall that, under SEM the exogenous variables are co-variant reflecting multifactor influences) on lateral coordination.

Looking at the individual observed variables for the lateral coordination endogenous variable 18 there is a mean value of 3.5. This mean indicates that the sample population is positively inclined to agree with the statement that “There are people with a coordinating role whose specific job it is to coordinate the efforts of several departments for purposes of a specific project”. Conversely, they tend to disagree that “Inter-unit committees are set up to allow units to engage in joint decision making” (mean value 2.25). However, “task forces (project teams) are set up to facilitate inter-unit collaboration on a specific project” (mean value 2.49). In other words they are in agreement that there is an organizational structure that facilitates lateral coordination, but tend to disagree that it is effective. Both the Virginia Tech tragedy and the 9/11 investigations found similar results. There were nominal processes in place to encourage this information sharing (through lateral coordination) but that the processes did not seem to be effective.

Weill and Ross, in their discussion of factors influencing a successful governance structure make very clear statements to the effect that governance and IT governance in
particular, require strong upper management engagement. While the interviews did not specifically provide a view on the governance of the federal organization the DCOO did state that it was essential.

Thus there is some indication of a disconnect between the federal organization’s intent vis-a-vis lateral coordination and its execution. There are obviously a variety of reasons on why this disconnect may be occurring. These reasons (per Weill and Ross and the IT Institute) can include such factors as: a lack of an information sharing plan; lack of a designated governance plan within the organization; lack of IT system enhancements such as an IT Portal; and linking the IT investment clearly to the organization’s business plan. The organization should change its structure and processes to address the possible shortcomings with an eye to improvement where appropriate. In terms of governance the organization should make an explicit policy statement to their employees to the effect that information sharing is a goal of the organization.

In the analysis of the survey incentives were included in Figure 4-8 and then subsequently dropped from the analysis. The rationale was that incentives when coupled with ITOE yielded a marginal SEM fit. However, when looking at the variables themselves there is a conspicuous difference between the mean value of Var 35 and the mean values of Variables 37 and 38. Variable 35 assess whether an individual is graded in their performance report based on the concept of teamwork while Variables 37 and 38 assess the success of intra unit coordination. The first variable is a personal assessment,
the latter two are organizational. For this particular sample, the respondents indicate they disagree that there is a personal incentive but agree that there are organizational incentives.

In the research leading to this thesis a great many journals were reviewed that addressed personal incentives or constraints to sharing information. Interestingly the issue of using personnel evaluations as an incentive or constraint was not often discussed. Where it was, it was discussed from the perspective of negative influence. The result for Variable 35 is informative because in an environment where there is knowledge that intra unit information sharing is encouraged. That is, the respondents recognize that they are not being individually graded. Yet, in the COO and DCOO interviews both confirmed that they viewed “customer engagement” evaluation as part of the personnel evaluation.

Recognizing that federal government organizations have little latitude in the personnel evaluation processes, the federal organization should review their evaluation processes with an aim to insert better measures of teamwork incentives.

Information Technology Outcome Expectations (ITOE – an efficiency proxy) in the SEM analysis for the federal organization and combined with either trust or lateral coordination had a negative influence on information sharing effectiveness. Chapters 5 and 7 addressed this influence in terms of recent research indicating that increases in the performance of an IT system may be causal to reduced effectiveness by facilitating a
reduction in actual person to person communications. All three of the observed variables associated with ITOE in the SEM model address efficiency changes. Variable 51 states that use of the IT system will increase effectiveness in the job while Variable 53 states that the quality of the output will be increased. Variable 54 states that a person will get more output in the same time period with use of the IT system. For both Variables 51 and 53 the sample respondents agree indicating that they value improvements in IT systems. However, for Variable 54 they do not agree with the X-efficiency concept of a synergistic increase in output in the same amount of time. The Variable 54 mean value is 2.75 indicating only a small degree of disagreement (where 3.0 is neither agree nor disagree). With that amount of difference it would be inappropriate to say that there is no agreement that efficiency is increased. However, it is instructive that the presumed linear increases of Variables 51 and 53 are recognized in the responses while the nonlinear X-efficiency is not.

One interpretation of the difference is that the employees understand and use the more traditional tools associated with IT since they can see a linear benefit to the use, i.e., I can do my work with a higher quality\(^{102}\) than before the new IT system was installed. However, the employees may not be able to generate the possible synergistic effects available in new IT systems. A possible effect discussed in some detail earlier in this thesis was the idea of data fungibility. Inherent in that discussion was idea that one

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\(^{102}\) An individual effectiveness measure functionally equivalent to individual efficiency. The source of this question (Venkatesh, et al, 2003) structured this as an efficiency question but used the word effectiveness.
person could easily use someone else’s data, saving time in generating new data. This data fungibility outcome is an X-efficiency tool that may not be realized in the federal organization. If these tools are now available then a step the organization can take (or enhance) is training personnel on the capabilities of the new system.

Finally, there are three variables that inform information sharing effectiveness. All have means that indicate respondent agreement with the individual statements. The variables addressed the propensity for the IT system to address gains in insights, improve individual effectiveness and to improve on unit effectiveness. These variables measure the effective outcome of information sharing, i.e., “how much more effective am I and my organization based on my available knowledge?”.

**Policy Implications for Governance and IT Implementation**

This research lends credence to the idea that variations in approach to information sharing processes lead to sometimes dramatically different results. The research suggests that policies in place, i.e., those requiring close compartmentalization of contractual data, have the effect of building barriers to information sharing in the wider organizational sense. The constraint is demonstrably true with respect to the two organizations surveyed. The finding is not that much different from the conclusions of both the 9/11 Commission (Kean & Hamilton, 2004) and the Virginia Tech report (Kaine, 2007). One of the recommendations of the 9/11 Commission was that the policies that restrict information
sharing between the evaluated organizations be critically reviewed with an aim to strictly corroborating the need for each restriction to information flow.

The organizations surveyed have different policies in place that either encourage or constrain information flow. One apparent difference is the approach to sensitive data. The federal organization, for contractual competition reasons, constrained the exchange of information in the organization. The public sector organization, whose mission did not include awarding contracts on behalf of the government, did not need to impose such information transfer restrictions. While the federal organization’s rule set does not include all information within the organization, a reasonable conclusion is that the policy, which apparently is not clearly defined nor evenly enforced, has a wide impact on the organization and may be an explanatory factor for the discovered difference in lateral coordination (a governance proxy) influence on information sharing effectiveness. Thus, the policy has apparently unintended consequences and is ripe for review. In a similar way, the impact of ITOE (an IT efficiency proxy) differences may have been affected by a different approach (policy) to staff engagement. The public sector organization has a series of proactive information sharing processes in place; the federal organization does not appear to. If the mission of the federal organization includes information sharing between staff, then the contractual constraint to information sharing policy should be reviewed to ensure that only information that is truly sensitive (contractually or by public law) is constrained. This review of policy is likely to reduce the apparent detrimental effect of the current policy.
Finally, the rejection of $H_{null-eff}$ has implications for IT implementation policies. The concept that an IT system implementation can create IT efficiencies without a corresponding increase in organizational effectiveness implies a needed review of organizational IT implementation policies for success.
CHAPTER 9: Further Research

This research, while productive and arguably with impact, is just the cusp of a potentially rich area of further study. As addressed in Chapter 8, the SEM method holds promise for additional research. Perhaps the most obvious area for future research is the need to replicate the effort with other federal agencies. The cost impact to the federal government of the indicated policy changes are likely to be consequential and should not be undertaken on the strength of one study. The survey sample size, while small, was adequate, but the efforts to reduce the number of observed variables, although indicated for model fit, may have precluded discovery of other significant factors. Further, a larger sample across more diversified federal organizations would probably reduce the kurtosis values of some of the response sets to allow for a richer SEM model. The richer model effort might provide for more nuanced research findings.

A larger sample size would potentially provide a more solid basis for modification of the questions themselves. In the federal organization survey, all of the questions used for incentives had high kurtosis values. Perhaps the small sample size was not the source of the kurtosis, but it may indicate a lack of respondents’ understanding of the questions, which implies a need for a new survey.
This methodology appears to be a promising technique for helping senior IT management understand their organization’s IT culture\textsuperscript{103}. Another research area that suggests itself is to investigate whether or not a more comprehensive analysis could provide a template for change. For example, could expanded mapping of influences be used for investment decisions? Would such an effort yield better return on investment decisions? The possible research question underlying this is: Could a technology implementation effort be guided by a survey to determine if and how to structure such an enhancement? Does it make sense to emphasize a particular technology in an IT investment in such a way as to leverage the organization’s IT culture? How might such leveraging influence an organization’s structure? Could such a mapping of an IT culture influence hiring practices by allowing for profiling (the trigger might be responses outside the standard error of the organizational responses) particular skill sets and attitudes?

Is the constraining effect of ITOE (an IT efficiency proxy) found in the federal organization on interpersonal information exchange more pronounced by age group, education, other social factors or gender? How might such a finding inform the ongoing research on social media? Do any of the other postulated IT influences in this work assume a more significant role in a larger survey? In particular, is lateral coordination (a governance proxy) correlated with IT complexity or IT social factors? What role did the use of an online survey play in data gathering? Does the use of an online survey bias the

\textsuperscript{103} “IT culture” is an often bandied but little understood term. In most cases it encompasses acceptance and use of IT systems. In this thesis the term is expanded to include the acceptance, use and organizational incentives/constraints in its use.
data gathering to a younger group on the presumption that younger people are more at ease with technology?

What role does this type of reproducible research play in the classic case study? Does a strong qualitative analytical method change the balance in a case study?

The demographic analysis exposed a key consideration of the role of federal contractual staff in the study of organizational dynamics. Given that contractual staff will continue to be a fact of life in federal organizations, how does their presence impact organizational studies? Are they excluded in surveys such as the one performed here? If they are not excluded, how are they accounted for in the demographic match?

The interview exposed the dependencies this study had during the data gathering stage on an assumption of well-defined organizational borders. The data gathered gave some indication that the assumption was not entirely valid. A new effort that accounts for such border uncertainties would prove useful.

This research has created a richer group of research questions to be addressed within the public policy domain. These questions, depending on how they are answered and modeled, may lead to an expanding field within this domain.
## APPENDIX 1: Literature Analysis Spreadsheet

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| Mean Score | 2.40 | 2.40 | 4.00 | 2.10 | 2.20 | 2.80 | 1.70 | 2.30 | 2.70 | 3.70 | 1.30 | 3.30 | 2.35 |
APPENDIX 2: Interview Question Set

Organizational Incentives/Constraints in Implementing a Service Oriented Environment

Personal Identification

1. To ensure that I correctly identify you I wonder if you could tell me a bit about yourself and your role in the organization. Are you comfortable with this?
   a. Ans: Yes
      i. Please confirm your name as ?????
      ii. Please confirm your position title
         1. Does that position accurately reflect your role?
      iii. Could you provide your highest educational level?
      iv. If a college degree, could you describe your major?
      v. Do you believe that your education has been beneficial to your role in the implementation of a SOA?
      vi. Have you had specific professional training in SOA or associated technologies?
         1. If so, can you provide a brief description of that training?
         2. If not, do you believe that such training would have been beneficial to the role you played?
      vii. If you are a government employee are you a Civil Servant or a political appointee?
   b. Ans: No
      i. Respecting your privacy could I confirm your name as ?????
      ii. Again respecting your privacy would you feel comfortable with confirming your position title?

Organizational Identification

2. Moving on to your Organization I would like to ask a few questions to confirm my understanding of your organization’s role. Would you describe your organization as governmental, commercial or a non-governmental organization?
   a. If Governmental
      i. Is your organization an independent agency or a member of a specific cabinet organization?
      ii. If cabinet how many organizational levels are there between your organization and the Cabinet Secretary?
      iii. If independent is there an oversight group to your chief executive?
iv. Does your CIO have direct access to your organizational chief executive?

b. If commercial
   i. Is your organization of publicly held organization or private
   ii. Would you describe your organization as healthy financially?
   iii. Is your IT organization viewed as core to the business or in a support role?
      1. If core to the business does your CIO report directly to the CEO/COO
      2. If in a support role does your CIO report directly to the CEO/COO
      3. In either case are you satisfied with this reporting arrangement?

c. If Non governmental Organization
   i. Does your organization have a governmentally approved charter?
   ii. Is your organization independently funded (Foundation, Charity, et al.)?
   iii. Is your IT organization viewed as core to the business or in a support role?
      1. If core to the business does your CIO report directly to the CEO/COO
      2. If in a support role does your CIO report directly to the CEO/COO
      3. In either case are you satisfied with this reporting arrangement?

IT Management

3. In terms of your IT Management how would you describe the organization of your Management Team (centralized, decentralized, hierarchical, distributed?)
   a. Might I have a copy of your organization chart?
      i. Could you describe the major functions of the 1st tier management in this chart (go through the names/job functions)
   b. Who in your organization is the final decision maker with regard to IT architectural design
      i. Is that person a line manager or a SME advisor to line management
   c. Does your organization embrace any type of IT maturity model?
      i. If so, which model?
      ii. At what level in this model to you self assess your efforts to be?
      iii. Have you been independently assessed? If so, by whom?
         1. Would you care to share the results?
   d. In terms of specific efforts in IT management how would you self assess (in terms of a Lekert scale of 1= most satisfied, 2 = somewhat satisfied,
3=neutral, 4=somewhat dissatisfied, 5=dissatisfied) your success in terms of

i. Strategy
ii. Architecture
iii. Data Sharing
iv. Agility
v. Employee exposure/knowledge of SOA strategy

ERP/CRM/SRM Incentives/Constraints
The following are a series of questions to understand your past efforts in large scale enterprises initiatives.

4. In terms of your IT engineers would you say that they have an engineering imperative to implement ERP/CRM/SRM?
   a. Is it your belief that they would agree (1=agree, 2=somewhat agree, 3=neutral, 4=somewhat disagree, 5=disagree) that implementation of the ERP/CRM/SRM has eased their workload? And, if so, how?
      i. In the past 6 months?
      ii. In the past year?
      iii. In the past 3 years?
   b. Is it your belief that they would agree (1=agree, 2=somewhat agree, 3=neutral, 4=somewhat disagree, 5=disagree) that the implementation of the ERP/CRM/SRM has improved the quality of their work? And if so, how?
      i. In the past 6 months?
      ii. In the past year?
      iii. In the past 3 years?
   c. At this stage of implementation would you say that your IT engineers are generally satisfied with the impact of the ERP/CRM/SRM implementation on their professional engineering efforts?

5. In terms of your IT managers would you say that they have a management imperative to implement a ERP/CRM/SRM?
   a. Is it your belief that they would agree (1=agree, 2=somewhat agree, 3=neutral, 4=somewhat disagree, 5=disagree) that implementation of ERP/CRM/SRM has eased their workload? And if so, how?
      i. In the past 6 months?
      ii. In the past year?
      iii. In the past 3 years?
   b. Is it your belief that they would agree (1=agree, 2=somewhat agree, 3=neutral, 4=somewhat disagree, 5=disagree) that the implementation of the SOA has improved the quality of their work? And if so, how?
      i. In the past 6 months?
      ii. In the past year?
      iii. In the past 3 years?
c. At this stage of implementation would you say that your IT managers are generally satisfied with the impact of the ERP/CRM/SRM implementation on their professional efforts?

6. In terms of your overall organization (not exclusively IT) what business incentives does the implementation of ERP/CRM/SRM provide?
   a. Are there incentives in terms of organizational (and sub organizational) budgets?
   b. Are there incentives in terms of organizational (and sub organizational) control and use of information?
   c. Are there incentives in terms of organizational (and sub organizational) measurements of influence?
      i. With senior management?
      ii. With peer management?

7. In terms of the broad personnel community what personal incentives does the implementation of ERP/CRM/SRM provide?
   a. Are there incentives in terms of personal compensation?
   b. Are there incentives in terms of career?
      i. To what extent if any does your personnel evaluation system reflect ERP/CRM/SRM implementation priorities? (such as the sharing of information)
   c. Are there incentives for personnel in terms of the measurement of influence?
      i. With senior management?
      ii. With peer management?
   d. Are there incentives in terms of personal workload?

Lessons Learned to date

8. In the implementation of ERP/CRM/SRM did you or your organization discover any constraints in
   a. The Management process (please describe)
   b. The Budgetary process (please describe)
   c. The Personnel process (please describe)

9. What other organizational lessons learned were discovered before, during or after the implementation
SOA Incentives/Constraints

10. In terms of your IT engineers would you say that they have an engineering imperative to implement a SOA?
   a. Is it your believe that they would agree (1=agree, 2=somewhat agree, 3=neutral, 4=somewhat disagree, 5=disagree) that implementation of the SOA has eased their workload? And, if so, how?
      i. In the past 6 months?
      ii. In the past year?
      iii. In the past 3 years?
   b. Is it your believe that they would agree (1=agree, 2=somewhat agree, 3=neutral, 4=somewhat disagree, 5=disagree) that the implementation of the SOA has improved the quality of their work? And if so, how?
      i. In the past 6 months?
      ii. In the past year?
      iii. In the past 3 years?
   c. At this stage of implementation would you say that your IT engineers are generally satisfied with the impact of the SOA implementation on their professional engineering efforts?

11. In terms of your IT managers would you say that they have a management imperative to implement a SOA?
   a. Is it your believe that they would agree (1=agree, 2=somewhat agree, 3=neutral, 4=somewhat disagree, 5=disagree) that implementation of the SOA has eased their workload? And, if so, how?
      i. In the past 6 months?
      ii. In the past year?
      iii. In the past 3 years?
   b. Is it your believe that they would agree (1=agree, 2=somewhat agree, 3=neutral, 4=somewhat disagree, 5=disagree) that the implementation of the SOA has improved the quality of their work? And if so, how?
      i. In the past 6 months?
      ii. In the past year?
      iii. In the past 3 years?
   c. At this stage of implementation would you say that your IT managers are generally satisfied with the impact of the SOA implementation on their professional efforts?

12. In terms of your overall organization (not exclusively IT) what business incentives does the implementation of SOA provide?
   a. Are there incentives in terms of organizational (and sub organizational) budgets?
   b. Are there incentives in terms of organizational (and sub organizational) control and use of information?
   c. Are there incentives in terms of organizational (and sub organizational) measurements of influence?
      i. With senior management?
ii. With peer management?

13. In terms of the broad personnel community what personal incentives does the implementation of SOA provide?
   a. Are there incentives in terms of personal compensation?
   b. Are there incentives in terms of career?
      i. To what extent if any does your personnel evaluation system reflect SOA implementation priorities? (such as the sharing of information)
   c. Are there incentives for personnel in terms of the measurement of influence?
      i. With senior management?
      ii. With peer management?
   d. Are there incentives in terms of personal workload?

SOA Lessons Learned to date

14. In the implementation of SOA did you or your organization discover any constraints in
   a. The Management process (please describe)
   b. The Budgetary process (please describe)
   c. The Personnel process (please describe)
   d. What other organizational lessons learned were discovered before, during or after the implementation

Other thoughts

15. Are there other issues that we haven’t covered that you believe are germane?
APPENDIX 3: Numbered Question Set

(note that question numbers have been added to allow mapping of questions to survey factors addressed in the body of this proposal. Note also that the questions numbers start at 3 to allow for the Informed Consent verbiage below. Finally, note that the question numbers do not appear on the online survey itself)

Informed Consent Section

Hello: You are invited to participate in a survey to assess attitudes towards Information Sharing and Information Technology in the Public Sector workplace. This survey is one of series of surveys that are being taken as part of my dissertation work. Your organization has kindly agreed to allow me to administer this survey to you for which I am very grateful. It should take less than 20 minutes to complete the questionnaire. Please note that once started the survey needs to be completed in one session. Your participation in this study is completely voluntary. There are no foreseeable risks associated with this project. However, if you feel uncomfortable answering any questions, you can withdraw from the survey at any point. However, it is very important to me to learn your opinions making a completed survey is very valuable. Your survey responses will be strictly confidential and data from this research will be reported only in the aggregate. Your information will be coded and will remain confidential. If you have questions at any time about the survey or the procedures, you may contact me by email at the email address specified below. Thank you very much for your time and support. Please start with the survey now by clicking on the Continue button below.

Information Sharing and Information Technology in the Public Sector Informed Consent Form

RESEARCH PROCEDURES

This research is being conducted to help frame attitudes towards information Sharing and Information Technology in the Public Sector. If you agree to participate, you will be asked to participate in the online survey below. This survey seeks to record your experiences and knowledge in this area. This survey is expected to take, on average, less than 20 minutes.

RISKS

There are no foreseeable risks or discomforts other than might be encountered in a normal office environment.

BENEFITS

There are no benefits to you as a participant other than to further research in organizational dynamics and information technology. In addition, the benefits to the IT Management community include a possible
better understanding of the organizational pitfalls in the implementation of Information Sharing Technologies.

CONFIDENTIALITY

The data in this study will be individually confidential and will not be reported individually. Aggregate results may become part of analysis reported in an eventual dissertation. It is not expected that your individual or the aggregate results will be in any way “backward traceable” to you. The survey electronic files will be under positive control (treated as proprietary) of the person conducting the survey for the duration of the study. After completion the survey data will be electronically destroyed. For more information as to how that is accomplished please refer to the privacy policy of “Question Pro” at the following link: http://www.questionpro.com/help/489-window.html

PARTICIPATION

Your participation is voluntary, and you may withdraw from the survey at any time and for any reason. If you decide not to participate or if you withdraw from the survey, there is no penalty or loss of benefits to which you are otherwise entitled. There are no direct costs to you or any other party.

CONTACT

This research is being conducted by David W. Coleman, PhD Candidate in the School of Public Policy at George Mason University. He may be reached at 703-303-5180 (cell) or at dcolema2@gmu.edu for questions or to report a research-related problem. If unavailable, Dr. Wayne D. Perry, Dissertation Chair (wperry@gmu.edu, 703 - 993-2276) may be contacted as an alternative. You may contact the George Mason University Office of Research Subject Protections at 703-993-4121 if you have questions or comments regarding your rights as a participant in this research.

CONSENT

The George Mason University Human Subjects Review Board has waived the requirement for physically signing this consent form. If you are not comfortable with this waiver you have the option to physically sign. To print this page please “right click” on your mouse anywhere on this page and select “print” from the “pop up” menu. In the resultant print menu choose “all pages” and click OK. This process is known to work in Internet Explorer and is believed to work in other browser environments. To submit the signed page please contact David W. Coleman/Wayne D. Perry as listed under “CONTACT” above. However, if you are comfortable indicating consent electronically please do so below by either checking the “yes ” box or the “no” box.. If you do not consent to this survey please indicate “no” and close this survey from your browser. This research has been reviewed according to George Mason University procedures governing your participation in this research. I have read this form and consent to participate in this study.

1. Yes
2. No
Power Games\textsuperscript{104}

3. In meetings, it is always the same people, and seldom the most competent ones, who talk too much
   1. Strongly Disagree
   2. Disagree
   3. Neither agree nor disagree
   4. Agree
   5. Strongly Agree

4. Within our organization, power games between the units seldom play an important role\textsuperscript{105}.
   1. Strongly Disagree
   2. Disagree
   3. Neither agree nor disagree
   4. Agree
   5. Strongly Agree

5. Relationships between people of different units can be rather strained.
   1. Strongly Disagree
   2. Disagree
   3. Neither agree nor disagree
   4. Agree
   5. Strongly Agree

6. In our organization, favoritism is an important way to achieve something.
   1. Strongly Disagree
   2. Disagree
   3. Neither agree nor disagree
   4. Agree
   5. Strongly Agree

7. Staff members are seldom taken advantage of in our organization\textsuperscript{105}.
   1. Strongly Disagree
   2. Disagree
   3. Neither agree nor disagree
   4. Agree
   5. Strongly Agree

\textsuperscript{104} These titles and the subsequent questions were extracted with permission from Willem and Beulens. The titles were not included in the actual survey.
\textsuperscript{105} These questions were changed to a negative connotation to avoid survey bias
Identification\textsuperscript{104}

8. People in my work group are seldom willing to make sacrifices for the sake of the work group (such as working late now and then, going out of their way to help)\textsuperscript{105}.
   1. Strongly Disagree
   2. Disagree
   3. Neither agree nor disagree
   4. Agree
   5. Strongly Agree

9. People in my work group do realize that they sometimes are going to have to make sacrifices for the sake of the work group as a whole.
   1. Strongly Disagree
   2. Disagree
   3. Neither agree nor disagree
   4. Agree
   5. Strongly Agree

10. People are aware that if they are going to be a part of the work group, they are sometimes going to have to do things they do not want to do.
    1. Strongly Disagree
    2. Disagree
    3. Neither agree nor disagree
    4. Agree
    5. Strongly Agree

11. People in my work group seldom do their best to cooperate with each other, instead they try to work things out on their own\textsuperscript{105}.
    1. Strongly Disagree
    2. Disagree
    3. Neither agree nor disagree
    4. Agree
    5. Strongly Agree

Trust\textsuperscript{104}

12. The people in the other unit approach their job with professionalism and dedication
    1. Strongly Disagree
    2. Disagree
    3. Neither agree nor disagree
    4. Agree
    5. Strongly Agree

13. Given the other units track record. I have every reason to doubt their competence and preparation for the job\textsuperscript{105}.
    1. Strongly Disagree
    2. Disagree
    3. Neither agree nor disagree
    4. Agree
    5. Strongly Agree
14. I can rely on the people from the other unit not to make my job more difficult by careless work.
   1. Strongly Disagree
   2. Disagree
   3. Neither agree nor disagree
   4. Agree
   5. Strongly Agree

15. Most people, even those who are not close friends to people in the other unit consider the people of the other unit to be trustworthy.
   1. Strongly Disagree
   2. Disagree
   3. Neither agree nor disagree
   4. Agree
   5. Strongly Agree

**Lateral Coordination**

16. Inter-unit committees are seldom set up to allow units to engage in joint decision making.
   1. Strongly Disagree
   2. Disagree
   3. Neither agree nor disagree
   4. Agree
   5. Strongly Agree

17. Task forces (project teams) are seldom set up to facilitate inter-unit collaboration on a specific project.
   1. Strongly Disagree
   2. Disagree
   3. Neither agree nor disagree
   4. Agree
   5. Strongly Agree

18. There are people with a coordinating role whose specific job it is to coordinate the efforts of several departments for purposes of a specific project.
   1. Strongly Disagree
   2. Disagree
   3. Neither agree nor disagree
   4. Agree
   5. Strongly Agree

19. Decision making in our organization is characterized by participative, cross-functional discussions in which different departments, functions, or divisions get together.
   1. Strongly Disagree
   2. Disagree
   3. Neither agree nor disagree
   4. Agree
   5. Strongly Agree
20. There are people with a process responsibility whose specific job it is to exchange knowledge and information related to a specific process.
   1. Strongly Disagree
   2. Disagree
   3. Neither agree nor disagree
   4. Agree
   5. Strongly Agree

21. Information and experiences are seldom shared in meetings or during teamwork.¹⁰⁵
   1. Strongly Disagree
   2. Disagree
   3. Neither agree nor disagree
   4. Agree
   5. Strongly Agree

**Formal Systems**¹⁰⁴

22. Formal procedures determine how we work together with the other unit.
   1. Strongly Disagree
   2. Disagree
   3. Neither agree nor disagree
   4. Agree
   5. Strongly Agree

23. Information is mainly held in and exchanged through a large number of reports and formal documents.
   1. Strongly Disagree
   2. Disagree
   3. Neither agree nor disagree
   4. Agree
   5. Strongly Agree

24. In general, our work is not subject to a large number of rules.¹⁰⁵
   1. Strongly Disagree
   2. Disagree
   3. Neither agree nor disagree
   4. Agree
   5. Strongly Agree

25. The information that is required to do my job is laid down in procedures, goals and rules.
   1. Strongly Disagree
   2. Disagree
   3. Neither agree nor disagree
   4. Agree
   5. Strongly Agree

26. Our direct supervisors decide how we should execute our tasks.
   1. Strongly Disagree
   2. Disagree
   3. Neither agree nor disagree
   4. Agree
   5. Strongly Agree
27. Communication with other units occurs via the unit heads.
   1. Strongly Disagree
   2. Disagree
   3. Neither agree nor disagree
   4. Agree
   5. Strongly Agree

28. Knowledge and information exchange between units is the responsibility of the unit heads.
   1. Strongly Disagree
   2. Disagree
   3. Neither agree nor disagree
   4. Agree
   5. Strongly Agree

**Informal Coordination**

29. I have my informal network of friends in the organization.
   1. Strongly Disagree
   2. Disagree
   3. Neither agree nor disagree
   4. Agree
   5. Strongly Agree

30. Having your own personal network is not important in our organization.
   1. Strongly Disagree
   2. Disagree
   3. Neither agree nor disagree
   4. Agree
   5. Strongly Agree

31. Personal networks are necessary to learn from others.
   1. Strongly Disagree
   2. Disagree
   3. Neither agree nor disagree
   4. Agree
   5. Strongly Agree

32. Personal networks are not necessary to do your job efficiently in our organization.
   1. Strongly Disagree
   2. Disagree
   3. Neither agree nor disagree
   4. Agree
   5. Strongly Agree
33. I have my own network with people that can advise me when I face a problem or need help.
   1. Strongly Disagree
   2. Disagree
   3. Neither agree nor disagree
   4. Agree
   5. Strongly Agree

Incentives

34. We are evaluated as a team.
   1. Strongly Disagree
   2. Disagree
   3. Neither agree nor disagree
   4. Agree
   5. Strongly Agree

35. Teamwork is not included in our yearly evaluation.
   1. Strongly Disagree
   2. Disagree
   3. Neither agree nor disagree
   4. Agree
   5. Strongly Agree

36. Cooperative behavior is seldom explicitly rewarded in our organization (e.g., through bonuses, promotion, and formal evaluations).
   1. Strongly Disagree
   2. Disagree
   3. Neither agree nor disagree
   4. Agree
   5. Strongly Agree

37. Exchanging knowledge and information between units is formally encouraged.
   1. Strongly Disagree
   2. Disagree
   3. Neither agree nor disagree
   4. Agree
   5. Strongly Agree

38. Cooperation between units is one of the strategic objectives of our organization,
   1. Strongly Disagree
   2. Disagree
   3. Neither agree nor disagree
   4. Agree
   5. Strongly Agree
39. Inter-unit knowledge sharing is one of the priorities of our management.
   1. Strongly Disagree
   2. Disagree
   3. Neither agree nor disagree
   4. Agree
   5. Strongly Agree

Knowledge Sharing Intensity

40. Knowledge is frequently shared between the two units.
   1. Strongly Disagree
   2. Disagree
   3. Neither agree nor disagree
   4. Agree
   5. Strongly Agree

41. We frequently provide information to the other unit
   1. Strongly Disagree
   2. Disagree
   3. Neither agree nor disagree
   4. Agree
   5. Strongly Agree

42. We seldom share our expertise and knowledge with the other unit.
   1. Strongly Disagree
   2. Disagree
   3. Neither agree nor disagree
   4. Agree
   5. Strongly Agree

43. There is seldom an exchange of ideas and experiences between the two units.
   1. Strongly Disagree
   2. Disagree
   3. Neither agree nor disagree
   4. Agree
   5. Strongly Agree

44. We share knowledge about our way of working with the other unit.
   1. Strongly Disagree
   2. Disagree
   3. Neither agree nor disagree
   4. Agree
   5. Strongly Agree

45. There is a good exchange of knowledge between the units.
   1. Strongly Disagree
   2. Disagree
   3. Neither agree nor disagree
   4. Agree
   5. Strongly Agree
Effectiveness of Knowledge Sharing\textsuperscript{104}

46. To what extent did you acquire knowledge that generally caused you to develop new insights.
   1. To a very small extent
   2. To a small extent
   3. Somewhat
   4. To a great extent
   5. To a very great extent

47. To what extent did you receive knowledge that enabled you to see new ways of performing current tasks within your organization.
   1. To a very small extent
   2. To a small extent
   3. Somewhat
   4. To a great extent
   5. To a very great extent

48. To what extent did the cooperative projects with the other units prevent you from performing new or existing tasks as a result of acquired knowledge.
   1. To a very small extent
   2. To a small extent
   3. Somewhat
   4. To a great extent
   5. To a very great extent

49. The available knowledge improves your effectiveness in performing your tasks.
   1. Strongly Disagree
   2. Disagree
   3. Neither agree nor disagree
   4. Agree
   5. Strongly Agree

50. The available knowledge improves my units overall effectiveness.
   1. Strongly Disagree
   2. Disagree
   3. Neither agree nor disagree
   4. Agree
   5. Strongly Agree

Information Technology Outcome Expectations\textsuperscript{106}

For this set of questions please answer from the perspective of the system (not necessarily a single application) that you use most in your job.

51. If I use the system I will decrease my effectiveness on the job\textsuperscript{105}.
   1. Strongly Disagree

\textsuperscript{105} These questions were extracted with permission from Venkatesh, Morris, Davis. The titles were not included in the survey.

\textsuperscript{106} These questions were extracted with permission from Venkatesh, Morris, Davis. The titles were not included in the survey.
2. Disagree
3. Neither agree nor disagree
4. Agree
5. Strongly Agree

52. If I use the system I will spend more time on routine job tasks. \[105\]
   1. Strongly Disagree
   2. Disagree
   3. Neither agree nor disagree
   4. Agree
   5. Strongly Agree

53. If I use the system I will increase the quality of output of my job.
   1. Strongly Disagree
   2. Disagree
   3. Neither agree nor disagree
   4. Agree
   5. Strongly Agree

54. If I use the system I will decrease the quantity of output for the same amount of effort. \[105\]
   1. Strongly Disagree
   2. Disagree
   3. Neither agree nor disagree
   4. Agree
   5. Strongly Agree

55. If I use the system my coworkers will perceive me as competent.
   1. Strongly Disagree
   2. Disagree
   3. Neither agree nor disagree
   4. Agree
   5. Strongly Agree

56. If I use the system I will increase my chances of obtaining a promotion.
   1. Strongly Disagree
   2. Disagree
   3. Neither agree nor disagree
   4. Agree
   5. Strongly Agree

57. If I use the system I will increase my chances of getting a raise.
   1. Strongly Disagree
   2. Disagree
   3. Neither agree nor disagree
   4. Agree
   5. Strongly Agree

**IT Complexity** \[106\]

For this set of questions please answer from the perspective of the system (not necessarily a single application) that you use most in your job.
58. Using the system takes too much time from my normal duties.
   1. Strongly Disagree
   2. Disagree
   3. Neither agree nor disagree
   4. Agree
   5. Strongly Agree

59. Working with the system is not complicated, it is easy to understand what is going on.
   1. Strongly Disagree
   2. Disagree
   3. Neither agree nor disagree
   4. Agree
   5. Strongly Agree

60. Using the system involves too much time doing mechanical operations (e.g. data input).
   1. Strongly Disagree
   2. Disagree
   3. Neither agree nor disagree
   4. Agree
   5. Strongly Agree

61. It takes too long to learn how to use the system to make it worth the effort.
   1. Strongly Disagree
   2. Disagree
   3. Neither agree nor disagree
   4. Agree
   5. Strongly Agree

**IT Social Factors**

For this set of questions please answer from the perspective of the system (not necessarily a single application) that you use most in your job.

62. I use the system because of the proportion of co-workers who use the system.
   1. Strongly Disagree
   2. Disagree
   3. Neither agree nor disagree
   4. Agree
   5. Strongly Agree

63. The senior management of this business has not been helpful in the use of the system.
   1. Strongly Disagree
   2. Disagree
   3. Neither agree nor disagree
   4. Agree
   5. Strongly Agree

64. My supervisor is very supportive of the use of the system for my job.
   1. Strongly Disagree
   2. Disagree
   3. Neither agree nor disagree
   4. Agree
   5. Strongly Agree
65. In general, the organization has not been supportive of the use of the system.  
   1. Strongly Disagree  
   2. Disagree  
   3. Neither agree nor disagree  
   4. Agree  
   5. Strongly Agree

Thank you for completing the body of the survey. I would now like to collect just a little information about you. As with body of the survey the individual information collected will be coded and remain confidential. It will be used only to show if the responses follow any particular pattern associated with the groups of people that you are a member of.

66. Please indicate your gender  
   1. Male  
   2. Female

67. Please indicate, within the ranges provided, your age as of your last birthday.  
   1. under 18  
   2. 19 to 29  
   3. 29 to 46  
   4. 47 and older

68. Please indicate the last academic qualification that you completed.  
   1. High School Diploma  
   2. Associate Degree  
   3. Bachelor’s Degree  
   4. Master’s Degree  
   5. PhD or DSc

69. Please indicate the degree of management responsibility that you exercise.  
   1. No consistent responsibilities.  
   2. Small Work Group Manager  
   3. Junior/Trainee Manager  
   4. Middle Manager  
   5. Senior Management

70. Please indicate your years of service with your current organization  
   1. Less than 1  
   2. Over 1  
   3. Over 5  
   4. Over 10  
   5. Over 15  
   6. Over 20
APPENDIX 4: Pilot Email Distribution Note

Dear Colleague,

I need to solicit your help for what I promise will take only a few minutes and which will make a difference for me personally/scholastically and potentially for this organization. Please note that the Vice President and Personnel Manager have approved this effort as outlined below.

I am a PhD student at George Mason’s School of Public Policy working on my dissertation. The dissertation, among other things, is examining the presumed relationship between information sharing and organizational dynamics. One of the methods that I am using to collect data in this area is to survey individuals within organizations. This is where I need your help and where you can potentially help this organization to better understand your thoughts and concerns.

Please note, the survey that I am asking you to take is completely voluntary, is not this organization’s work (i.e. not chargeable nor part of the this organization’s research program) and has been approved by the Vice President and Personnel Manager for distribution to this organization’s members. They were kind enough to approve the distro as this organization provides a population of the right size and makeup for this survey.

On the first page of the survey you will find an “informed consent page” that will provide more information on the purposes of the survey, the risks and benefits to you of taking the survey and how I will safeguard the information that you provide. Please note that the record that you will be filling out will have no individually identifiable information and will only be reported out in aggregate. I will be providing this organization with the aggregate information of respondents only (which is the way you can help this organization). If you are interested in seeing those results please email me after taking the survey and I will provide when I have finished compiling the results.

The survey needs to be taken in one sitting. Testing by volunteers to date has indicated that the survey should take less than 20 minutes. Please take the survey here:

LINK – note that the link will vary for different organizational subunits (Divisional level and above as well as grade level)
Most Sincerely and thanking you in advance,

David Coleman
APPENDIX 5: Original Pilot SEM Analysis

The below figure models the W&B reported influences on knowledge sharing effectiveness applied to the results of the pilot study.
The below figure is the same model as above with the question variables removed for additional clarity in understanding. The numbers indicate a normalized regression weighting using a Structural Equation Modeling program (AMOS).
The below table shows the non normalized regression weights with their associated probability.

Regression Weights: (Group number 1 - Default model)

<table>
<thead>
<tr>
<th>Regression</th>
<th>Weights: (Group number 1 - Default model)</th>
<th>Estimate</th>
<th>S.E.</th>
<th>C.R.</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lateral_Coordination</td>
<td>-- Informal_Coordination</td>
<td>0.006</td>
<td>0.063</td>
<td>0.094</td>
<td>0.925</td>
</tr>
<tr>
<td>Power_Games</td>
<td>-- Identification</td>
<td>-0.479</td>
<td>0.121</td>
<td>-3.96</td>
<td>***</td>
</tr>
<tr>
<td>Power_Games</td>
<td>-- Informal_Coordination</td>
<td>0.423</td>
<td>0.094</td>
<td>4.52</td>
<td>***</td>
</tr>
<tr>
<td>Knowledge</td>
<td>-- Power_Games</td>
<td>-0.037</td>
<td>0.128</td>
<td>-0.293</td>
<td>0.77</td>
</tr>
<tr>
<td>Knowledge</td>
<td>-- Formal_Systems</td>
<td>-0.106</td>
<td>0.066</td>
<td>-1.617</td>
<td>0.106</td>
</tr>
<tr>
<td>Knowledge</td>
<td>-- Informal_Coordination</td>
<td>0.184</td>
<td>0.104</td>
<td>1.778</td>
<td>0.075</td>
</tr>
<tr>
<td>Knowledge</td>
<td>-- Lateral_Coordination</td>
<td>0.293</td>
<td>0.133</td>
<td>2.194</td>
<td>0.028</td>
</tr>
<tr>
<td>Knowledge</td>
<td>-- Identification</td>
<td>-0.007</td>
<td>0.131</td>
<td>0.054</td>
<td>0.957</td>
</tr>
<tr>
<td>Knowledge</td>
<td>-- Trust</td>
<td>0.195</td>
<td>0.152</td>
<td>1.28</td>
<td>0.201</td>
</tr>
<tr>
<td>Knowledge</td>
<td>-- Incentives</td>
<td>0.432</td>
<td>0.124</td>
<td>3.48</td>
<td>***</td>
</tr>
</tbody>
</table>
The figure below shows the figure above with the non significant weights removed.
APPENDIX 6: SEM Analysis Federal Organization

The information below is an expanded view of the information first presented in Chapter 5. As such, there is some duplication in the analysis. However, since removal of the duplication would diminish the readability of this Appendix, a limited amount of this overlap is included.

The survey was conducted from July to August 2010 using an online Web-based service. George Mason University Human Subject Research protocols were observed and implemented in the survey instrument. These protocols included consent of the respondent, the protection of anonymity of the respondent, and the overall protection of the gathered data in a secure storage repository. The survey was terminated on the 22nd of August 2010. The data was extracted from the web server and consolidated in one file on the 23rd of August 2010. Following this, a series of data massaging steps was undertaken. Included in these efforts was removal of all individual records where consent was not given but data was entered anyway (a refinement of the software midway through the survey reduced this number in the final results). Also included was recoding to invert the responses for the 21 questions that were phrased in a negative manner (to avoid respondent acquiescence bias). Finally, those records that had more than 15 questions unanswered were removed as incomplete responses. As a result of these massaging efforts, the original raw response rate of 145 was reduced to a working sample of 131. This is considered a small but adequate sample.

Using the model developed for the pilot study, the AMOS software settings were revised to estimate means and intercepts (account for missing data in the sample). This necessitated disabling modification indexes and bootstrapping. Modification indexing is a capability of the program to suggest model fit improvements. Bootstrapping is a process to reduce model iterations. Neither is applicable when using AMOS’s Missing Data Algorithm, which we used. These variables, in a second order relationship, then are postulated to influence information sharing effectiveness (ISE) (the central oval). In the follow-on analysis below, power games is represented as PG, identification as ID, trust as TR, lateral coordination as LC, incentives as IN, informal coordination as IC, and formal systems as FS.

In a series of additional runs of the model, various settings adjustments were made as recommended by various software dialog boxes to allow the software to converge on an iterated model that best fit the data. These adjustments included adding error terms (a
constraining function) to some of the endogenous variables and adjusting fixed weight regression terms for some of the observed variables (questions from the survey). These efforts allowed the model to converge to an over identified model, a desired state in a structured equation model. These software runs (also known as software executions) did not converge fully.

Because they did not fully converge, the next step was to enable a function of the AMOS program that has the AMOS program “try to identify unidentified models.” The model ran and converged, but the resultant model fit parameters were not good, indicating a poor fit.

At this point it was discovered that postulated endogenous variables had missing/misaligned observed variables, probably due to earlier effort to reduce the number of variables. This makes earlier modeling in this effort invalid. The variables were reinserted in accordance with the Beulens & Willems model and it ran successfully. The model fit was poor, with marginally acceptable RMSEA (.086) with Pclose not significant (= 0).

AMOS provides a unique tool (in terms of SEM programs) for enhancing model fit that is meant to reduce the workload on the researcher. This tool, called a specification search, enables the analyst to allow several observed variables to “float” within the model. In other words, the analyst tells the program which variables may or may not be evaluated in the model, and then lets the program run all of the resultant combinations that either include or exclude that variable. The program calculates the fit indexes for each combination. The researcher can then sort on the fit index of choice.

107 A lesson learned for SEM researchers. The graphical interface capabilities of the AMOS program make realignment of the model a relatively easy task, but it also breeds mistakes.
In Figure A6-1, observe that, based on previous iterations of checking model fit, the group of endogenous variables that inform information sharing effectiveness were narrowed to power games, lateral coordination and incentives. This decision reflects findings in earlier work (Coleman & Perry, 2011) that showed these variables as usually influential on ISE. Other variables could have been chosen at this point, as the intention was to reduce the number of endogenous variables for a better fit, i.e., a more parsimonious model.

Using the specification search tool, some paths (marked in magenta) were chosen for the AMOS program to evaluate. The specification search was run to have the program attempt to point out the best combination of the observed variables (there were just over 1,048,000 combinations for the program to run for the entire model, a lengthy process).
The results were inconclusive for this particular run, with no notable improvement in model fit. This process was iterated over several different sets of combinations, adding and removing both endogenous variables and individual observed variables. While the fit improved slightly on some combinations, there was no clear pattern of improvement that suggested a convergence to an improved fit.

At this point the possibility was considered that the missing data algorithm within AMOS might not be providing a good representation of the missing data in the sample. AMOS’s built-in missing data process (which according to the literature is more dynamic than that of SPSS) had been in the efforts to date. Both processes use a variation of expectation maximization (see Shumacker for a discussion), but it was felt that this process needed to be re-evaluated as a source of misrepresentation. The sample results (n=131) were taken in raw form and then run in the latest version (version 19) of SPSS’s Missing Data analytical tool. The resultant modified SPSS file was used as the basis for the SEM/AMOS analysis. Variations of the endogenous variables, observed variables and specification search were run but had no notable fit improvement. Of note, during this process all observed variables were allowed to “float” in a specification search with a resultant combination set of over one billion. After a month of allowing this model to continuously run, it became clear (there were several months left) that there was insufficient computing power to adopt this approach. Thus, as a research lesson learned with SEM, while it is tempting to allow the machine to do the grunt work, it is not practicable without either a very high powered computing machine or a long timeline for the research.

Up to this point the model had been restricted to one that roughly replicated both the pilot evaluation and the Willem and Beulens approach. In the pilot study the intent of the fit evaluation was to demonstrate and validate the methodology, less to obtain a good model fit (although the pilot study model had an acceptable fit). The pilot study fit process had a decided advantage in this process, because the sample size (n=407) was much more in line with the literature guidelines for an adequate sample size than the current sample size (n=131). Because it was recognized that this model would require a great reduction in observed variables and their associated endogenous variables, the decision was made to introduce the full model supported by the survey instrument. Thus, information technology (IT) outcome expectations (ITOE), IT complexity, and IT social factors (IT SF) were introduced to the model (Figure 3).

After each run, the evaluation process up to this point was to look at the fit measurements alone. As this continued to offer no real improvement in fit, other indicators available in the output were analyzed. Since the program evaluates and records the residuals between the covariance models of $\Sigma$ (the postulated model) and $S$ (the observed model), these covariances were analyzed in terms of individual observed variable. The effort addressed covariances that were relatively higher than the others in the reported matrix. These
variables would be removed by hand (not using the specification search process). Several iterations of this process were attempted with no appreciable improvement of model fit.

The next approach in this analysis was to look at the statistical significance of the influence of each observed variable on an endogenous variable. One of the first results of this approach was to observe that none of the observed variables (variables 62-65) on IT SF were significantly influential on this endogenous variable. This led to a review of the survey result data. This review identified nearly 20 of the 131 samples where the respondent did not answer these questions. While the AMOS embedded expectation maximization process imputes data, a reasonable speculation may be that the degree of missing data was too high for the algorithm to properly adjust. The observed variables for IT complexity exhibited a similar degree of missing data, but conversely had some statistically significant influences on the endogenous variable.

The model was run without IT SF but with IT complexity. The model was a moderate fit (RMSEA .096, Pclose 000, CFI .531, $\chi^2$ 000), however the fit values were not statistically significant. A subsequent run (with IT complexity removed) very marginally improved the fit parameters to RMSEA .096, CFI .532. These remained non-significant measurements.

At this point a specification search was run on the model, “floating” the observed variables for ITOE only. This search revealed that removing variables 55-57 slightly improved some of the fit parameters (specifically BCC and BIC), but did not improve the RMSEA and the CFI values. Nevertheless, an evaluation of the questions linked to these variables indicated they were less directly worded, leading to the possibility of more variability in the responses (a subsequent review of the variables’ kurtosis values validated this analysis). As a result, the variables were removed from the model. The removal of these variables improved the overall model fit to RMSEA .88 and CFI .631.

Note: the steps in this analysis begin to wholly duplicate the information provided in the main body addressing kurtosis and so are omitted here.

In the main body after Figure 5-8, the text addresses the analysis of additional exploratory variations on the model. The following addresses those variations.

In Figure A6-2, the endogenous variable trust has been removed. The model parameters are better but still not a good fit. Note that the RMSEA value has a small significance value.
In Figure A6-3, lateral coordination has been removed and trust reinserted.
For this result the RMSEA value is approaching a good fit and is statistically significant, while the CFI result is considered a good fit. In Figure A6-4, lateral coordination has been reinserted and incentives removed.
This results in even better fit parameters. In Figure A6-5, incentives is reinserted but ITOE is removed. The fit parameters become relatively worse.
This is a step backward in terms of fit.

Figure A6- 5 ITOE Removed

In the following series of figures, two endogenous variables are removed at a time. In the first such removal, trust and lateral coordination are removed, as shown in Figure A6-6.
In this model the RMSEA value reflects a poor to moderate fit, the CFI value indicates a good fit, and in both cases the significance value is positive.

At this point the main text continues the analysis with Figure 5-9.
APPENDIX 7: SEM Analysis Pilot Revised

The information below is an expanded view of the information first presented in Chapter 5. As such, there is some duplication in the analysis. However, since removal of the duplication would diminish the readability of this Appendix, a limited amount of this overlap is included.

In a process modeled on the federal analysis, the pilot model SEM analysis was iterated for model fit. Figure A7-1 below reflects this result. Note that in the analysis that follows Figure A7-1, the numbered observed variables were removed from the figures to allow for showing them more concisely. The observed variables associated with each endogenous variable do not change from those listed in Figure A7-1 for the remainder of this Appendix.
At this point, a series of model reductions were conducted by adding and removing the endogenous variables and evaluating model fit after each iteration. The observer variable boxes have been removed for ease of viewing.
This is the first of two good fit models. The RMSEA value of .037 is a good fit and significant, and the CFI value is superb. Notably the Chi Squared value is statistically significant, which is an indication of a very strong fit. Finally, Figure A7-3 shows the best of the models (in terms of model fit).
The RMSEA value of .029 indicates an excellent model fit as does the CFI value of .993. In addition, the RMSEA value is highly significant while the Chi Squared significance indicates excellent model fit.

At this point the analysis continues in the main body.
APPENDIX 8:  Interview Data and Notes

In the table below the raw interview data is correlated and tabularized. The Interview Data column correlates with interview questions shown in Appendix 2, personnel columns are self-evident and the last column reflects notes on the question responses. In addition cell and text highlighted in magenta show responses related to Governance while text highlighted in yellow reflect responses related to Efficiency.

<table>
<thead>
<tr>
<th>Interview Data</th>
<th>Individual 1 (COO)</th>
<th>Individual 2 (DCOO)</th>
<th>Individual 3 (COS)</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Background</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Highest Education</td>
<td>Masters</td>
<td>Masters</td>
<td>Bachelors</td>
<td></td>
</tr>
<tr>
<td>Type (Technical, Business, Scientific, Liberal Arts)</td>
<td>Technical</td>
<td>Technical</td>
<td>Technical</td>
<td></td>
</tr>
<tr>
<td>Education of Use in Current Role</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>SOA/SOE specific</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>IT Management</td>
<td>Centralized</td>
<td>Hierarchical</td>
<td>Centralized</td>
<td>Perspective is the issue. Some discussion on the boundaries of the organization vis-a-vis IT responsibility</td>
</tr>
<tr>
<td>IT Organization</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Organizational Final Decision Maker for IT</td>
<td>Extra Organizational</td>
<td>Extra Organizational</td>
<td>Sub organization</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>IT Maturity Model</td>
<td>ITIL</td>
<td>ITIL</td>
<td>CNMI/ITIL</td>
<td>Comment: efforts are at individual Program Manager level, not organization wide</td>
</tr>
<tr>
<td>Interview Data</td>
<td>Individual 1 (COO)</td>
<td>Individual 2 (DCOO)</td>
<td>Individual 3 (COS)</td>
<td>Notes</td>
</tr>
<tr>
<td>------------------------------</td>
<td>---------------------</td>
<td>----------------------</td>
<td>---------------------</td>
<td>----------------------------------------------------------------------</td>
</tr>
<tr>
<td>Is it used</td>
<td>By PMs</td>
<td>No</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>Independent assessment</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>Self assess</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Strategy</td>
<td>4</td>
<td>4</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Architecture</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Data Share</td>
<td>5</td>
<td>4</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Agility</td>
<td>5</td>
<td>3</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Employee knowledge SOA</td>
<td>5</td>
<td>2</td>
<td>3</td>
<td></td>
</tr>
</tbody>
</table>

**ERP/CRM/Incentives Constraints**

<p>| Engineering imperative to implement |                     |                      |                     |                                                                     |
| Eased workload                   | ask them            | 4                    | 5                   | more than a numerical answer the answers was more of a &quot;not proven&quot;. COS said no, not at all, DCOO said not really and COO said &quot;ask them&quot; |
| improved quality of work         | 5                   | 2                    | 5                   | clear that organizational boundaries factored into this answer. DCOO had a wider view of the organizational boundaries |
| Impact of ERP/CRM on engineering efforts satisfaction | no | no | no | Sense that the engineers are not able to get sufficient information from the system - technical issue compounded by |</p>
<table>
<thead>
<tr>
<th>Interview Data</th>
<th>Individual 1 (COO)</th>
<th>Individual 2 (DCOO)</th>
<th>Individual 3 (COS)</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Management Imperative to Implement</td>
<td></td>
<td></td>
<td></td>
<td>comment from COO - organization subunits do but stymied to an extent by the wider organization that the Fed Organization is part of.</td>
</tr>
<tr>
<td>Eased workload</td>
<td>too early to tell</td>
<td>4</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>improved quality of work</td>
<td>too early to tell</td>
<td>2</td>
<td>2</td>
<td>COO comment - some suborganizations have implemented, others have not</td>
</tr>
<tr>
<td>Impact of ERP/CRM on engineering efforts satisfaction</td>
<td>yes</td>
<td>4</td>
<td>yes</td>
<td>COO comment - implementation in progress, not complete, 18 months after start of implementation getting better ==&gt; learning curve</td>
</tr>
<tr>
<td>Business Incentives provide?</td>
<td></td>
<td></td>
<td></td>
<td>COO comment - business linked to fiscal challenges in Federal Budget. ==&gt; need for implementation speed ==&gt; need for a transition COO comment - tools brought by ERP are more efficient==&gt; fiscal</td>
</tr>
</tbody>
</table>


<table>
<thead>
<tr>
<th>Interview Data</th>
<th>Individual 1 (COO)</th>
<th>Individual 2 (DCOO)</th>
<th>Individual 3 (COS)</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>reality, must have ERP.</td>
</tr>
<tr>
<td>incentives in terms of org and suborg budgets?</td>
<td>yes</td>
<td>yes</td>
<td>no</td>
<td>DCOO comment - ERP as a tool ==&gt; transparency COS comment - not really relevant since there is a corporate decision to do based on other factors such as need for data management (ERP function)</td>
</tr>
<tr>
<td>incentives in term of control and use of info?</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
<td>COO comment - visibility ==&gt; better business decisions DCOO comment - primarily around resource organization and justification COS comment - allows for quantification of information</td>
</tr>
<tr>
<td>incentives in terms of org and suborg influences?</td>
<td>not yet realized</td>
<td>yes</td>
<td>not clear</td>
<td>DCOO comment - transparency enhanced</td>
</tr>
<tr>
<td>Personal Incentives provide</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>incentives in terms of personal compensation?</td>
<td>yes</td>
<td>no</td>
<td>no</td>
<td>COO comment - depending on whether they have ERP</td>
</tr>
<tr>
<td>Interview Data</td>
<td>Individual 1 (COO)</td>
<td>Individual 2 (DCOO)</td>
<td>Individual 3 (COS)</td>
<td>Notes</td>
</tr>
<tr>
<td>----------------------------------------</td>
<td>--------------------</td>
<td>---------------------</td>
<td>--------------------</td>
<td>----------------------------------------------------------------------</td>
</tr>
<tr>
<td>incentives in term of career</td>
<td>yes</td>
<td>yes</td>
<td>no</td>
<td>DCOO comment - linked to evaluation of a person's &quot;customer engagement&quot;</td>
</tr>
<tr>
<td>personnel evaluation</td>
<td>don’t know</td>
<td>N/A</td>
<td>no</td>
<td>COO comment - personnel evaluation systems not under this organization’s control - higher organization - however must align with business process ==&gt; must be done so that leadership has a clear idea of expectations for personnel evaluation</td>
</tr>
<tr>
<td>incentives in terms of measures of influence</td>
<td>Yes</td>
<td>yes</td>
<td>no</td>
<td>COO - persons who know how to leverage ERP become more valuable DCOO - becomes part of &quot;communication&quot; skill assessment</td>
</tr>
<tr>
<td>Lessons Learned</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Constraints-Management</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
<td>COO - existing processes - resistance to change - legacy systems and processes are problematic during transition precisely because systems not fully implemented</td>
</tr>
<tr>
<td>Interview Data</td>
<td>Individual 1 (COO)</td>
<td>Individual 2 (DCOO)</td>
<td>Individual 3 (COS)</td>
<td>Notes</td>
</tr>
<tr>
<td>----------------</td>
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<td>---------------------</td>
<td>-------</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>DCOO - &quot;unity of vision&quot; needed for successful implementation</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>COS - management challenges in scheds that slip</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Constraints - budget</td>
</tr>
<tr>
<td></td>
<td>Yes</td>
<td>Yes</td>
<td>yes</td>
<td>COO - resistance to change due to threat on individual’s budget</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>DCOO - somewhat driven by &quot;color of money&quot; ==&gt; tradespacing H/W, S/W, training et al. ==&gt; efficiency in cross loading between things supported by different colors. Also influenced by cash flow and periods of different colors of money ==&gt; spend when you got which can lead to inefficiencies in implementation ==&gt; constraint</td>
</tr>
<tr>
<td>Interview Data</td>
<td>Individual 1 (COO)</td>
<td>Individual 2 (DCOO)</td>
<td>Individual 3 (COS)</td>
<td>Notes</td>
</tr>
<tr>
<td>----------------------</td>
<td>--------------------</td>
<td>---------------------</td>
<td>--------------------</td>
<td>-------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>constraint-personnel process</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
<td>COO comment - need is to &quot;capture hearts and minds&quot; of personnel, get them excited over the improvements =&gt; need to invest in training/engagement</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>DCOO comment - personnel skill set becomes limitation i.e. difficult for government to hire needed skill sets if it wants to be on leading edge of technology, tend not to have skill sets in house, sets stage for cross threading contractor/consultant skill sets with government, raises question of inherently governmental functions being driven to non gov because gov not sufficiently trained.</td>
</tr>
<tr>
<td>Interview Data</td>
<td>Individual 1 (COO)</td>
<td>Individual 2 (DCOO)</td>
<td>Individual 3 (COS)</td>
<td>Notes</td>
</tr>
<tr>
<td>----------------</td>
<td>--------------------</td>
<td>--------------------</td>
<td>--------------------</td>
<td>-------</td>
</tr>
<tr>
<td>ERP - any other LLs`</td>
<td>no</td>
<td>yes</td>
<td>yes</td>
<td>DCOO comment - Fan of Clinger/Cohen - LL is that greatest challenge is Governance⇒⇒ lack of urgency and vision</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>COS comments - Failure in IT implementation is an institution - implementation effort are arcane and cumbersome - the implementation intrudes on the employee’s daily life (i.e. job performance but also satisfaction), weighs down personnel ⇒⇒ human interface is flawed⇒⇒ begs question of why is Facebook successful - because of superior design</td>
</tr>
</tbody>
</table>

**SOA Incentives and Constraints**

| Engineering imperative to implement | Yes | Yes | Yes | COO comment - considers definition of SOA (and SOE) to be pretty shaky ⇒⇒ different folks will have different understanding of what SOA/SOE actually are, i.e. |

228
<table>
<thead>
<tr>
<th>Interview Data</th>
<th>Individual 1 (COO)</th>
<th>Individual 2 (DCOO)</th>
<th>Individual 3 (COS)</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>give me some of that SOA ==&gt; reduction in authority (because can’t really define it) CSO comment - approach to implementation is often naive and badly thought out</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Eased workload</td>
<td>5</td>
<td>4</td>
<td>5</td>
<td>COO comment - no runtime environment as yet ==&gt; motivation DCOO comment - understanding is growing</td>
</tr>
<tr>
<td>improved quality of work</td>
<td>5</td>
<td>3</td>
<td>5</td>
<td>DCOO comment - cost and security - best influence o.</td>
</tr>
<tr>
<td>Impact of SOA/SOE on engineering efforts satisfaction</td>
<td>not assessed</td>
<td>3</td>
<td>3</td>
<td>DCOO comment - issue is prevalence of legacy systems ==&gt; kludged systems - progress has been made but not yet complete</td>
</tr>
<tr>
<td>Management Imperative to Implement</td>
<td>no answer</td>
<td>yes</td>
<td>no</td>
<td></td>
</tr>
<tr>
<td>Eased workload</td>
<td>yes</td>
<td>4</td>
<td>5</td>
<td>DCOO comment - they have to keep it running-need to deal with warts</td>
</tr>
<tr>
<td>improved quality of work</td>
<td>yes</td>
<td>2</td>
<td>5</td>
<td>COO comment - for areas where it is implemented DCOO comment - data management - single integration points ==&gt;</td>
</tr>
<tr>
<td>Interview Data</td>
<td>Individual 1 (COO)</td>
<td>Individual 2 (DCOO)</td>
<td>Individual 3 (COS)</td>
<td>Notes</td>
</tr>
<tr>
<td>-------------------------------------------------------------------------------</td>
<td>-------------------</td>
<td>---------------------</td>
<td>--------------------</td>
<td>----------------------------------------------------------------------</td>
</tr>
<tr>
<td>reduction of legacy systems - also budget and control</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Impact of SOA/SOE on engineering efforts satisfaction</td>
<td>don’t know, why do I care</td>
<td>2</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>Business Incentives provide?</td>
<td>no answer</td>
<td>no answer</td>
<td></td>
<td></td>
</tr>
<tr>
<td>incentives in terms of org and suborg budgets?</td>
<td>yes</td>
<td>yes</td>
<td>no</td>
<td>COO comment - got to get approval of dollars</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>DCOO comment - non SOA systems are not funded</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>COS comment - for virtualization - cost savings are substantial</td>
</tr>
<tr>
<td>incentives in terms of control and use of info?</td>
<td>5</td>
<td>no</td>
<td>no</td>
<td>DCOO comment - issue technology makes things more transparent</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>- may not be welcomed at lower levels</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>- begs question of why they would fear/be adverse to</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>==&gt; flexibility and agility to make decisions within</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>constraints ==&gt; more info to senior level implies more intrusion</td>
</tr>
<tr>
<td>incentives in terms of org and suborg influences?</td>
<td>5</td>
<td>yes</td>
<td>4</td>
<td>DCOO comment - solutions are exposed</td>
</tr>
<tr>
<td>Personal Incentives provide</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Interview Data</td>
<td>Individual 1 (COO)</td>
<td>Individual 2 (DCOO)</td>
<td>Individual 3 (COS)</td>
<td>Notes</td>
</tr>
<tr>
<td>----------------</td>
<td>---------------------</td>
<td>---------------------</td>
<td>--------------------</td>
<td>-------</td>
</tr>
<tr>
<td>incentives in terms of personal compensation?</td>
<td>5</td>
<td>yes</td>
<td>no</td>
<td>DCOO comment - industry is headed to SOA ==&gt; expertize in demand</td>
</tr>
<tr>
<td>incentives in term of career</td>
<td>yes</td>
<td>yes</td>
<td>no</td>
<td>DCOO comment - linked to evaluation of a person’s &quot;customer engagement&quot;</td>
</tr>
<tr>
<td>personnel evaluation</td>
<td>don’t know</td>
<td>N/A</td>
<td>no</td>
<td>DCOO comment - measured as 2nd order in terms of customer engagement and relationship management - greater expectation of transparency</td>
</tr>
<tr>
<td>incentives in terms of measures of influence</td>
<td>no</td>
<td>yes</td>
<td>no</td>
<td>DCOO comment - individual viewed as open and transparent, also at peer level &quot;encourages informal coordination&quot;</td>
</tr>
</tbody>
</table>

**Lessons Learned**

| Constraints-Management | no | yes | yes | DCOO comment - decentralized ownership of legacy system - at boundaries of architecture - value of SOA decreases when cross boundary COS comment - lack of understanding of cloud/SOA by budget masters - |

231
<table>
<thead>
<tr>
<th>Interview Data</th>
<th>Individual 1 (COO)</th>
<th>Individual 2 (DCOO)</th>
<th>Individual 3 (COS)</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>built a world class application but could not implement for lack of money</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>constraints - budget</td>
<td>Yes</td>
<td>Yes</td>
<td>yes</td>
<td>COO - Lack of money from budget masters</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>DCOO - similar to management comment - we talk about efficiencies ROI - struggle with the investment side - difficult to think long term ==&gt; investment decisions are challenging</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>COS comment - similar to management comment</td>
</tr>
<tr>
<td>constraint-personnel process</td>
<td>yes</td>
<td>yes</td>
<td>no</td>
<td>COO comment - not having a full understanding cannot monitor and govern ==&gt; stovepipe</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>DCOO comment - concentrate on authoritative data around personnel - challenge is getting folks to consider re-skilling around modern system - is</td>
</tr>
<tr>
<td>Interview Data</td>
<td>Individual 1 (COO)</td>
<td>Individual 2 (DCOO)</td>
<td>Individual 3 (COS)</td>
<td>Notes</td>
</tr>
<tr>
<td>----------------</td>
<td>---------------------</td>
<td>---------------------</td>
<td>---------------------</td>
<td>-------</td>
</tr>
<tr>
<td></td>
<td>no</td>
<td>yes</td>
<td>yes</td>
<td>a change management cultural challenge</td>
</tr>
</tbody>
</table>

DCOO comment - need a process to govern the influx of good ideas, i.e. ideas are faster than the implementation process, i.e. the planned process is too hard to do, let’s do this new (and presumably easier).

COS comments - leadership education - business case: there is no silver bullet, i.e. "more with less doesn’t work"; "it does not get cheaper if you hold IT needs constant"
APPENDIX 9: Interview Consent Form

Organizational Incentives/Constraints in Implementing a Service Oriented Architecture

INFORMED CONSENT FORM

RESEARCH PROCEDURES
This research is being conducted to help frame organizational imperatives in implementing Service Oriented Environments/Architectures (SOE/SOA). If you agree to participate, you will be asked to participate in an individual interview process that will seek to record your experiences and knowledge in this area.

RISKS
There are no foreseeable risks or discomforts other than might be encountered in a normal office environment.

BENEFITS
There are no benefits to you as a participant other than to further research in organizational dynamics that support a Service Oriented Architecture Environment. In addition, the benefits to the IT Management community include a possible better understanding of the organizational pitfalls in the implementation of SOE/SOA.

CONFIDENTIALITY
The data in this study will be confidential unless you agree to be quoted. You will be given the opportunity to review such quotes before publication of any affected segment of the resulting paper or papers. The interview worksheets and drafts, final copies and publishable manuscripts of any resultant paper or papers will be under positive control (treated as proprietary) of the person conducting the survey for the duration of the study. After completion the work will be shredded with a .32 inch cross cut shredder.

PARTICIPATION
Your participation is voluntary, and you may withdraw from the study at any time and for any reason. If you decide not to participate or if you withdraw from the study, there is no penalty or loss of benefits to which you are otherwise entitled. There are no costs to you or any other party.
CONTACT
This research is being conducted by David Coleman, PhD Candidate in the School of Public Policy at George Mason University. He may be reached at 703-303-5180 (cell)/dcolema2@gmu.edu for questions or to report a research-related problem. If unavailable, Dr. Wayne Perry, Dissertation Committee Chair ((703) 993-2276 wperry@gmu.edu) may be contacted as an alternative. You may contact the George Mason University Office of Research Subject Protections at 703-993-4121 if you have questions or comments regarding your rights as a participant in the research.

This research has been reviewed according to George Mason University procedures governing your participation in this research.

CONSENT
I have read this form and agree to participate in this study.

__________________________
Name

__________________________
Date of Signature
APPENDIX 10: Type II Error

Principle among these indices, CHI Squared ($\chi^2$) is a good indicator of overall model fit given that the sample size is reasonable for the model, the model complexity (number of variables) is not high and the statistical significance of $\chi^2$ is not significant. The rationale for non-significance is that in this case the intent is to accept the Null of: model fit covariance differences (between hypothesized and data enabled) $\rightarrow 0$. With regard to model complexity, in models used for both the federal organization and the Public Sector Organization in initial results the $\chi^2$ values were high and significant, i.e. the models did not reflect an adequate fit. As the model observed values were incrementally reduced the $\chi^2$ values reduced. In the final models reported in Chapter 6 the $\chi^2$ values began to become smaller and non-significant.

Recall that one of the methods to reduce the number of variables was examine the kurtosis values for significance. Significantly non normal observed values distributions were removed as SEM assumes normality in the variable distributions. Similarly $\chi^2$ is not effective as a measure across distributions that are not normal. Thus the effort to remove variables for parsimony reported in Chapter 5 appears to have had the additional effect of providing better $\chi^2$ scores. Finally, recall the axiom above that sample size has an effect on $\chi^2$. AMOS uses $\chi^2$/DF, i.e. Normal $\chi^2$, as a method for normalizing the effects of sample size on $\chi^2$ (Byrne, 2009; Maruyama, 1997). Literature varies on what is an acceptable ratio. A ratio of 1 indicates a perfect fit of the model to the data, while most literature indicates values of less than 2 are adequate. For the models reported in this thesis values are less than 1.5, indicative of a good fit and a reduced probability of Type II error. For exact figures please see below.

Table $\chi^2$ Results

<table>
<thead>
<tr>
<th></th>
<th>$\chi^2$</th>
<th>DF</th>
<th>P</th>
<th>$\chi^2$/DF</th>
</tr>
</thead>
<tbody>
<tr>
<td>FED ORG</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TR and ITOE</td>
<td>27.626</td>
<td>25</td>
<td>0.325</td>
<td>1.105</td>
</tr>
<tr>
<td>LC and ITOE</td>
<td>34.446</td>
<td>25</td>
<td>0.099</td>
<td>1.378</td>
</tr>
<tr>
<td>PUB SECT ORG</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TR and ITOE</td>
<td>18.649</td>
<td>12</td>
<td>0.097</td>
<td>1.554</td>
</tr>
<tr>
<td>LC and ITOE</td>
<td>16.055</td>
<td>12</td>
<td>0.189</td>
<td>1.338</td>
</tr>
</tbody>
</table>
An additional nuance to the issue of the probability of Type II error is possibility of error that might be generated between the incremental models that SEM uses to reduce the covariance values. The Comparative Fit Index (CFI) provides an indication of this possibility by comparing the data enable model with a more restricted null model (e.g., a correlation model). This different approach to the same end provides another opportunity to expose error. Finally, Root Mean Square Error of Approximation (RMSEA) provides the opportunity to consider Type II error as the model becomes more parsimonious and therefor is a good indicator of Type II error for small sample sizes.
REFERENCES


CURRICULUM VITAE

A native Virginian, David Coleman has lived in Belgium and the UK, travelling extensively in Europe, the UK, and in selected spots in the Middle East and South America. In addition to his role as a part time student, he is an IT consulting engineer at a Federally Funded Research & Development Center working on federal programs. He has previously been employed by defense consulting firms and the International Monetary Fund (IMF). He retired from the US Navy after 21 years of service in 1995. Highlights of that service included over eight years at sea, three overseas assignments and command of a Naval Communications Station in the UK. Married, he has a lovely wife, three fine children, and three lovely grandchildren.