Doctoral Dissertation:

Field Studies in Offshoring and Process Standardization

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Abstract

Although business services outsourcing has grown dramatically in size and scope over the last decade, firms continue to encounter difficulties in managing and delivering services. An important choice for service providers is whether to use a standardized set of processes for service delivery across delivery centers. The standardization of processes through the implementation of frameworks such as the CMMI, TQM and ISO 9000 has become an established practice among manufacturing and software development firms. However, the role of process standardization in the delivery of business services such as accounting, procurement, and human resources has not been examined to a significant extent. In this doctoral dissertation, I examine a process improvement framework that is designed specifically for outsourcing service providers: the eSourcing Capability Model for Service Providers, or eSCM-SP (Hyder et al, 2004a, 2004b). I have collected detailed archival data from an offshore delivery center of a large IT and business services firm that has implemented and received certification in the eSCM-SP. I examine the implementation of this model, and its implications for internal service delivery performance, in two empirical studies.

Study One: The Effectiveness of Tool-, Team-, and Task-based Knowledge Transfer Mechanisms for Implementing Process Improvement Frameworks. It is challenging for global service providers to effectively deliver services to their customers. Process improvement frameworks promise consistent performance, better quality, and less rework. However, implementing such frameworks can be both difficult and costly. Organizations may choose to structure process improvement projects using multiple implementations to facilitate knowledge transfer within and across units. Further, while a variety of knowledge transfer mechanisms are available it is an open question as to whether such mechanisms actually improve implementation performance and whether these effects differ in initial and repeated implementations. In this study, I examine the implementation of process improvement frameworks from the perspective of knowledge transfer. Drawing upon Argote and Ingram's (2000) typology, I theorize that the use of tool-, team-, and task- based mechanisms to transfer process knowledge will lead to higher implementation performance, particularly in repeated implementations. However, I also hypothesize that these beneficial effects will be weakened by the extent to which the process knowledge transferred must be customized in these implementations. I evaluate my theoretical model using data collected in a field study of multiple implementations of a process improvement framework in two units of an offshore delivery center for a large IT and business services provider. The findings suggest that, for processes that do not require customization in repeated implementations, team-based mechanisms are as effective in the repeated implementation as in the initial implementation while tool-based mechanisms are more effective in the repeated implementation than in the initial implementation. In addition, task-based mechanisms are also effective in the repeated implementation. However, for processes that require customization in repeated implementations, none of the knowledge transfer mechanisms result in better implementation performance.

Study Two: Process Standardization, Task Variability, and Internal Performance in IT and Business Services Outsourcing. The standardization of processes through the implementation of process improvement frameworks has become an established practice among manufacturing and software firms. However, the relationship between standardization and performance in these settings is not clear, and existing empirical results are inconsistent.

Furthermore, the mechanisms by which process standardization lead to performance improvement in highly variable tasks such as IT and business services are not well understood. In this study I analyze detailed performance data from a large service provider that has implemented a process improvement framework for services outsourcing. I evaluate the extent to which process standardization influences service delivery performance, and how the effect of standardization differs based on task variability and the length of experience with the new processes. The results indicate that for non-variable tasks, performance improves significantly in the immediate period after the implementation of the framework. Performance also improves at a faster rate over time after standardized processes are introduced. In contrast, for variable tasks there is an immediate decline in performance after process standardization occurs. However, performance on variable tasks after process standardization also increases at a faster rate over time than performance on non-variable tasks. The results suggest that after an initial period of difficulty, the organization learns over time to apply the new processes to variable tasks more effectively.

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CHAPTER ONE: INTRODUCTION AND RESEARCH OBJECTIVES

The sourcing of business services to third party firms has grown dramatically over the last decade (Maglio et al, 2006; Sheehan, 2006). Much of the growth in services sourcing can be attributed to the maturation of networking and software technologies that have made it easier to codify and transfer knowledge about services (Chesbrough and Spohrer, 2006). However, the services industry is still quite labor-intensive, and firms continue to search for innovations that will lower costs or enhance service delivery. As a result, recent work has emphasized the need for a greater understanding of service system improvements and failures (Spohrer et al, 2007), in particular the role of organizational process innovation (Sundbo and Gallouj, 1998; OECD, 2000).

Process standardization frameworks have historically played a key role in these areas. Since the turn of the twentieth century, thousands of organizations have implemented process standardization frameworks. Broadly defined, process standardization is the use of documents, rules, guidelines, or activities aimed at achieving an optimum degree of order in a given context (ISO, 1996). In manufacturing industries, the application of scientific management principles and Total Quality Management (TQM) programs have enabled firms to reduce variation and realize significant economic returns (Sila, 2007). Formal process standards such as ISO 9000 have also been associated with improved performance in manufacturing firms (Corbett et al, 2005). Software development has also evolved into a distinct and mature industry, and many software firms have implemented process improvement programs such as the Capability Maturity Model Integration, or CMMI (Harter et al 2000; Gopal et al 2002). More recently, manufacturing and software firms have begun to adopt the Six Sigma framework to further refine and standardize their processes (Schroeder et al, 2008). Some firms – in particular, late adopters – implement

process standardization programs primarily to serve as a signal of quality, or for institutional reasons (Gopal and Gao, 2009; Naveh and Marcus, 2004). However, many organizations implement these programs with the expectation that process standardization will result in improved financial or operational performance (Benner and Veloso, 2008).

Firms introducing process innovations across multiple organizational units have many options in designing implementation projects. Smaller or highly centralized organizations may choose a "big bang" approach whereby the innovation is introduced across the firm at a single point in time. With this approach differences among organizational units are minimized, and the firm does not have to operate using different sets of processes simultaneously (Markus et al, 2000). Another common approach taken by many large organizations is to implement the innovation within a single business unit, then to extend it to other business units when the initial implementation is complete. From a knowledge transfer perspective, a potential advantage of this approach is that it introduces discrete milestones where information may be evaluated and passed from one phase to the next (Laudon and Laudon, 2006). For example, procedures or other artifacts that are generated in the initial implementation and prove to be valuable can be reused in subsequent implementations, reducing overall effort. In addition, with a unit-by-unit approach changes in processes are confined to specific areas of the organization, minimizing disruption to normal operations.

However, implementing process standardization frameworks across an organization can be extremely challenging. Individuals in various roles and units may need to fundamentally rethink their work patterns and relationships, develop new cognitive frameworks and schemas, and embed these new structures into their work practices (Spencer, 1994; Ravichandran and Rai, 2003; Slaughter and Kirsch, 2006). Organizations implementing process innovations often must

decompose and recreate work routines several times before new capabilities can be developed (Pan et al, 2007). Genuine improvement emanates from a deep and broad understanding of work processes, their patterns and their implications for restructuring organizational tasks. Firms that obtain the greatest performance increases from process improvement frameworks oftentimes go beyond the minimum standards of the framework, tailoring processes to their specific needs (Naveh and Marcus, 2004). Recent work on the diffusion of ISO9000 and ISO13000 has demonstrated that firms customize these frameworks in order to obtain greater economic benefits, as well as to achieve greater conformance to perceived industrial and cultural norms (Albuquereque et al, 2007).

While empirical research has generally shown a positive relationship between the adoption of process standardization programs and performance, the results have been surprisingly inconsistent. Naveh and Marcus (2004) found that the adoption of ISO 9000 led to better operating performance, but not better financial performance; other studies, however, have revealed significant financial performance improvements resulting from ISO 9000 (Corbett et al, 2005). Two other studies on the same industry – electronics manufacturing – have also drawn opposing conclusions about the impact of TQM on cost-related performance and customer satisfaction (Choi and Eboch, 1998; Yeung et al, 2004). Even within the same firm, process standardization can result in opposing outcomes; for example, Naveh and Erez (2004) showed that the adoption of ISO 9000 was positively associated with attention to detail but negatively associated with innovation. Finally, several studies have found no relationship at all between process standardization and performance (e.g. Powell, 1996; Terziovski et al, 1997), while others have shown that the positive impact of process standardization on performance is generalizable to the extent that firm-level or industry-level factors are unimportant (Sila, 2007). In short,

despite a significant body of research the business value of process standardization continues to be an open question.

In summary, a more comprehensive understanding of the adoption of process improvement programs, and their effect on organizational performance, is critical for firms that want to improve their service delivery methods. My dissertation will help to advance this understanding by addressing the following broad research questions:

1. How can firms implement a process standardization framework most efficiently?

2. What is the business value of process standardization in IT and business services?

These research questions will be addressed in two studies examining a process improvement framework specifically designed for service providers: the eSourcing Capability Model for Service Providers, or eSCM-SP (Hyder et al, 2004a; Hyder et al, 2004b). The two studies will examine the implementation and utilization of this framework at an offshore delivery center of a large, multinational firm that specializes in outsourcing services. In Chapter Two, I will provide some background about the eSCM-SP. Chapters Three and Four will describe the studies that I have conducted in order to address the research questions. Chapter Five will provide a summary of my dissertation and some concluding remarks.

CHAPTER TWO: RESEARCH SETTING

2.1. The eSourcing Capability Model for Service Providers

The eSourcing Capability Model for Service Providers (eSCM-SP) was developed by the IT Services Qualification Center (ITSqc) at Carnegie Mellon University to enable service providers to determine and improve their capabilities in service design and delivery, to provide clients with an objective means of evaluating and comparing service providers, and to offer service providers a standard to use when differentiating themselves from their competitors. There

are many similarities between the eSCM-SP and other well-known process improvement frameworks, but the specific processes and emphases in the eSCM-SP are different (Paulk et al, 2005; Guha et al, 2005). The model consists of processes for services outsourcing, each consisting of a set of activities that must be implemented before the process is considered to be complete. Within the model, these processes are referred to as Practices. Each eSCM-SP Practice may be characterized along several dimensions, including:

- *Capability Level*: there are five capability levels that describe an improvement path for the service provider: Level 1-providing services; Level 2-consistently meeting requirements; Level 3-managing organizational performance; Level 4-proactively enhancing value; Level 5-sustaining excellence.

- *Sourcing Life-cycle*: the phase within the sourcing lifecycle where the Practice is used (Initiation, Delivery, Completion, or Ongoing).

- *Capability Area*: one of ten logical groupings that represent critical outsourcing functions (e.g., Contracting, Technology Management, or Service Design and Delivery).

Capability areas are particularly important in terms of knowledge transfer, since all Practices within a capability area are presumed to contain knowledge about related business processes. At the research site, capability areas were also the primary basis for assigning Practices to implementation teams. This is sensible, given the fact that capability areas delineate related processes; the typical implementation projects of many other process frameworks are similarly organized along business lines.

An example Practice in the eSCM-SP is "tch03 – Control Technology". The intent of this Practice is to "Establish and implement procedures to track and control changes to the technology infrastructure". The Practice contains four primary activities which are further

divided into sub-activities: (1) identifying the types of technology infrastructure changes which need to be tracked and controlled; (2) selecting and documenting methods for tracking and controlling changes; (3) creating a technology inventory; and (4) maintaining documentation on technology changes (Hyder et al, 2004b). This example illustrates a process which technology-enabled service providers need in order to be able to provide efficient and consistent service. Additionally, it illustrates the potential for a multiple-unit approach to implementation; technology may be controlled at multiple levels, including the organization, business units, geographies, or even for individual clients.

Service providers can achieve certification in the model through evaluations conducted by an external team that reviews evidence of implementation of the Practices. Certification in the eSCM-SP is a rigorous and labor-intensive process. For eSCM-SP certification to be given, each Practice relevant to a particular Capability Level must be supported by strict evidence requirements. Appropriate evidence includes documentation of Practices as well as observed usage, either in organizational activities or as revealed in interviews. Once a certification is given, it is valid for up to two years. Some organizations have chosen to implement the Practices for a particular capability level without going through certification because the process is so time-consuming and expensive. This indicates that these firms are not merely using certification as a signal of quality to clients, although signaling may be a contributing factor in the adoption decision for some.

2.2. Research Site

My studies utilize detailed documentation on the implementation of the eSCM-SP and resulting performance outcomes in an offshore service delivery center of a large, multinational company. The delivery center has several thousand employees and has received certification in

the eSCM-SP. The site has two primary business units: Financial Services and Human Resource Services. The site provides services directly to its clients, and also provides internal services to other delivery centers within the organization (i.e., "insourcing").

CHAPTER THREE: STUDY ONE

3.1. Introduction: Process Implementation and Knowledge Transfer Mechanisms

The implementation of process improvement frameworks can be viewed from the perspective of knowledge transfer. Knowledge transfer is a dyadic exchange in which a recipient learns and applies knowledge transmitted from a source (Argote and Ingram, 2000). Various mechanisms facilitate the creation, management and transfer of knowledge (Linderman et al, 2004; Ko et al, 2005). Several mechanisms for knowledge transfer are available to organizations, including the movement of personnel (Darr et al, 1995), hiring individuals with new knowledge (Almeida and Kogut, 1999), knowledge management systems (Alavi and Leidner, 2001) and replication of tasks or environments (Winter and Szulanski, 2001). Mechanisms such as these can help individuals and project teams to retain and transfer knowledge, and consequently to implement process improvement frameworks more efficiently. However, the efficacy of any knowledge transfer mechanism may depend upon characteristics of the task and the environment in which the task is being performed (Hansen et al, 1999; Slaughter and Kirsch, 2006). There can be diminishing returns to new knowledge, and not all learning and knowledge transfer methods are strictly compatible (March, 1991; Kattila and Ahuja, 2002).

More importantly, while a few studies have examined the direct effects of knowledge transfer mechanisms in a *single* implementation of process improvements (e.g., Szulanski, 1996; Slaughter and Kirsch, 2006), to the best of my knowledge, no studies have examined the efficacy of knowledge transfer mechanisms in *repeated* implementations of process improvements. A

"repeated" implementation is the repetition of the implementation of the practices in a process improvement framework in a *subsequent* business unit. Specifically, in this study I address the question: *Is a given knowledge transfer mechanism more effective in the initial or repeated implementation of a process improvement*? This is an important question from both theoretical and practical perspectives. In terms of theory, comparing the effectiveness of knowledge transfer mechanisms across different implementation contexts may shed light on the ways in which these mechanisms operate, and consequently the conditions under which they will be most effective. In terms of practice, managers of large implementation projects are often constrained in terms of time and resources. Illustrating differences in knowledge transfer mechanism effectiveness across implementations may help managers to make better decisions that will help to optimize implementation efficiency.

I attempt to fill this gap in the literature by examining process improvement with respect to three specific knowledge transfer mechanisms – tools (knowledge repositories), teams (personnel rotation) and tasks (repetition of routines). First, knowledge repositories (KR) are a type of knowledge management system in which documents or other artifacts of an organization are stored in a searchable format (Bock et al, 2008). They are particularly effective when the information to be stored and retrieved is explicit and easily codifiable (Alavi and Leidner, 2001). Increasingly, organizations are depending upon KR and other information technologies as an important component of their overall knowledge management strategies. To be useful repositories of an organization's knowledge, KR must contain information that is directly relevant to the organization, and this information must be searchable and extractable (Kulkarni et al, 2007). Much of the existing academic research on KR has focused on motivating employees to contribute their knowledge to KR (Huber, 2001; Kankanhalli et al, 2005) or increasing the

subsequent accessibility of the information (Kwan and Balasubramanian, 2003a; Poston and Speier, 2005). Consequently, empirical studies on KR outcomes have typically used KR utilization, or perceived KR quality and satisfaction, as their dependent variables (e.g. Poston and Speier, 2005; Kulkarni et al, 2007). In contrast, I examine whether the utilization of KR for process improvement within organizations leads directly to higher implementation performance, and whether differences in KR effectiveness exist between initial and repeated implementations. While the relationship between general knowledge management *capabilities* and performance has been examined (e.g. Tanriverdi, 2005), to the best of my knowledge the link between KR usage and objective performance outcomes has not been established empirically.

Second, implementation project units are often divided into multiple teams that are responsible for specific functional areas. The movement of personnel across those teams can help to facilitate knowledge transfer, particularly when the knowledge is of a tacit or personal nature or requires direct observation (Argote, 1999). The transfer of new knowledge between work teams has been demonstrated in prior experimental research (e.g. Kane et al, 2005), but to the best of my knowledge has not been demonstrated in the context of process improvement implementation. In addition, while most prior studies have examined the impact of personnel transfer in isolation from other knowledge transfer mechanisms, I examine the concurrent use of personnel transfer and KR and their interactions with implementation characteristics. Further, I examine these in both initial and repeated implementations of processes.

Third, as noted by Argote and Ingram (2000), tasks can be used to capture and transfer knowledge by embedding it in an organization's routines and standard operating procedures. In the context of process improvement, process knowledge can be captured in routines that are replicated in other units of the organization. For example, Argote (1999) described how a more

cost-effective process for painting trucks was embedded in a routine that all workers used at a truck assembly plant. Another example is given in Darr, Argote and Epple (1995) who describe how the knowledge about how to produce a higher quality pizza was embedded in a routine that was transferred to other stores within a fast-food franchise.

In this study, I examine the use of these tool-, team- and task-based knowledge transfer mechanisms in the implementation of a process improvement framework designed specifically for service providers – the eSourcing Capability Model for Service Providers, or eSCM-SP (Hyder et al, 2004a, 2004b). Knowledge management and transfer mechanisms are particularly important to services because services are labor-intensive and service units are prone to high turnover rates (Rai and Sambamurthy, 2006; Levina and Su, 2008). Further, the increase in services offshoring implies that information must be retained and transmitted across a wide range of geographical and organizational boundaries (Metters and Marucheck, 2007). Standardized processes, and the mechanisms used to implement and retain those processes, are therefore expected to be instrumental in delivering services effectively. The adoption of comprehensive process improvement frameworks such as the eSCM-SP is similar to the adoption of other process frameworks such as total quality management (TQM); common characteristics are multiple project teams and a multi-stage implementation project design. Despite the fact that the general process improvement framework remains the same across all units, the nature of the implementation tasks and the information available to the team members may vary greatly within and between implementations. Consequently, the effectiveness of the knowledge transfer mechanisms may differ depending upon whether they are used during the initial implementation or repeated implementations.

My study provides a novel theoretical contribution by providing insight into the effects of different types of knowledge transfer mechanisms across multiple implementations of practices in a process improvement framework, and by revealing the differences in the effectiveness of the mechanisms for each implementation. Further, the study reveals that the different knowledge transfer mechanisms are more or less effective depending on the level of customization required in the repeated implementation. I am able to empirically examine these phenomena due to detailed, primary data collected in a setting that is particularly well suited to this study – the implementation of the eSCM-SP process improvement framework in two business units at a large outsourcing service provider.

3.2. Theoretical Background and Hypotheses

My research considers how tool-based, team-based, and task-based knowledge transfer mechanisms relate to implementation performance. Since prior research has focused on the direct effects of these mechanisms, in my study I focus upon how the effects of these mechanisms differ in the repeated versus the initial implementation, as well the impact of customization on knowledge transfer effectiveness. I present my hypotheses in the following sections.

3.2.1. Knowledge Transfer Mechanisms

Multiple methods for knowledge transfer exist within the context of a single organization. Knowledge may be transferred through different forms of person-to-person communication such as regular meetings, informal conversations, or e-mail (Darr et al, 1995; Alavi and Leidner, 2001). Knowledge may be transferred through the movement or sharing of individuals among teams or organizational units. It may also be transferred via indirect observation or through directed training or mentoring, particularly if individuals are in the same location (Argote, 1999). People-based knowledge transfer mechanisms can be particularly effective when the knowledge

to be transferred is tacit in nature (Berry and Broadbent, 1987). However, not all forms of knowledge transfer require personal interaction. Knowledge may be easily stored and transferred in the form of knowledge management systems or other information repositories (Alavi and Leidner, 2001). Knowledge may also be stored and transferred via physical technology such as products (Gailbraith, 1990), or in organizational routines or structure (Cyert and March, 1992).

Prior research has categorized this gamut of knowledge transfer mechanisms in various ways. Some research has focused on the physical nature of the artifacts used – for example, whether the mechanisms are person-based, technology-based, or structure-based (Argote, 1999). Other studies have focused on how the mechanisms are used – whether knowledge becomes codified or personalized, or whether the mechanism is used at an individual or a collective level (Hansen et al, 1999; Boh, 2007). Taxonomies such as these are useful when considering how particular knowledge transfer mechanisms operate in specific contexts. For this study, I adopt a framework proposed by Argote and Ingram (2000): the categorization of organizational knowledge repositories as member-based, tool-based, or task-based. According to Argote and Ingram (p. 153), *members* are the human components of organizations; *tools*, including both hardware and software, are the technological component; and *tasks* reflect the organization's goals, intentions, and purposes. With this framework, knowledge may be transferred by moving (or copying) any of these repositories, or by moving "networks" consisting of multiple repositories. In my study, I am interested in how the use of knowledge transfer mechanisms related to members, tools and tasks influences implementation duration – and whether the effect of these mechanisms differs between the initial and subsequent implementations within a single organization.

While a very frequent usage of knowledge transfer mechanisms may suggest problems in communication or understanding, increasing levels of transfer mechanism utilization are generally associated with more effective outcomes (Slaughter and Kirsch, 2006). This is because at least some level of knowledge is presumed to be transferred with each use of the transfer mechanism. However, research has also demonstrated that not all types of learning and knowledge transfer are strictly compatible. For example, mechanisms that promote knowledge codification are difficult to use in conjunction with mechanisms that promote knowledge development and personalization (Haas and Hansen, 2004). In addition, processes that involve exploration, or seeking new knowledge, are often incompatible with processes involving exploitation, or mining existing knowledge (He and Wong, 2004; Wong, 2004). However, organizations that are able to successfully integrate internal and external knowledge may be more successful in quickly implementing new technologies (Mitchell, 2006).

In a staged process improvement implementation project, multiple opportunities for learning and knowledge transfer exist. The most obvious one is the potential for each implementation to learn from previous implementations. However, it is not a certainty that learning from previous implementations is universally beneficial. First, information that is transferred from previous implementations may be not applicable to the current one, or worse, it may be incorrect. This incongruence is more likely to occur if the two implementations possess different design characteristics or if the individuals in the implementation teams possess different skill sets or perform different tasks (Slaughter and Kirsch, 2006). Second, the implementation team's attempts to use information from prior implementations may interfere with information that may naturally be learned on its own through the implementation process (Wong, 2004). For example, suppose a team member of a repeated implementation unit receives information from a

KR that was input by a member of the initial implementation unit. If the knowledge is novel and applicable, the repeated implementation team member should benefit. But if the knowledge is something the team member already knows, the team member has incurred unnecessary search costs; or, if the knowledge is incongruent with something the team member knows, then the team member experiences cognitive dissonance that must be resolved. Importantly, the resolution of this dissonance may ultimately benefit the effectiveness of the process implementation. However, it is also likely to result in increased effort and longer implementation times.

In summary, organizations that use multiple knowledge transfer mechanisms during process implementation do so with the expectation that they will provide value to the implementation teams. However, in the complex, multi-implementation approach that is often used with lengthy process improvement projects, the realization of that value is not straightforward. I examine this through my discussion of the three types of knowledge transfer mechanisms identified by Argote and Ingram (2000): tasks, tools, and team members. I first consider the effects of knowledge transfer mechanisms in the implementation where processes are repeated; then I consider the effects in the implementation where processes are repeated and also customized.

3.2.2. Repeated Implementations

The ability to reuse knowledge appropriately has long been recognized as an important source of competitive advantage for organizations (e.g., Zander and Kogut 1995). In order to effectively reuse knowledge, it is necessary to identify, store and apply the knowledge residing in the organization's employees, or the knowledge that the firm obtains from external sources, such that the firm is able to exploit existing capabilities or develop new capabilities (Grant, 1996). Knowledge reuse can be facilitated by the use of common routines, particularly among

individuals within an organization who perform similar or related tasks (Markus, 2001). The relationship between knowledge reuse and productivity or efficiency has been well established in the arena of software development. For example, the use of standard software development processes and methodologies across projects has been shown to improve software project outcomes (e.g., Harter et al. 2000). Knowledge reuse has also led to increased efficiency in radically innovative tasks such as the development of scientific experiments (Majchrzak et al, 2004). Importantly though, the efficiencies to be gained from knowledge reuse are not limited to creative or developmental tasks. For example, the reuse of templates has been shown to increase efficiency in the transfer of best practices across physical locations (Jensen and Szulanski, 2007). Knowledge reuse is also perceived as helpful in the provision of consulting or project management services (Boh, 2008).

In the case of a repeated process implementation, process knowledge reuse is expected to provide significant efficiencies. Processes that are developed for one context – for example, a particular business line or client – may be reused in other contexts (Darr et al, 1995). In the context of the eSCM-SP an example would be a standard process developed in one business unit for service delivery that is subsequently reused in another business unit for a similar purpose. The application of existing process knowledge in new contexts thus has the potential to significantly reduce implementation time and effort, given the extent to which the new context is similar to the prior context. This suggests that:

H1: *In a repeated process implementation, process reuse will be associated with higher implementation performance for processes that do not require customization.*

In addition to defined processes, knowledge repositories are important tools enabling the reuse of information. Knowledge repositories (KR) are used by organizations to store knowledge

in the form of electronic documents or databases (Alavi and Leidner, 2001). KR are a particularly effective tool when the knowledge to be stored is simple and easily codifiable (Zander and Kogut, 1995). Generally, the utilization of KR is a multi-step process. First, information must be codified into an electronic format. Next, the codified information must be entered into the system. Upon entry the information must be appropriately classified, or "tagged", so that it is searchable by other individuals. Finally, after the information has been entered it can be retrieved and reused multiple times by others who have access to the system. This reusability is a primary benefit of an electronic KR – information that is stored once can be used repeatedly, even by individuals in different physical locations (Alavi and Leidner, 2001). However, the contribution of information to a KR requires effort and must be explicitly encouraged. Prior research has focused on factors that motivate individuals to contribute to KR, including intrinsic rewards, social exchange, and trust (Bock et al, 2005; Kankanhalli et al, 2005). Leadership and supervisor commitment can also influence individuals' willingness to contribute (Kulkarni et al, 2007). The population of the KR may be done as part of the first implementation cycle, or it may be done prior to process implementation activities (Kwan and Balasubramanian, 2003b). Although the entry of information into the KR can create considerable costs in terms of time and effort, the available information is expected to benefit personnel involved in the initial implementation. When the KR is populated prior to the initial implementation, implementation team members should be able to use the information in the KR to facilitate their implementation tasks. For example, information about the organization's existing policies or competitive environment may help the implementation team to develop new processes. In addition, individuals involved in the first implementation may enter information

into the KR themselves. This information may be accessed again by those individuals, or it may be accessed by other individuals that are responsible for related processes.

Since information is typically entered into the KR either during or before the initial implementation, KR may be construed primarily as a mechanism for knowledge transfer between the initial implementation and repeated implementations. Thus in repeated implementations, KR are expected to provide the greatest value. Implementation team members in repeated implementations can pull information from KR and use it to facilitate their own work – in other words, they act as knowledge consumers (Markus, 2001). This is particularly true if the processes in the repeated implementation are very similar to the processes in the initial implementation and do not require customization, since the information from the KR will be highly applicable. For example, a template for use in the technology procurement process may be created during the initial implementation and stored within the KR. If subsequent business units use a similar process for technology procurement, the availability of this template should significantly reduce implementation times for those business units. Thus:

H2: *In a repeated process implementation, the use of KR will be associated with higher performance than in the initial implementation for processes that do not require customization.*

Knowledge may be transferred by moving individuals from one organization, organizational unit or project team to another. This mechanism may be particularly effective when the information is tacit and not easily articulated, since tacit knowledge often has a personal quality that requires a common understanding to communicate effectively (Nonaka, 1994). Within large organizations, the movement of personnel from one unit to another has been shown to improve performance via transfer of knowledge about new processes (Darr et al, 1995). Research with small groups has also shown that the movement of personnel from one team to

another can improve performance on creative tasks like idea generation, as well as physical tasks like origami (Choi and Thompson, 2005; Kane et al, 2005). However, the effectiveness of personnel transfer within the process implementation context has not been examined to a significant extent. Within an organization-wide process framework implementation, the presence and use of other knowledge transfer mechanisms may influence the effectiveness of personnel transfer (Haas and Hansen, 2004; Wong, 2004). This may be particularly true in a multi-stage implementation setting where the specific use of these mechanisms may differ.

In the context of process implementation, large implementation projects are often divided into teams which are given responsibility for implementing sets of processes. With this structure, individuals working on a single implementation may be transferred from one team to another, either to balance workload or to intentionally share their expertise. When this transfer occurs, the knowledge that the individual possesses becomes available to the new team. During the initial implementation, this knowledge transfer may facilitate the subsequent work of that new team.

In a repeated implementation the organization already has experience in using personnel transfer during the initial implementation. As the organization gains experience in using this mechanism, it will learn to use it more effectively. For example, suppose that during the initial implementation significant efficiencies were realized by transferring an individual from a team implementing service design processes to a team implementing service delivery processes. In the subsequent implementation, the teams and personnel rotation can be specifically structured to facilitate knowledge transfer between service design and service delivery processes. Again, this will be particularly true when processes do not require customization, as team members will be able to perform repetition of processes that have already been implemented. More generally,

when efficiency gains are realized, they can be replicated in subsequent implementations to transfer personnel more effectively. Thus:

H3: *In a repeated process implementation, the transfer of personnel across teams will be associated with higher performance than in the initial implementation for processes that do not require customization*.

3.2.3. Customized Processes

Although knowledge reuse can be a powerful vehicle for knowledge transfer, using a standard routine or entering data into a KR does not ensure knowledge reuse, nor does knowledge reuse necessarily imply increased capabilities. An organization's knowledge is dynamic, growing and changing with time and experience. As time elapses between the storage of knowledge and its retrieval, the knowledge becomes less applicable and more difficult to integrate (Carlisle and Rebentisch, 2003). Knowledge also becomes more difficult to integrate as specializations or customizations are introduced between storage and retrieval (Carlisle and Rebentisch, 2003).

Knowledge reuse is generally expected to be beneficial when the implementation of processes is repeated. However, for some processes changes must be made between the initial implementation and subsequent implementations. These processes must be customized, for example due to organizational, legal, or cultural requirements. Processes may also be customized due to client-specific or service-specific demands. For example, a technical helpdesk process may require 12-hour support after the initial implementation; however, for a subsequent implementation in another geographical area, 24-hour support may be required. Knowledge that is gathered during the initial implementation will then become less easily integrated during the

customized implementation of that process (Carlisle and Rebentisch, 2003). Therefore, I expect that:

H4: *The implementation performance benefits of process reuse will be weakened in repeated process implementations for processes that require customization***.**

The reuse of information stored in a knowledge repository will be particularly impeded by the customization of processes, since the information is more difficult to access and adapt. In a customized implementation, the implementation team member may incur unnecessary search costs if the information retrieved from the KR does not match the current context. In addition, the team member may experience cognitive dissonance if the information does not match. The individual may even try to reconcile the differences in information, even though the information does not need to match due to contextual differences. The customization of processes to fit a particular context is inherently a developmental, creative activity. However, activities that promote knowledge reuse may interfere with creative activities (Cheung et al, 2008; Oshri et al, 2003). This type of interference may occur when attempting to reuse KR documents that are directly or indirectly tied to processes that require customization. Thus:

H5: *The implementation performance benefits of using a KR will be weakened in repeated process implementations for processes that require customization***.**

The effectiveness of personnel movement as a knowledge transfer mechanism is also expected to be reduced in a customized implementation, for two reasons. First, during the initial implementation all personnel are performing essentially the same activity: development and implementation of new processes. In the subsequent implementation however, personnel are performing two kinds of work: repetition of processes that have already been implemented (repeated implementation) and customization of processes for further implementation

(customized implementation). Since the team members in the subsequent implementation are split between these two tasks, they share fewer mutual experiences and a smaller common base of knowledge. Second, in implementations that are performed across multiple stages, the initial implementation naturally takes longer. This task environment provides greater opportunities for knowledge transfer among teams in that implementation unit. In contrast, repeated and customized implementations may be done more quickly, with more tasks done in parallel. This environment reduces opportunities for knowledge transfer through personnel movement and interaction and may be especially detrimental when the transferred knowledge must be adapted. Therefore:

H6: *The implementation performance benefits of transferring personnel across teams will be weakened in repeated process implementations for processes that require customization*.

3.3. Implementation at the Research Site

The research site took a staged implementation approach. Financial Services was the first unit to implement the practices in the eSCM-SP, and in the remainder of the paper I refer to this as the "initial implementation". After the completion of this implementation, the Human Resource Services unit underwent a subsequent implementation effort, and I refer to this as the "repeated implementation". The research site devised an implementation plan for each unit that divided implementation activities into three main areas: analysis (current process design, gap analysis, and recommendations); development (creation and/or customization of processes and the artifacts supporting those processes); and rollout (organizational communication, training of users, and transfer of ownership from the implementation team to the organization). A few characteristics of the two implementation efforts have bearing on the subsequent discussion. First, both units implemented the same set of eSCM-SP Practices, so the content of the process

improvement framework was in most cases identical between units. However, certain Practices had to be customized to meet the specific needs of the Human Resource Services unit. This customization included differences in organization structure, legal requirements, and requirements related to specific clients or deals. Second, while the same executive management structure was in place for both implementations, no individuals from the Financial Services implementation unit participated directly in the implementation unit for Human Resource Services. Third, each implementation unit was organized into teams (eight for the initial implementation, seven for the repeated implementation) that were given responsibility for specific Practices or eSCM-SP Capability Areas.

In addition, the general implementation approach was somewhat different between the two implementations. In the initial implementation durations for each Practice were generally longer, and Practices were implemented more sequentially. The implementation focus was on making processes operational and ensuring a good "fit" between the eSCM-SP Practices and the services that the organization was performing. In the repeated implementation, the team members spent more time assimilating process knowledge that had been created in the initial implementation than they did developing new knowledge; the goal was to "roll out" the new processes to the unit as efficiently as possible. The tasks in this implementation were organized such that more work was done in parallel – in other words, more eSCM-SP Practices were implemented concurrently, rather than sequentially as was done in the initial implementation. The choice of a multi-stage approach, and these implementation characteristics, suggest that the assimilation of the eSCM-SP in my research site is similar to the adoption of large-scale process improvement frameworks in many organizations (Markus et al, 2000).

I evaluate the implementation of the eSCM-SP using data collected from these two implementations. The data include archival project plan records, assessment data, and supplemental interviews with implementation participants. Field data of this sort are well-suited to performance studies because the data are objective and unaffected by potential response biases or response rates.

3.4. Research Design and Measures

3.4.1. Dependent Variable

Implementation Performance: Implementation Duration (LOGDURATION). The dependent variable used to test hypotheses 1 through 6 (implementation performance) is measured as the actual duration of the implementation for each Practice within the eSCM-SP, log-transformed to mitigate skewness. As noted, the implementation of the eSCM-SP was conducted in two distinct efforts: the initial implementation in the Financial Services business unit, and the repeated implementation in the Human Resource Services business unit. The organization implemented 74 of the 84 eSCM-SP Practices in each unit, yielding a total of 148 observations of implementation durations: 74 initial and 74 repeated. Among the 74 practices in the repeated implementation, 43 needed to be customized. Because the same set of Practices was implemented in both business units, I can directly compare the effects of knowledge transfer mechanisms on the implementation duration for each Practice.

The efficiency of a process framework implementation may be measured in several ways, including total cost or effort. I use implementation *duration* for two reasons. First, given a relatively fixed supply of resources, duration is a close facsimile for implementation effort and cost (Project Management Institute, 2000). Second, duration indicates the *total amount of time* that the organization must have personnel and other resources participating in the project. This is

particularly important during the implementation of process improvements due to the potential for disruption in the daily activities of organizational members. For example, while the implementation project is ongoing, new client decisions will be made with two sets of processes in mind. In addition, some work may need to be done twice – for example, reporting or documentation of decisions may need to be done using two different methods or templates. The amount of additional work is a function of the *duration* of the implementation and not necessarily the *effort* in terms of person-hours that are devoted to the project. Since a higher duration is more costly to the organization, higher values for duration denote lower implementation performance, and vice versa.

3.4.2. Independent Variables

Knowledge Repository (KR_DOCS). The research site made use of a knowledge repository system during the eSCM-SP implementation process. The number of unique documents in this system directly linked to each eSCM-SP Practice was tabulated in order to generate a count for the Practice; this variable will serve as a proxy for the intensity of investment made in the knowledge repository. Each document in the system is date-stamped. The dates indicate that all documents in the system relevant to the eSCM-SP were generated during the initial implementation. The dataset does not indicate the number of times each document was accessed; however, it does indicate that each document was accessed at least one time during either the repeated implementation or the customized implementation. Thus, the knowledge repository in my setting serves as a primary mechanism for transferring knowledge *between* the initial and repeated implementations.

Personnel Transfer (TEAM_SHARE). Many team members participated in multiple teams within an implementation, facilitating knowledge transfer across Practices within that

implementation. A binary variable was created for each Practice indicating whether members of the implementation team assigned to that Practice had been transferred from other teams within the implementation unit. Thus, in contrast with the knowledge repository, personnel transfer in my setting serves as a primary mechanism for transferring knowledge about processes across teams *within* a single implementation unit (initial or repeated).

Process Reuse (REPEATED). Practices that were implemented during the repeated implementation are identified using a binary variable. In effect, this variable acts as an additional intercept term which indicates the average difference in times between initial and repeated implementations due to process reuse, and is used to test hypothesis 1. I have also interacted this variable with the independent variables measuring the knowledge repository and personnel transfer mechanisms to test hypotheses 2 and 3.

Customized Practices (CUSTOMIZED). Individuals at the research site identified the Practices that had to be customized in the repeated implementation due to legal, organizational or client-specific requirements. These Practices are indicated using a binary variable which is used to test hypothesis 4, and also interacted with other independent variables to test hypotheses 5 and 6. It is important to note that customization only occurs during the second, or repeated, implementation. Therefore, each time the CUSTOMIZED variable is set to 1, the REPEATED variable is also by default set to 1. This characteristic of the data should be considered when calculating the total effect of each knowledge transfer mechanism in the customized implementation.

3.4.3. Control Variables

Planned Duration (PLANNED_DURATION). Prior to implementing the eSCM-SP, the implementation teams generated project plans and estimates of implementation duration at the

Practice level. These estimates were based on the implementation teams' perceptions of the necessary analysis, development, and rollout effort for each Practice. I include these estimates of planned duration for each Practice as an additional variable to control for any innate differences in Practices that are not captured in the other control variables.

Tacitness (TACIT). Generally, knowledge that is tacit or not well understood is more difficult to transfer than explicit knowledge (Nonaka, 1994). In part, this is because tacit knowledge cannot be easily articulated, documented and communicated. Practices that contain a higher degree of tacit knowledge are expected to be more difficult to implement, resulting in longer durations. To control for this possibility, I developed a set of questions in order to evaluate the extent to which each Practice is dependent upon tacit knowledge for its implementation. Guidelines for formulating the questions were derived from the three factors of tacit knowledge defined by Sternberg (1986): the degree of prior organizational knowledge required to implement the Practice; the degree to which the Practice requires creative or innovative thinking; and the degree to which the activity must be customized or adapted to meet engagement-level or service-level requirements. After some pilot testing, the final set of questions (see Appendix A) was completed by a panel of four experts who are knowledgeable about the eSCM-SP. These individuals are either employees of the ITSqc or employees of ITSqc Consortium members. Interrater agreement was calculated using the R_{WG} index (James et al, 1984); the mean correlation was satisfactory at 0.88. The ratings were averaged to generate a mean tacitness score for each Practice.

Implementation Complexity (IMPLEMENTATION_COMPLEXITY). Practices in the eSCM-SP may be independent or may be linked or coupled with other practices. For example, the eSCM-SP documentation states that the Practice knw05 (Engagement Knowledge) is related

to Practices rel05 (Stakeholder Information), prf06 (Make Improvements), and knw08 (Resource Consumption). Similarly, the Practice tch03 (Control Technology) is related to the Practice tch01 (Acquire Technology) "since the acquisition and deployment of technology leads to changes in the technology infrastructure that must be tracked and controlled" (Hyder et al, 2004b). A practice with links to many other practices has high implementation complexity in that it would require careful planning and sequencing of the practice implementation. This implies that having to consider other, coupled Practices will increase implementation times for the Practice in question. Therefore, I control for the complexity of implementation for a Practice by measuring the degree to which the Practice is connected to other Practices within the eSCM-SP. This level of connectedness was calculated using UCINET (Borgatti et al, 2002), a social network analysis tool. A map of dependencies among Practices was extracted from the details of the model (Hyder et al., 2004b). Based on these dependencies, UCINET was used to generate a number of measures indicating the degree of interrelatedness for each Practice (node) to all others in the model (network). The Practice implementation complexity measure I chose is Eigenvector Centrality, which assesses the degree of connectedness of one node to all others in the network (Hanneman and Riddle, 2005). A higher measure of Eigenvector Centrality indicates that a Practice is coupled with a greater number of other Practices, which themselves are coupled with a greater number of Practices, and so on. As I have described, connections to other Practices are relevant because when implementing a Practice that is linked to other Practices, the planning and sequencing of implementing those other Practices must be taken into account during the implementation process.

Time on Project (EXPERIENCE). One concern might be that individuals are able to implement Practices faster because of cumulative experience on the project, rather than learning

via the knowledge transfer mechanisms examined. I control for this by including a variable indicating the total amount of time that each implementation team member spent on the project before starting the implementation of the Practice. This variable indicates *individual* learning which may be attained through the cumulative implementation of any Practices, as opposed to my other measures that identify the effects of specific knowledge transfer mechanisms.

Ongoing Practices (ONGOING). A binary variable was created to designate whether a Practice was an Ongoing Practice or belonged to one of the Sourcing Life-cycles (Delivery, Completion, or Initiation). Ongoing Practices are more likely to involve persistent changes to organizational processes, while the other Practices are only used at particular times. Thus, the implementation process for Ongoing Practices may differ from Practices in other phases of the sourcing life cycle, and I control for this possibility.

3.4.4. Statistical Model and Analyses

The data were analyzed hierarchically using Ordinary Least Squares. First, I estimated a model using only the control variables and the main effects of each of the knowledge transfer variables across all three implementations. Second, the interactions identifying the use of knowledge transfer mechanisms in the repeated implementation were added. Finally, I added the interactions identifying the use of knowledge transfer mechanisms in the customized implementation[1]. Because the dataset includes two observations for each eSCM-SP Practice, I use robust standard errors with clustering at the Practice level to control for potential correlation in the error terms. The fully specified linear model for the implementation of Practice i in implementation j is

---

[1] The continuous independent variable KR_DOCS was centered before interaction with other variables. For this reason, to evaluate hypothesis tests I use a mean value of zero for this variable. The control variable PLANNED_DURATION was also centered within each implementation.

$$
\begin{aligned}
LOGDURATION_{ij} = \quad & \beta_0 + \beta_1\,KR\_DOCS_{ij} + \beta_2\,TEAM\_SHARE_{ij} + \\
& \beta_3\,REPEATED_{ij} + \beta_4(REPEATED_{ij} * KR\_DOCS_{ij}) + \\
& \beta_5(REPEATED_{ij} * TEAM\_SHARE_{ij}) + \\
& \beta_6\,CUSTOMIZED_{ij} + \beta_7(CUSTOMIZED_{ij} * KR\_DOCS_{ij}) + \\
& \beta_8(CUSTOMIZED_{ij} * TEAM\_SHARE_{ij}) + \\
& \beta_9\,TACIT_i + \beta_{10}\,IMPLEMENTATION\_OMPLEXITY_i + \\
& \beta_{11}\,EXPERIENCE_{ij} + \beta_{12}\,ONGOING_i + \\
& \beta_{13}\,PLANNED\_DURATION_{ij} + \varepsilon_{ij}
\end{aligned}
\tag{1}
$$

Because lower implementation durations are desirable, unlike in typical empirical models the independent variables that have a *negative* effect on duration are considered favorable. Collinearity diagnostics reveal that the highest condition index for the data is 19.20, which is within the acceptable range for data of this nature. In addition, boxplots of the dependent variable did not reveal any outliers in the data. When I generated box plots for the initial and repeated implementations separately, the box plot for the repeated implementation revealed two outliers – one above and one below the plot. I removed these two observations and re-estimated the models, and the results were essentially unchanged.

3.5. Results

Descriptive data and pairwise correlations are reported in Tables 3.1 and 3.2. Coefficients and standard errors for the implementation duration regressions are reported in Table 3.3.

Table 3.1: Descriptive data

Variable	Mean	SD	Min	Max
logduration	3.682	0.598	2.303	4.700
duration	47.777	30.673	10	110
tacit	16.277	2.183	12	22.667
implementation_ complexity	5.643	11.990	0	57.12
team_share	0.446	0.499	0	1
kr_docs	3.899	3.813	0	13
repeated	0.500	0.502	0	1
ongoing	0.568	0.497	0	1
customized	0.291	0.456	0	1
experience	8.277	18.675	0	98
planned_duration	17.186	6.176	10	29

Table 3.2: Correlation matrix

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
1. logduration	1.000								
2. tacit	0.060	1.000							
3. implemen-tation_ complexity	0.200*	0.136	1.000						
4. team_share	-0.419*	-0.094	0.022	1.000					
5. kr_docs	0.066	0.043	-0.016	-0.141	1.000				
6. repeated	-0.605*	0.007	0.000	0.245*	0.005	1.000			
7. ongoing	0.291*	0.043	0.150	-0.644*	0.221*	-0.000	1.000		
8. customized	-0.388*	0.010	0.105	-0.095	-0.042	0.640*	0.378*	1.000	
9. experience	-0.186	-0.181*	-0.109	0.199*	-0.049	0.100	-0.137	0.018	1.000
10. planned_ duration	0.527*	0.085	0.022	-0.111	-0.076	-0.900*	-0.139	-0.661*	-0.081

* significant at 5% level

When the regression data are pooled across both implementation units (Table 3.3, Column 1) there are few significant effects. The variable indicating sharing across sub-teams is negative and significant, indicating that personnel transfer generally results in lower implementation times. In addition, the control variables indicating the customized implementation are also negative and significant, indicating lower average implementation times for Practices in that implementation.

Table 3.3: Time to implement results

	(1)	(2)	(3)
	logduration	logduration	logduration
kr_docs	-0.001	0.031	0.025
	(0.010)	(0.013)*	(0.011)*
team_share	-0.250	-0.271	-0.804
	(0.099)*	(0.098)**	(0.118)**
repeated_x_kr_docs		-0.070	-0.118
		(0.018)**	(0.019)**
repeated_x_team_share		0.441	0.060
		(0.270)+	(0.240)
customized_x_kr_docs			0.092
			(0.022)**
customized_x_team_share			0.973
			(0.169)**
repeated	-0.474	-0.886	-0.323
	(0.103)**	(0.277)**	(0.252)
customized	-0.311	0.051	-0.732
	(0.123)**	(0.271)	(0.261)**
tacit	0.004	-0.010	-0.013
	(0.017)	(0.016)	(0.014)
implementation_complexity	0.009	0.010	0.007
	(0.003)**	(0.003)**	(0.003)**
ongoing	0.303	0.293	0.023
	(0.106)**	(0.104)**	(0.101)
experience	-0.001	-0.000	-0.000
	(0.002)	(0.002)	(0.002)
planned_duration	0.400	0.262	0.220
	(0.289)	(0.279)	(0.242)
Constant	3.975	4.066	4.470
	(0.286)**	(0.283)**	(0.252)**
Observations	148	148	148
R-squared	0.54	0.59	0.70
Adjusted R-squared	0.51	0.56	0.67
Δ in R-squared		$F_{(2, 136)} = 8.39$ $p < .001$	$F_{(2, 134)} = 24.45$ $p < .001$

Robust standard errors in parentheses
+ significant at 10%; * significant at 5%; ** significant at 1%

To test hypothesis 1 – the effect of process reuse – I differentiate the full model in column 3 of Table 3 with respect to the process reuse variable, *REPEATED*. By doing this, I include the partial effects of the interaction between process reuse and the other knowledge transfer mechanisms (Kennedy, 2003; Greene 2003). Differentiating the model with respect to

process reuse leaves coefficients on three variables that must be considered: *REPEATED*, *KR_DOCS × REPEATED*, and *TEAM_SHARE × REPEATED*. I then calculate the coefficient for process reuse using a two-step process (Greene, 2003). First, I multiply the coefficients of the interaction variables by the mean values of the knowledge transfer mechanism variables for repeated Practices that do not require customization. Second, I add these values to the coefficient of the reuse variable. This gives us the total effect of process reuse as $(- 0.323) + (-0.118 \times 0.392) + (0.060 \times 0.839) = -0.319$. A Wald test on this value was statistically significant ($p = 0.001$) and the value is in the expected direction, supporting hypothesis 1. Holding all other variables at their means, the mean implementation time for non-customized processes in the repeated implementation was 25.6% lower than in the initial implementation. This implies that the team members' ability to reuse implementation knowledge in the repeated implementation resulted in significant efficiencies.

The results also indicate that the interaction between the KR variable (*KR_DOCS*) and the repeated implementation variable is negative and highly significant ($\beta = -0.118$, $p < .001$), supporting hypothesis 2 (KR in a repeated implementation). For the repeated implementation, an additional available KR document was associated with a decrease in implementation duration of about 12 percent. This result suggests that individuals working on the repeated implementation were able to realize significant efficiencies by using information from the KR. My results demonstrate that in the initial implementation, the use of the KR actually results in a slight increase in implementation times, perhaps because individuals had to expend additional effort to enter information. However, this additional time was more than offset by the time saved in using the KR in the repeated implementation, as can be seen by a comparison of the coefficients. If this

organization were to implement the eSCM-SP in additional units that were also able to reuse the KR information, the time savings could be even greater.

The interaction between the repeated implementation indicator and the personnel transfer variable (*TEAM_SHARE*) was positive and not statistically significant ($\beta = 0.060$, $p > .10$), so I do not have support for hypothesis 3 (personnel transfer in a repeated implementation). The absence of a significant effect indicates that personnel transfer within an implementation unit is not significantly more effective in the repeated implementation than in the initial implementation. This suggests either that the organization did not learn from the initial experience with personnel transfer in the first implementation, or that personnel transfer was already being used at close to maximum effectiveness. Importantly, the net effect of personnel transfer as a knowledge transfer mechanism continues to result in significantly lower durations for the repeated implementation, as I will discuss further in section 3.6.

The test for hypothesis 4 (customization and process reuse) uses the same procedure as the test for hypothesis 1. I differentiate the full model in column 3 with respect to process customization (*CUSTOMIZED*), leaving three variables of interest: *CUSTOMIZED*, *KR_DOCS* × *CUSTOMIZED*, and *TEAM_SHARE* × *CUSTOMIZED*. The total effect of process customization is then calculated as $-0.732 + (0.092 \times 0) + (0.973 \times 0.446) = -0.298$. A Wald test on this value is not statistically significant ($p = 0.214$), so I do not have support for hypothesis 4. Customization neither weakens nor strengthens the beneficial effects of process re-use.

The interaction between the KR variable and the variable indicating the customized implementation is positive and highly significant ($\beta = 0.092$, $p < .001$), indicating support for hypothesis 5 (customization and KR). For Practices requiring customization, an additional KR document resulted in an implementation time increase of about 9.2 percent, relative to repeated

Practices that were not customized. This result implies that the information in the KR was not as valuable for these customized Practices because, relative to repeated Practices, they had less in common with the Practices as implemented in the initial stage.

Finally, the variable indicating the use of personnel transfer in the customized implementation is positive and significant ($\beta = 0.973$, $p < .001$), supporting hypothesis 6 (customization and personnel transfer). Team member sharing across teams within an implementation unit actually resulted in an implementation time *increase* of about 165 percent for practices that were customized in the repeated implementation relative to those that were not, suggesting that the use of personnel transfer across teams is not an effective strategy for implementing customized processes. Although personnel transfer is generally an effective mechanism for propagating tacit knowledge throughout the organization, it does not seem to work well in this context. Perhaps this is because individuals are performing two kinds of work (repetition and customization), and there is a smaller base of common knowledge among the team members. Additionally, the coordination costs may be higher on these subsequent implementations since more tasks are done in parallel, and two different types of work are being performed.

Table 3.4 shows the combined coefficients for each of the knowledge transfer mechanism variables for each of the implementations, reflecting the total effect of the mechanisms on implementation durations. The total effect does not reflect the hypothesis tests, which evaluate the repeated implementation relative to the base case of the initial implementation; rather, the total effect indicates the aggregate influence of each of the knowledge transfer mechanisms on implementation durations. This summary shows that for the initial implementation, the knowledge repository has a significant, positive effect on implementation duration while team

sharing has a significant, negative effect. However, in the repeated implementation for Practices not requiring customization, both the knowledge repository and team sharing significantly lower implementation times. While the sharing of team members generally has the greater impact, Practices that have a large number of KR documents also experience significant reductions in implementation times. The results for Practices that needed to be customized in the repeated implementation are quite different – neither KR use nor team sharing has a significant effect.

Table 3.4: Combined coefficients – using Table 3.3, column 3

	Initial	Repeated but not Customized	Repeated with Customization
kr_docs	0.025**	-0.093**	-0.001
team_share	-0.804**	-0.744**	0.229

+ significant at 10%; * significant at 5%; ** significant at 1%

3.5.1. Robustness Checks

In this section, I describe additional specifications used to ensure the robustness of the main set of results. Results of these robustness checks are reported in Table 3.5.

Table 3.5: Robustness checks

	(1)	(2)	(3)
	logduration	logduration	logduration
kr_docs	0.025	0.023	0.024
	(0.011)*	(0.011)*	(0.011)*
team_share	-0.803	-0.769	-0.801
	(0.119)**	(0.120)**	(0.119)**
repeated_x_kr_docs	-0.117	-0.118	-0.120
	(0.019)**	(0.019)**	(0.019)**
repeated_x_team_share	0.059	0.060	0.173
	(0.240)	(0.239)	(0.302)
customized_x_kr_docs	0.090	0.091	0.092
	(0.023)**	(0.022)**	(0.022)**
customized_x_team_share	0.975	0.931	0.963
	(0.170)**	(0.171)**	(0.170)**
repeated	-0.325	-0.327	-0.304
	(0.253)	(0.251)	(0.255)
customized	-0.736	-0.718	-0.730
	(0.262)**	(0.260)**	(0.262)**
tacit	-0.014	-0.012	-0.012
	(0.014)	(0.014)	(0.014)
implementation_complexity	0.007	0.008	0.007
	(0.003)*	(0.003)**	(0.003)**
ongoing	0.025	0.051	0.034
	(0.102)	(0.103)	(0.103)
experience	-0.000	0.003	-0.000
	(0.002)	(0.003)	(0.002)
planned_duration	0.208	0.267	0.235
	(0.245)	(0.243)	(0.244)
elapsed_time	-0.000		
	(0.001)		
cumulative_practices		-0.036	
		(0.025)	
practices_by_resource			-0.004
			(0.007)
Constant	4.488	4.432	4.467
	(0.257)**	(0.253)**	(0.253)**
Observations	148	148	148
R-squared	0.70	0.70	0.70
Adjusted R-squared	0.67	0.67	0.67

Robust standard errors in parentheses
+ significant at 10%; * significant at 5%; ** significant at 1%

First, one potential concern with the personnel transfer measure (TEAM_SHARE) is that

it might be picking up cumulative learning effects; in other words, team members are only

transferred after a certain number of Practices have been implemented, so organizational learning

increases as personnel transfer becomes more frequent. In part, I have controlled for this possibility through the use of the variable indicating the team member's experience (EXPERIENCE). As an additional test, I separately added two different Practice-level control variables to the baseline model: elapsed project duration time (Table 3.5, column 1) and cumulative number of Practices implemented (Table 3.5, column 2). Neither of these variables was significant, nor did they affect the direction or significance of any of the other independent variables, suggesting that the current measure accurately identifies the influence of the personnel transfer mechanism.

Second, in learning studies it is common to use units of output as a measure of experience, rather than elapsed time (Argote, 1999). To ensure consistency with these prior studies, I substituted the number of Practices implemented by the team member for the variable indicating the amount of time spent on the project. The use of this variable did not materially affect the results (Table 3.5, column 3).

3.6. Discussion

Performance enhancements in service organizations often involve the improvement of processes and procedures, and process improvement frameworks are an important tool that organizations can use to achieve these enhancements. My study has important theoretical implications for researchers who examine the adoption and implementation of process improvement frameworks. In addition, my study has important implications for the decisions that organizations can make to reduce the implementation duration of such frameworks.

First, my results suggest that knowledge repositories can be used to reduce the overall duration of an implementation effort. To the best of my knowledge, this is one of the first studies to empirically demonstrate the impact of KR usage on an objective performance outcome –

process implementation times. However, the results suggest that organizations may experience an increased workload during the initial stage of an implementation effort as the KR systems are created and populated. Services firms that utilize KR often have trouble motivating their employees to enter the necessary data to make the systems effective because data entry has short-term costs for the employee (Kankanhalli et al, 2005). However, the results demonstrate that the use of KR throughout repeated implementations can also provide tangible benefits in the form of reduced implementation times. As more repetitions are built into the implementation schedule, the potential for knowledge reuse increases – as long as the information is accessible and applicable. Therefore, my results may be relevant to prior work that has examined employees' motivation to contribute to and utilize knowledge repositories (e.g. Kulkarni et al, 2007). Specifically, the results suggest that to maximize the effectiveness of KR in process implementations, managers in initial implementations should give team members appropriate incentives to ensure that they enter as much relevant information as possible into the KR, even if costs are incurred in the short term. Likewise, managers in repeated implementations should encourage the utilization of this information and also refine it as necessary for future use. However, the results also suggest that enthusiasm for KR usage may need to be tempered by the extent to which the organization perceives that processes will need to be customized. Processes that require customization after the initial implementation do not obtain the same level of benefits from KR as those that are simply repeated; in fact, virtually no performance improvement is realized. Figure 3.1 illustrates the effect of KR on each implementation, where the "Without KR" point depicts implementation with no KR use and the "With KR" point depicts a one-standard deviation increase in the number of KR documents used. As can be seen in this figure, KR usage significantly lowers implementation times in the repeated

implementation, but this effect disappears for processes that require customization. Therefore, if a majority of practices need to be customized from one implementation to the next, the use of KR may not be warranted. In the services offshoring setting, this may occur when processes are implemented across different geographies, or across business lines that offer substantially different services (Chesbrough and Spohrer, 2006).

Figure 3.1: Effectiveness of knowledge repositories on implementation durations
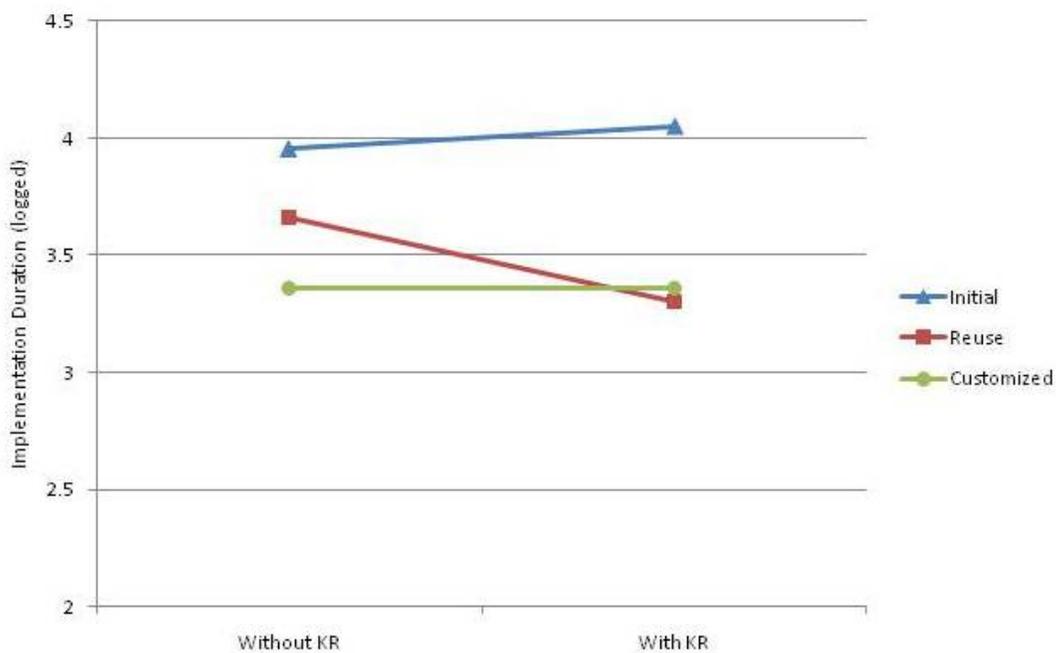
Second, the effectiveness of the total portfolio of knowledge transfer mechanisms was quite different between the implementations. In the initial implementation, the results show that personnel transfer was the most effective mechanism. In fact, a Wald test of the combined coefficients [$F(1, 134) = 49.27, p < .001$] suggests that the beneficial effect of personnel transfer is substantial enough to offset any increased effort required in entering documents into the KR in the initial implementation. In the repeated implementation, the KR was successful in lowering implementation times, while the use of personnel transfer continued to provide benefits. Because the tasks in the initial implementation are more focused on knowledge production than on knowledge reuse, it is perhaps not surprising that the use of people-based

mechanisms would result in a more effective process implementation; personnel that are knowledgeable about the organization's current processes are needed to create and refine new processes. What is somewhat surprising is that people-based mechanisms are also associated with reducing implementation durations and implementing new processes in a more *efficient* manner, because the transfer of personnel across teams can be disruptive to schedules and can involve additional training or mentoring. Furthermore, personnel transfer continued to result in reduced implementation durations in the repeated implementation where many activities were focused on knowledge reuse rather than knowledge creation (Markus, 2001). In summary, my results build upon prior work that has examined personnel transfer (e.g. Darr et al, 1995) by showing that the rotation of personnel across teams is a very effective knowledge mechanism that is robust to a variety of process implementation contexts and uses. Future research could address boundary conditions where the effectiveness or efficiency of this mechanism might diminish.

One possible boundary condition may be the need to customize processes. Team member sharing was only effective in the repeated implementation for practices that were not customized, as illustrated in Figure 3.2. Actually, the results suggest that none of the knowledge transfer mechanisms (process re-use, knowledge repositories and personnel transfer) were effective in lowering implementation times for practices that needed to be customized. This is an interesting finding. Conceptually, the implementation of customized processes should bear many similarities to the initial implementation of processes; for example, in both situations the process must be analyzed and developed in relation to a particular business context. Consequently, we might expect that the use of knowledge transfer mechanisms would have the same effect in either the initial or customized implementations, but this is not the case. A plausible explanation is that there are additional context-specific differences between these two types of implementations that render the use of knowledge transfer mechanisms ineffective for customized processes – for example, a reduced implementation cycle, or the fact that different types of implementation tasks are occurring in parallel. In addition, it is possible that the customization of previous knowledge to meet new conditions may have proven to be more difficult than developing that

knowledge directly for those conditions. The findings regarding customization provide an additional opportunity for future research.

Figure 3.2: Effectiveness of Personnel Transfer on Implementation Durations
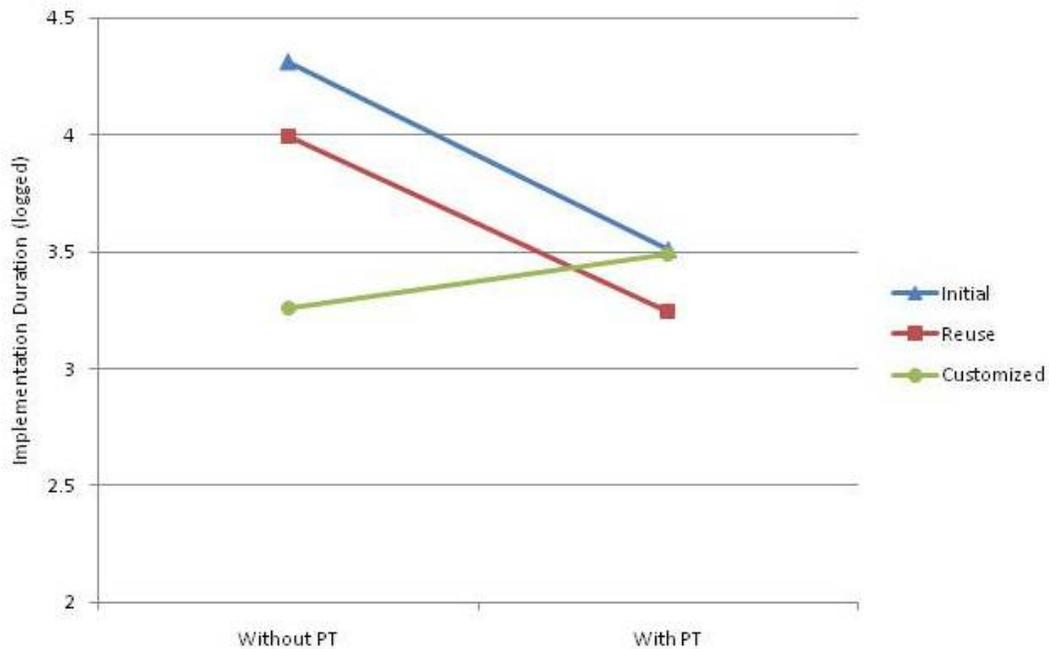
Finally, my findings provide some support for the benefits of a multi-stage strategy for implementing new processes across an organization. The organization in my study implemented the model initially in the Financial Services unit, followed by repeated and customized implementations in the Human Resource Services unit. An implementation structure such as this provides checkpoints that allow organizations to evaluate the knowledge that they have created and obtained and to determine its applicability to future work (Laudon and Laudon, 2005). Given the differing degrees of effectiveness in knowledge transfer mechanisms by implementation, organizations using a multi-implementation approach should be able to structure their team members, tools, and tasks to achieve maximum efficiency. Furthermore, even after controlling

for different degrees of knowledge transfer mechanism usage and effectiveness, the estimated results show that the multi-stage strategy yields an average of 13 days less time to implement each Practice in the repeated implementation for practices that were not customized. The difference in times between the implementations can be attributed at least partly to extended opportunities for knowledge transfer from one implementation to the next. I should also point out that this organization did have prior experience implementing previous methodologies using a phased approach, and this experience may have contributed to their overall success in implementing the eSCM-SP.

3.7. Conclusion

I evaluate the effectiveness of three different types of knowledge transfer mechanisms in the implementation of a process improvement framework. My findings reveal that the use of knowledge repositories and the reuse of processes results in significantly lower durations in repeated implementations than in the initial implementation. The transfer of individuals across teams within implementation unit also lowers implementation times in repeated implementations, but not significantly more than in the initial implementation. In contrast, none of these mechanisms significantly lowered implementation times for customized processes. My interpretation is that differences in the implementation contexts, and in particular the reuse of processes and KR information in the repeated implementation, result in the differential effects of these mechanisms. Process reuse also resulted in lower aggregate implementation times, suggesting that the organization learns from its implementation experience with repetition. My study provides a theoretical contribution by extending previous work examining the benefits of knowledge transfer mechanisms in process improvement contexts. Specifically, my study theorizes and empirically examines the concurrent use of three mechanisms in a well-known

knowledge transfer framework (Argote and Ingram, 2000), and the effectiveness of these mechanisms under different conditions of knowledge creation, reuse, and customization. To my knowledge, this is the first study to examine these phenomena within an organization. My findings reveal the effectiveness of different knowledge transfer mechanisms in reducing effort in initial and repeated implementations of a process improvement framework. In addition, the results show how the need to customize processes in a repeated implementation affects the influence of these mechanisms on implementation durations.

My research is innovative in several ways. First, I integrate previous research in knowledge management and transfer, quality management practices, and the implementation of process improvement frameworks. In contrast to prior work in these areas which has utilized survey methods to capture a broad cross-section of users, the current research design involves an in-depth field study in which I investigate the implementation of practices within one large service provider. While this potentially limits the ability to generalize the results to other settings, it increases internal validity by enabling me to control for cross-sectional differences among firms and to isolate how characteristics of knowledge transfer mechanisms affect implementation efficiency. Second, the research setting is novel. Services science is an area that is capturing increasing interest in business and academia (Metters and Marucheck, 2007), and major IT firms such as IBM have identified services sciences as a priority area for research and hiring (Wladawsky-Berger, 2006; Jana, 2007). The eSCM-SP is one of the first process improvement models specifically targeted toward service organizations. While my study does examine the implementation of a specific process improvement framework, the characteristics of the implementation should make my findings sufficiently generalizable to a broad range of process improvement frameworks that cross multiple organizational units.

CHAPTER FOUR: STUDY TWO

4.1. Introduction: Process Standardization and Organizational Performance

As described in the introduction to my dissertation, empirical support for the relationship between process standardization and performance has been mixed. The discrepancies in the empirical literature have recently inspired researchers to further investigate potential moderating and mediating factors between process standardization and performance (Benner and Veloso, 2008; Gopal and Gao, 2009). The impact of process standardization under conditions of variability is a particularly important issue. Because one goal of process standardization is to impart some consistency on task performance, standardization may be ill-suited to situations in which conditions are variable or inconsistent. Early examinations of TQM have proposed that a distinction needs to be made between the characteristics of standardization which impose control from those that impose learning and continuous improvement (Sitkin et al, 1994). In this framework, process control is a poor fit for variable or uncertain environments, while processes that increase learning may facilitate adaptation when the environment demands change (Sitkin et al, 1994). The dichotomy between control and learning is reflected in the literature on organizational routines, where some have argued that standardized processes may increase inertia (e.g. Hannan and Freeman, 1983) and others have argued that they may increase flexibility and facilitate adaptation (e.g. Feldman and Pentland, 2003). Although there is considerable theoretical and empirical research on the importance of routines in variable environments, the impact of process standardization frameworks under conditions of variability has not been investigated to a significant extent. Furthermore, studies that have examined process standardization and variability have primarily focused on environmental variability and not task variability (Davenport and Beers, 1995; Choo et al, 2007; Benner and Veloso, 2008). In

firms that are characterized by persistent variability in tasks, individuals must be able to accommodate exceptions and adapt to necessary changes on a continual basis. An examination of the value of process standardization for such firms – specifically, the immediate value of standardization and the emerging value of standardization over time – is needed.

The preponderance of research in process standardization, as well as the bulk of its application, has been centered on the manufacturing sector. This is not surprising given that many of the quality practices that are prevalent today were borrowed or adapted from Japanese manufacturing principles (Strang and Kim, 2006). However, developed economies in the last 50 years have experienced a remarkable growth in service industries. By one estimate, services now account for more than 70% of worldwide employment and nearly 80% in the U.S. (Metters and Maruchek, 2007). Organizations that specialize in the provision of information technology (IT) and business services have grown dramatically in size and number over the last two decades, both within the U.S. and abroad (Sheehan, 2006). In spite of this growth, the services sector has been the subject of relatively little academic research, and many prominent scholars have called for more rigorous investigation in this area (Rai and Sambamurthy, 2006; Metters and Marucheck, 2007). More specifically, the value of process standardization frameworks in IT and business services has not been investigated to a significant extent.

The production and delivery of services differs appreciably from the production and delivery of products in ways that could differentially influence the effectiveness of process standardization. Most importantly, services are often highly variable and uncertain in their production (Chesbrough and Spohrer, 2006). Services are produced as they are needed, so demand is more variable and difficult to forecast than it is for products that are made to meet stock requirements (Field et al, 2006). Because services are intangible, they are usually more

difficult to define and measure than products (Bowen and Ford, 2002). These characteristics make it challenging to define a standard process and to ascertain whether the process is being performed properly. Much of the theory underlying standardization programs such as TQM or Six Sigma is based on improved performance through consistent repetition and experience (Anderson et al, 1994). Because the volume of transactions in services is lower and less consistent (Rust and Miu, 2006), the benefits of process standardization may take longer to emerge or may be more limited in scale. Services are also more labor-intensive in their production than products. Therefore, organizational process improvements that are rooted in human cognition – such as organizational learning and the development of routines – will be particularly important in the services sector (Tucker et al, 2007). The handling of errors or exceptions in services – whether proactive or reactive – will also be substantially based in the interaction of personnel (Rai and Sambamurthy, 2006). In addition, process improvements that focus on coordination and information transfer will be also more important in services than in manufacturing, as will process improvements that focus on personnel management (Moran et al, 2005; Bowen and Ford, 2002). For these reasons, we may expect that the adoption of process standardization frameworks might have differing effects for services firms than for manufacturing firms.

In this study, I empirically examine the business value arising from a process standardization initiative at a multinational firm that provides IT and business services. My study utilizes a detailed dataset of delivery performance outcomes for a range of services both before and after the implementation of an organization-wide process standardization framework. I examine two categories of performance outcomes that are relevant to both services and manufacturing firms: quality-related outcomes and cost-related outcomes. I also examine task

variability as a moderator of the relationship between process standardization and performance for these outcomes. Additionally, many prior performance studies have used a single, organization-level measure such as production units or waste reduction as the outcome variable. In contrast, I examine the impact of process standardization across over one hundred detailed quality and cost outcomes within several business units of a large services organization.

My study makes several contributions to the existing work in process standardization and organizational learning. First, while prior work on process standardization has examined relationships between learning and variability in the firm's *environment*, I directly measure variability for the *tasks* that the site is performing internally, and assess the differing impacts of process standardization on performance outcomes for variable and non-variable tasks. Second, my theoretical model emphasizes differences in performance resulting from the early application of standardized processes versus iterative applications over time, including the effects of task variability. I am able to take a dynamic approach to this question because my dataset is longitudinal and includes monthly observations spanning three years. Third, for each performance outcome in the dataset, I have collected observations prior to and after the implementation of the process improvement framework; thus, the field setting resembles a natural experiment. Prior research has argued that the true impact of quality initiatives such as TQM may never be accurately assessed because the implementation of these frameworks is potentially confounded with other organizational or technological factors (Hackman and Wageman, 1995). Because my dataset examines a consistent set of objective process outcomes within a single unit of one firm over time, I am able to cleanly identify the impacts of process standardization and improvement. Finally, I also contribute to the growing literature on service management by demonstrating the effects of process standardization in a new context. My

results should be generalizable to a wide range of services firms and may have implications for manufacturing and software firms as well.

4.2. Theoretical Background and Hypotheses

4.2.1. Process Standardization and Performance Outcomes

Process frameworks for standardization and organizational improvement have been the subject of research by academics and practitioners for several decades, chiefly within manufacturing environments. The typical path for improvement begins with the mapping and documentation of the firm's existing processes, followed by the standardization and modification of these processes. As part of this effort, extraneous steps are often removed from the firm's procedures in order to eliminate waste (Hackman and Wageman, 1995). Ideally, this standardization results in reduced process variation, which in turn leads to more consistent performance and higher quality (Anderson et al, 1994). As quality improves, the firm should encounter less rework and exception handling, resulting in lower costs (Hackman and Wageman, 1995). Improved quality may also lead to greater internal or external customer satisfaction, which can lead to increased revenues and production demands (Choi and Eboch, 1998). As the production level increases economies of scale may also increase, further lowering unit costs over time (Dehning et al, 2007). Most process standardization frameworks also emphasize the need for continuous improvement in order to adapt to changing customer or environmental needs (Sitkin et al, 1994). Although this general improvement path is often portrayed as applicable to all process-oriented organizations, some research has analyzed the "fit" between quality initiatives and the firm's external environment (e.g. Sitkin et al, 1994). In addition, research has shown that organizations may obtain greater performance improvements from process

frameworks by going beyond the minimal standards and tailoring frameworks to meet specific needs (Naveh and Marcus, 2004).

Performance improvement at the organizational level can occur along many dimensions. Prior work in both manufacturing and software development has demonstrated that process standardization can have heterogeneous effects on different dimensions of performance such as cost, quality, and cycle time (Harter et al, 2000; Krishnan et al, 2000; Flynn et al, 1997). For this study I focus on two categories of internal performance outcomes that are relevant to the IT and business services context (Paulk et al, 2005a), which I will refer to as quality and cost. *Quality* indicates outcomes that are evaluated against organizational standards or guidelines, whether created internally or imposed externally. It includes accuracy and completeness, the avoidance of errors, timeliness, and internal satisfaction. Although other studies have measured timeliness separately from quality, in many services delivery time is considered a quality attribute and is included as a critical service level agreement (SLA) criteria (Rust and Miu, 2006). *Cost* indicates outcomes that reflect the cost or effort associated with performing a task. It includes resource-oriented outcomes such as labor productivity, detailed costs such as payroll, and variances in inputs that may affect costs or productivity.

An initial step in the implementation of standardized processes is an analysis of the firm's existing processes and a mapping of these processes to the new framework. As part of this analysis, opportunities to remove wasteful or inefficient procedures are identified (Hackman and Wageman, 1994). This removal of inefficient procedures should improve performance for both quality and cost-related outcomes. In addition, the new standardized processes are expected to be more efficient than existing processes; otherwise, organizations would rationally choose not to adopt them. The decision to adopt a process standardization framework is consistent with

explorative learning, whereby firms gather new information to develop new procedures (March, 1991). In the context of process improvement initiatives, explorative learning can enable firms to eliminate procedures altogether, to anticipate problems before they have occurred, and to develop new solutions (Hackman and Wageman, 1994; Sitkin et al, 1994). The identification and removal of inefficiencies and implementation of improved processes is also expected to be part of the implementation of process standardization frameworks within services firms. Service transactions are often produced by a single individual; or, when multiple individuals are involved, a significant degree of coordination and information transfer is required (Chesbrough and Spohrer, 2006). The standardization of service processes often means creating formal procedures for carrying out tasks and communicating effectively with others, resulting in additional performance improvements. This leads to my first, "baseline" hypothesis:

H1: *Process standardization will be associated with higher performance outcomes.*

More interestingly, I anticipate that there are dimensions of performance improvement vis-à-vis process standardization that are more likely to emerge over time. Human labor is the primary factor of production in services. Consequently, an important mechanism for performance improvement is the direct effect of learning and knowledge creation that influences performance outcomes. A cornerstone of the theory behind process standardization is the idea that standardized processes facilitate the consistent performance of tasks (Anderson et al, 1994). Over time, this consistency in execution allows the individuals performing the tasks to learn from experience more effectively. Because process standardization increases consistency it should be able to facilitate learning through repetition and experience, the primary mechanism underlying the "learning curve" (Argote, 1999). The process behind the learning curve is generally consistent with exploitative learning: as the firm gains repeated experience with a

process, it makes incremental adjustments that gradually increase efficiency (Argote, 1999). Exploitative learning has been likened to a feedback loop – an individual performs a process, receives some feedback via the outcomes of that process, and then makes adjustments to the process accordingly (Sitkin et al, 1994). However, learning curves may also be driven by specific improvements that are targeted towards increasing efficiency rather than through experience alone (Sinclair et al, 2000). Learning curves are typically associated with cost or productivity outcomes, but have been demonstrated in quality performance as well (Levin, 2000; Ramdas and Randall, 2006).

Consistent task execution leads in turn to consistency in outputs, an outcome that is associated with further performance improvement (Anderson et al, 1994). When performance improves as a result of process standardization, the producer encounters less rework and fewer exceptions (Dehning et al, 2007). Over time, this reduction of rework can result in lower costs, giving rise to the maxim "quality is free" (Crosby, 1979). This form of improvement in cost outcomes can be described as an indirect effect of cumulative, incremental learning in quality performance (Reed et al, 1996). This phenomenon has also been observed in software development processes, where cost improvements lag behind quality improvements (Slaughter et al, 1998). Because process standardization reduces variation in work, firms may also be able to learn more effectively from experience over time as causal ambiguity in work processes decreases. This increased ability to learn may further enable the firm to both increase quality and create lower average costs in the long run (Reed et al, 1996).

Process standardization frameworks also make it easier for employees to learn a fixed, documented set of processes (Dessein and Santos, 2006). This has two effects: employees may be more easily substitutable for one another, and employees are better able to apply process

knowledge to multiple tasks. Therefore, the standardization of processes can also increase efficiency by reducing the need for coordination among individuals in a single work unit, because managers are less constrained when assigning tasks (Dessein and Santos, 2006). Process standardization can also enable firms to create new procedural knowledge, which can be used over time to reduce costs (Linderman et al, 2004). However, these direct learning processes require purposeful, targeted effort, and performance improvements as a result are expected to take significant time to materialize.

A final mechanism for performance improvement is more subtle but no less important. In short, process improvement frameworks are often very expensive for organizations to implement. First, there are implementation costs – monetary expenditures associated with the framework itself, possible tools associated with the framework, and consultants (Victor et al, 2000). Perhaps more importantly, there are costs associated with process change as employees learn new procedures and adjust to them (Victor et al, 2000). Employees must be trained in the new processes, which is also costly. It would be natural, then for the organization to experience a short-term decline in performance immediately after implementation of standardized processes (McAfee, 2002). However, this decline must be reversed in order for the organization to prosper. Consequently, the organization must search for new ways to improve performance that extend beyond the boundaries of the process framework. Oftentimes, a "traumatic" experience is needed to spur the organization to extend itself beyond its boundaries and search for new solutions (Ittner et al, 2001). In addition, explorative learning within organizations is often encouraged when employees realize tension between actual performance and potential performance, as would exist immediately after a process framework implementation (Morrow et al, 1997). For these reasons, I hypothesize that:

H2: *The performance benefits of process standardization will increase over time.*

4.2.2. Task Variability

Process standardization may "fit", i.e., be more beneficial for, some tasks than others. In particular, I focus on task variability as a characteristic that influences the fit between the service provider's tasks and standardized processes. *Task variability* reflects the extent to which the task is consistently defined and has a consistent procedure (Poole, 1978). Variability in tasks creates a higher degree of uncertainty about the steps that need to be performed; indeed, some prior research has cast task variability as a dimension of uncertainty or nonroutineness (Van de Ven et al, 1976; Karimi et al, 2004). In addition, the causal linkages between the performance of the task steps and the outcome of the steps are less clear when the set of steps varies from instance to instance (Szulanski et al, 2004). This causal ambiguity impedes the ability of the organization to learn from repetition through experience. This is particularly problematic for intangible services, where the production process is already difficult to observe (Bowen and Ford, 2002). Service transactions are often variable and idiosyncratic, relying on knowledge from multiple parties to consummate (Chesbrough and Spohrer, 2006). Thus, even multiple repetitions of service transactions are less likely to result in learning through experience, since conditions are more likely to change. More variable tasks will also contain a greater number of exceptional cases that require different methods or procedures for completion of the work (Poole, 1978; Dellarocas and Klein, 2000). Exception handling with services often requires substantial coordination and personal interaction to complete, consuming additional time and resources (Moran et al, 2005).

Variable tasks require a higher degree of procedural flexibility so that the individual performing the task can accommodate exceptions or other conditions (Pentland, 2003). For tasks that exhibit high variability, I recognize two conflicting views concerning the impact of process

standardization. The first view is that a standardized process may reduce some needed flexibility, resulting in a decreased ability for the individuals involved in providing the service to meet the unique needs of the task (Victor et al, 2000). This would suggest that process standardization is less beneficial for tasks with high variability, perhaps even to the extent that performance is reduced. According to this view, task variability would impede the employee's ability to engage in learning through experience, a process that would otherwise be facilitated by the implementation of a process standardization framework. The second view is that a standardized process might actually reduce task variation; or, it may help the service provider to recognize and develop new and efficient routines for exception handling (Feldman and Pentland, 2003). Process standardization has been shown to increase conceptual learning or meta-learning in which firms "learn to learn" more efficiently, enabling the firm to adapt more effectively to changing environments (Mukherjee et al, 1998). This view implies that process standardization would be particularly *helpful* for variable tasks which require multiple routines.

To reconcile these competing views, I propose that their effects will be temporal; that is, each will dominate at a different point in the improvement path. This temporal view is particularly relevant in the services context. Because services are so labor-intensive, employees of services firms have a greater ability to develop new routines over time and apply them to their work (Schmenner, 2004). Individuals in service organizations can also interact and learn from each others' experiences. Thus, improvement may occur outside of the scope of a particular service; rather, improvement may occur across an entire business line or an even larger organizational unit (Schmenner, 2004). To formulate my hypotheses regarding task variability and process standardization, I draw a distinction between the initial effects of process standardization and the effects of process standardization that are realized over time.

In the short term, standardized processes will reduce flexibility as the organization attempts to establish a particular way of doing things. As individuals are learning the new processes, they will struggle to meet the changing requirements of variable tasks in particular (Reed, 1996). The adoption of new processes is typically expensive for organizations in terms of training and change management, so cost performance in particular will suffer in the short term. Standardized processes will make it harder for the organization to adapt to task variability in the short term, so any necessary adaptation that does take place will be more expensive (Reed, 1996). In the short term, organizations will be more willing to operate at lower margins in order to keep quality constant, because a certain standard of quality is a necessary prerequisite to remain in business. Thus, organizations in the short term will be more willing to allow cost performance to suffer than quality performance for variable tasks following the implementation of a process standardization framework. However, reduced flexibility may also impede the organization's ability to react to quality issues initially. This leads to my first hypothesis regarding task variability and process standardization:

H3: *The performance benefits of process standardization will be lower for variable tasks.*

However, this pattern will not be sustainable over time. At the organization level, any initial reductions in quality or cost performance as a result of process standardization must eventually be mitigated for the organization to continue operating in the long run. At the individual level, as employees learn and become accustomed to the new processes, they will be able to react to exceptions in variable tasks more easily (Feldman and Pentland, 2003). In addition, it is possible for the new processes to be tailored over time to meet the needs of the tasks, which will also help to mitigate increased costs. The ability of employees to adapt to the changing needs of variable tasks over time will be strengthened if the employees engage in

explorative learning by searching out novel solutions to task exceptions (Dellarocas and Klein, 2000). Explorative learning can increase the firm's stock of procedural knowledge, or knowledge about which processes can be performed and how they can be performed (Moorman and Miner, 1998). This knowledge may help the firm to adapt its processes to changing requirements in different repetitions of a task. The standardization of processes can also reduce the need for coordination among individuals in a single work unit because managers are less constrained when assigning tasks, increasing efficiency (Dessein and Santos, 2006). In interdependent organizations that perform multiple tasks, it is also possible that task variability for one organizational unit originates within another unit. For example, an accounting department may have to process travel and expense forms from multiple organizational units. This inter-unit task variability may also be reduced over time as individuals use the new, standardized processes, although a certain time lag is expected (Reed, 1996). These factors will result in an increased level of performance in outcomes over time:

H4: *The lower performance benefits of process standardization for variable tasks will be attenuated over time.*

4.3. Research Design and Measures

4.3.1. Data

The research site provides services directly to its clients, and also provides internal services to other delivery centers within the organization (i.e., "insourcing"). For my analyses, I focus on the delivery center's internal service processes, including accounting, finance, procurement, IT, human resources, training, and facilities management. The research site provided a database archive containing all of its recorded internal service performance outcomes from April 2004 to August 2006. Because the site received eSCM-SP certification during the

sample period, the database contains records related to performance outcomes both before and after the program was adopted, making *ex ante* and *ex post* comparisons possible. Importantly, only performance outcomes that are present in the dataset both before and after eSCM-SP certification are included in my analyses. The dataset contains information including the name of the outcome, method of calculation, frequency of calculation, business line, task, and date. Detailed archival data such as these are uniquely suited to performance studies because the data are objective and not subject to measurement bias, response bias, or response rates. Further, as I have noted the data are longitudinal, allowing me to isolate the performance impacts of process standardization. Because the data cover a limited time period, factors such as macroeconomic or technological changes should have a negligible impact. In addition to the performance data, I also conducted supplemental interviews with individuals at the research site to further my understanding of the site's business processes and use of the eSCM-SP framework.

Figure 4.1 illustrates sample data for the Human Resources business line. This figure depicts some of the tasks, outcomes / activities, eSCM-SP Practices, and outcome categories associated with that business line. Because the structure of the data is hierarchical and somewhat complex, I will refer to Figure 4.1 in my discussion of the dependent and independent variables in the analysis.

Figure 4.1: Data structure with examples from HR business line

Task	Outcome / Activity	eSCM-SP Practice	Outcome Type
Legal Audit	% compliance for BPO on guidelines set by legal team	thr06	Quality
Personnel Deployment	Managed attrition – YTD for the fiscal year	ppl06	Cost
	Managed attrition – Rolling 12 months annualized	ppl06	Cost
	Training feedback – % responses of 4 or above to overall satisfaction	ppl07	Quality
	% of available man hours lost in the current month due to unplanned absenteeism	prf03	Cost
Personnel File Creation	% of cases completed within 10 working days of receipt of request	prf02	Quality
Reporting	% of HR reports circulated by the 5th of every month	ppl04	Quality

4.3.2. Dependent Variable

Performance (PERFORMANCE). The unit of observation for the study is the actual value of a particular performance outcome for an activity completed during a particular calendar month [n = 2,050]. Performance outcomes that were recorded on a weekly basis have been averaged so that only one observation per month exists in the dataset. While most of the outcomes were expressed in terms of percentages, some were expressed in other units such as dollars or work-hours. To facilitate comparisons across outcomes, these outcomes were converted to percentages by dividing the actual value by the target value. Consequently, each performance outcome is scaled from 0 (low) to 100 (high), with 100 as the best possible outcome. It is important to note that 100 also indicates the highest possible performance for cost

outcomes; in other words, a higher outcome for cost performance does not indicate higher costs, but rather better performance in managing costs, or higher efficiency.

4.3.3. Independent Variables

Standardization (STANDARDIZATION). Standardization is indicated by a binary variable based on the certification date of a particular eSCM-SP Practice, where 1 = certified and 0 = not certified. Each activity in the dataset was assigned to either one or two eSCM-SP Practices. This assignment was based on the alignment of the activity with the performance objectives of the particular Practice. Only the Practices that were implemented by the site and validated during the certification process were considered in this mapping. The assignment was done by three individuals: myself working independently, and a team of two of the eSCM-SP authors. The initial inter-rater agreement between the study author and the team of eSCM-SP authors was calculated at $\kappa = 0.6710$, which indicates substantial agreement given the number of possible categories for assignment. In the cases where the initial assignments differed, agreement was reached through subsequent discussion. For example, in Figure 4.1 the activity "Training Feedback – % responses of 4 or above to overall satisfaction" is tied to the eSCM-SP Practice ppl07 (Plan and deliver training). Because this Practice was certified in February 2005, all observations for this activity that occur after this date would be considered standardized. In the few cases where an activity was tied to two eSCM-SP Practices that were certified on different dates, the standardization variable is set to 1 on the earlier certification date.

Task Variability (VARIABILITY). Prior to the eSCM-SP certification process, the research site defined a list of internal business lines and tasks to organize and track performance outcomes. The dataset contains outcomes for eight business lines and 57 distinct tasks. My measure of task variability is the number of distinct activities that are tied to each task. The

number of distinct activities is derived from the descriptions of all of the unique performance outcomes for a particular task. For example, two of the performance outcomes for the HR business line (see Figure 3) are "Managed attrition – YTD for the fiscal year" and "Managed attrition – Rolling 12 months annualized". Although these are different performance outcomes it is clear that they measure different aspects of a single activity (i.e., attrition management), so in terms of task variability the two metrics would indicate a single activity. Thus, the definition of task variability is congruent with the concept of "task specializations" as captured in the MIT Process Handbook (Malone et al, 2003). I initially designated the number of distinct activities for each task myself, and these were validated by an independent coder. The independent coder agreed with my initial assessments in 55 out of 57 cases (96.5%); the remaining two cases were reconciled through subsequent discussion.

Time Since Standardization (TIME_SINCE_STANDARDIZATION). This variable is a counter that indicates the number of months that have elapsed since standardization has taken place for each activity. Thus, higher values of this counter reflect greater organizational experience with the standardized processes related to that activity.

Outcome Types (COST, QUALITY). Because the dataset contains over 100 distinct performance outcomes, I decided to introduce additional fixed effects for outcome types to further control for unobserved differences. I considered several taxonomies of outcome types that were proposed as being relevant to the eSCM-SP by its authors (Paulk et al, 2005a). After examining the outcomes in the dataset, I developed a list of criteria to designate each outcome as either *quality* or *cost*, as I defined earlier. The outcomes were assigned to each category by two independent coders. The initial inter-rater agreement was calculated at $\kappa = 0.9474$, which indicates substantial agreement. Disagreements between the coders were discussed until a

consensus was reached. The outcome types are indicated by binary variables designating each type. Quality outcomes are used as the "base" type in the analyses, and the dummy variable COST is used to indicate cost outcomes.

4.3.4. Control Variables

Each observation is assigned to one business line as defined by the research site. I include dummy variables for each business line to control for unobserved heterogeneity in performance across business lines. I also include a time trend variable (MONTHCOUNTER) to control for performance improvements over time that may be independent of process standardization. I also interact the time trend variable with the binary indicator for cost outcomes to control for changes over time that may be specific to different outcome types.

4.3.5. Statistical Model and Analyses

The data have been constructed in panel form with the individual performance outcome as the panel identifier and the calendar month as the time identifier. Although Hausman specification tests did not indicate the presence of autocorrelation in the data ($\chi^2 = 7.37$, p = 0.999), a subsequent test of the residuals (Drukker, 2003) did indicate autocorrelation. Due to the conflicting results, I do not use autocorrelation in the main models but include a model with autocorrelation as a robustness check. In addition, a Hausman test did confirm the presence of heteroskedasticity ($\chi^2 = 168.62$, p = 0.000). Therefore, I chose a panel-corrected generalized least squares (GLS) model for the analysis. This type of specification is appropriate for data with a large number of panel groups, and allows me to correct for heteroskedasticity (Baltagi, 2005). The fully specified model is as follows:

$$PERFORMANCE_{it} = \beta_1 STANDARDIZATION_{it} + \beta_2(STANDARDIZATION_{it} \times COST_i) +$$

$$\beta_3 VARIABILITY_i + \beta_4(VARIABILITY_i \times COST_i) + \beta_5(STANDARDIZATION_{it} \times VARIABILITY_i) +$$

$$\beta_6(STANDARDIZATION_{it} \times VARIABILITY_i \times COST_i) +$$

$$\beta_7(TIME\_SINCE\_STANDARDIZATION_{it} \times STANDARDIZATION_{it}) +$$

$$\beta_8(TIME\_SINCE\_STANDARDIZATION_{it} \times STANDARDIZATION_{it} \times COST_i) +$$

$$\beta_9(TIME\_SINCE\_STANDARDIZATION_{it} \times STANDARDIZATION_{it} \times VARIABILITY_i) +$$

$$\beta_{10}(TIME\_SINCE\_STANDARDIZATION_{it} \times STANDARDIZATION_{it} \times VARIABILITY_i \times COST_i) +$$

$$\beta_{11}COST_i + \beta_{12}BL_i + \beta_{13}MONTHCOUNTER_t + \beta_{14}(MONTHCOUNTER_t \times COST_i) + \varepsilon_{it} \quad \textbf{(2)}$$

The subscript i indicates the panel dimension (outcome) and the subscript t indicates the time dimension (month). The term BL_i is a vector of fixed effect dummies that identify the business lines.

4.4. Results

Descriptive data and correlations are reported in Tables 4.1 and 4.2. Coefficients and standard errors for the GLS regressions are reported in Table 4.3. For brevity, I have suppressed the coefficients on the business line dummies. Results for the hypotheses tests are reported in Table 4.4. The hypotheses are tested using linear combinations of coefficients. For all hypotheses, I have two variables in question: a "variable of interest" and the interaction of that variable with a dummy indicating cost-related outcomes. The coefficient of the variable indicating cost outcomes is multiplied by the mean value of that variable (in other words, the proportion of cost outcomes), and then added to the coefficient of the variable of interest. These composite coefficients are then tested using Wald linear tests. The coefficients used in the hypotheses tests are drawn from Table 4.3, Column 3, which is my main set of results.

Table 4.1: Descriptive data

Variable	Mean	Std Dev	Min	Max
performance	95.005	14.803	0	161.98
standardization	0.778	0.407	0	1
variability	3.464	2.374	1	8
time_since_standardization	6.721	6.559	0	25
cost	0.246	0.431	0	1
business line: I/T	0.286	0.452	0	1
business line: HR	0.181	0.386	0	1
business line: Commercial	0.016	0.124	0	1
business line: Expansion	0.046	0.209	0	1
business line: Facilities	0.307	0.461	0	1
business line: Procurement	0.026	0.159	0	1
business line: Training	0.041	0.199	0	1
business line: Accounting	0.097	0.296	0	1
month counter	16.466	6.937	1	29

Table 4.2: Correlations

	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.
1. performance	1.000												
2. standardization	0.133*	1.000											
3. variability	-0.099*	-0.177*	1.000										
4. time_since_standardization	0.180*	0.531*	-0.151*	1.000									
5. cost	-0.374*	-0.186*	0.292*	-0.263*	1.000								
6. IT	0.158*	0.042	-0.097*	0.127*	-0.267*	1.000							
7. HR	-0.070*	-0.004	-0.074*	-0.043	0.192*	-0.298*	1.000						
8. Commercial	-0.026	-0.127*	0.241*	-0.104*	0.220*	-0.080*	-0.059*	1.000					
9. Expansion	-0.005	-0.269*	0.327*	-0.225*	0.302*	-0.139*	-0.103*	-0.028	1.000				
10. Facilities	-0.032	0.053*	0.042	0.047*	-0.167*	-0.421*	-0.314*	-0.084*	-0.146*	1.000			
11. Procurement	0.020	0.039	-0.101*	-0.070*	0.149*	-0.103*	-0.077*	-0.021	-0.036	-0.109*	1.000		
12. Training	0.017	0.042	0.186*	0.060*	0.000	-0.132*	-0.098*	-0.026	-0.046*	-0.139*	-0.034	1.000	
13. Accounting	-0.107*	0.052*	-0.225*	-0.013	0.032	-0.207*	-0.154*	-0.041	-0.072*	-0.218*	-0.053*	-0.068*	1.000
14. month_counter	0.155*	0.672*	-0.189*	0.852*	-0.200*	0.084*	-0.067*	-0.145*	-0.229*	0.038	0.014	0.056*	0.078*

* significant at 5% level

Table 4.3: GLS regression results with performance as dependent variable

	(1) Control variables	(2) Main effects	(3) With time since standardization	(4) With quarter dummies	(5) Without metrics that exit early	(6) With AR1 correlation
standardization		0.638	0.454	0.251	0.503	0.382
		(0.210)**	(0.221)*	(0.329)	(0.239)*	(0.237)
standardization × cost		-0.126	2.455	2.633	6.141	0.772
		(2.155)	(2.000)	(1.911)	(2.420)*	(1.605)
variability		-0.321	-0.240	-0.175	-0.275	-0.271
		(0.070)**	(0.081)**	(0.096)+	(0.087)**	(0.095)**
variability × cost		-1.048	0.414	0.638	2.370	0.055
		(0.596)+	(0.647)	(0.666)	(1.122)*	(0.679)
standardization × variability		0.175	0.059	-0.046	0.101	0.070
		(0.076)*	(0.094)	(0.113)	(0.101)	(0.101)

standardization × variability × cost			-0.968	-1.741	-1.791	-2.121	-1.477
			(0.563)+	(0.594)**	(0.629)**	(1.255)+	(0.545)**
time_since_standardization × standardization			0.020	0.062	0.018	0.010
			(0.019)	(0.025)*	(0.020)	(0.033)
time_since_standardization × standardization × cost			0.729	0.588	0.312	0.596
			(0.123)**	(0.093)**	(0.167)+	(0.173)**
time_since_standardization × standardization × variability			0.013	0.018	0.013	0.009
			(0.005)**	(0.007)**	(0.005)*	(0.008)
time_since_standardization × standardization × variability × cost			0.225	0.213	0.026	0.192
			(0.051)**	(0.052)**	(0.072)	(0.071)**
cost	-19.481	-16.604	-9.166	-11.148	-12.206	-9.155
	(1.239)**	(1.896)**	(2.127)**	(1.748)**	(2.946)**	(2.579)**
month counter	0.017	0.008	0.010		0.012	0.011
	(0.007)*	(0.009)	(0.015)		(0.015)	(0.029)
month counter x cost	0.493	0.402	-0.137		-0.007	-0.026
	(0.076)**	(0.108)**	(0.122)		(0.172)	(0.148)
Constant	99.237	98.040	98.262	97.062	98.271	98.726
	(0.527)	(0.561)**	(0.630)**	(1.867)**	(0.634)**	(0.859)**
Observations	2050	2050	2050	2050	1797	2050
Number of panel3	114	114	114	114	91	114
Wald χ^2	561.01	762.57	1316.34	834.87	212.20	444.39

Standard errors in parentheses
+ significant at 10%; * significant at 5%; ** significant at 1%

To test hypothesis 1, the impact of process standardization on performance, I differentiate the model with respect to standardization as follows: [∂ performance / ∂ standardization = β_1 + β_2 × cost + β_5 × variability + β_6 × variability × cost + β_7 × time_since_standardization + β_8 × time_since_standardization × cost + β_9 × time_since_standardization × variability + β_{10} × time_since_standardization × variability × cost]. Because I use centered (zero-mean) variables for variability and time since standardization in the analyses, all terms drop out of this derivation except for β_1 and β_2. For quality outcomes, the average effect of process standardization is β_1 = 0.454, p = 0.040. For cost outcomes, the average effect of process standardization is β_1 + β_2 = 0.454 + 2.455 = 2.909, p = 0.1432. Thus, while H1 is supported for quality outcomes, it is in the expected direction but not supported for cost outcomes. This improvement suggests that the organization is, on average, experiencing an increase in quality performance as a result of process standardization. The coefficient for standardization on performance is 0.454, which corresponds to roughly a one half of a percentage point increase. Although this average effect appears small, it is in fact a materially significant improvement. The predicted baseline performance level across quality and cost outcomes is 98.26%, so process standardization is allowing the organization to realize about 26% of their potential for improvement. For example, one quality outcome for the IT business line is "% availability of LAN connectivity". For 24 x 7 operations, a 0.454 percentage point improvement amounts to an additional 39.8 hours of availability over the course of a year. Another example outcome from the accounting business line is "% of employees paid salary accurately and on time". For 5,000 employees, a 98.26% success rate means that in a given month 87 people are not paid accurately. After process standardization, this number would be reduced to 64 people. Because these types of errors often require significant time to resolve, the reduction from 87 to 64 is a meaningful difference.

Table 4.4: Hypothesis Tests

	Quality		Cost	
	Effect	p-value	Effect	p-value
Hypothesis 1: Standardization	0.454	p = 0.040	2.909	p = 0.143
Hypothesis 2: Time Since Standardization	0.020	p = 0.303	0.749	p = 0.000
Hypothesis 3: Standardization × Variability	0.059	p = 0.529	-1.682	p = 0.004
Hypothesis 4: Time Since Standardization × Variability	0.013	p = 0.000	0.239	p = 0.000

To test hypothesis 2, the impact of process standardization on performance over time, I differentiate the model with respect to standardization and time_since_standardization as follows: $[\partial^2$ performance $/ \partial$ standardization ∂ time_since_standardization $= \beta_7 + \beta_8 \times$ cost $+ \beta_9 \times$ variability $+ \beta_{10} \times$ variability $\times$ cost]. After dropping the terms that include zero-mean variables, we are left with β_7 and β_8. For quality outcomes, the impact of process standardization on performance over time is $\beta_7 = 0.020$, p = 0.303. For cost outcomes, the impact of process standardization on performance over time is $\beta_7 + \beta_8 = 0.020 + 0.729 = 0.749$, p = 0.000. Thus, while H2 is supported for cost outcomes, it is in the expected direction but not supported for quality outcomes. Interestingly, while the average performance improvement from process standardization is significant only for quality outcomes, the rate of improvement over time increases significantly only for cost outcomes. After standardization occurs, performance for cost outcomes increases at a rate of about 0.749 percentage points per month, suggesting that the organization is becoming more efficient over time.

To test hypothesis 3, the impact of process standardization on performance for variable tasks, I differentiate the model with respect to standardization and variability as follows: $[\partial^2$ performance $/ \partial$ standardization ∂ variability $= \beta_5 + \beta_6 \times$ cost $+ \beta_9 \times$ time_since_standardization $+ \beta_{10} \times$ time_since_standardization $\times$ cost]. After dropping the terms that include zero-mean variables, we are left with β_5 and β_6. For quality outcomes, the impact of process standardization on performance for variable tasks is $\beta_5 = 0.059$, p = 0.529. For cost outcomes, the impact of

process standardization on variable tasks is $\beta_5 + \beta_6 = 0.059 - 1.741 = -1.682$, p = 0.004. Thus, while H3 is supported for cost outcomes, it is not supported for quality outcomes. Figures 4.2 and 4.3 illustrate the predicted differences between variable and non-variable tasks for cost and quality performance. The vertical lines in these graphs indicate the point when the majority of standardized processes are implemented. At the point of process standardization, quality performance for variable tasks actually increases slightly, similar to the increase in quality performance for non-variable tasks. However, cost performance on variable tasks drops significantly after process standardization. A one-standard deviation increase in task variability results in a 4 percentage point decrease in cost performance ($-1.682 \times 2.374 = 3.993$) after process standardization has occurred.

Figure 4.2: Effect of Process Standardization over Time for Quality Performance
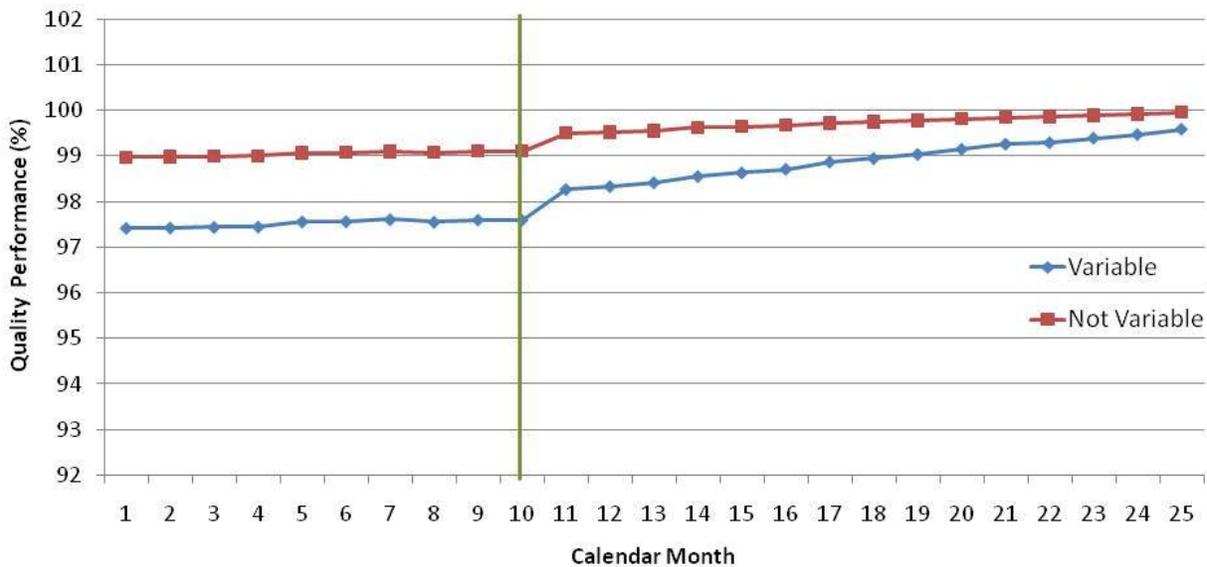
Figure 4.3: Effect of Process Standardization over Time for Cost Performance
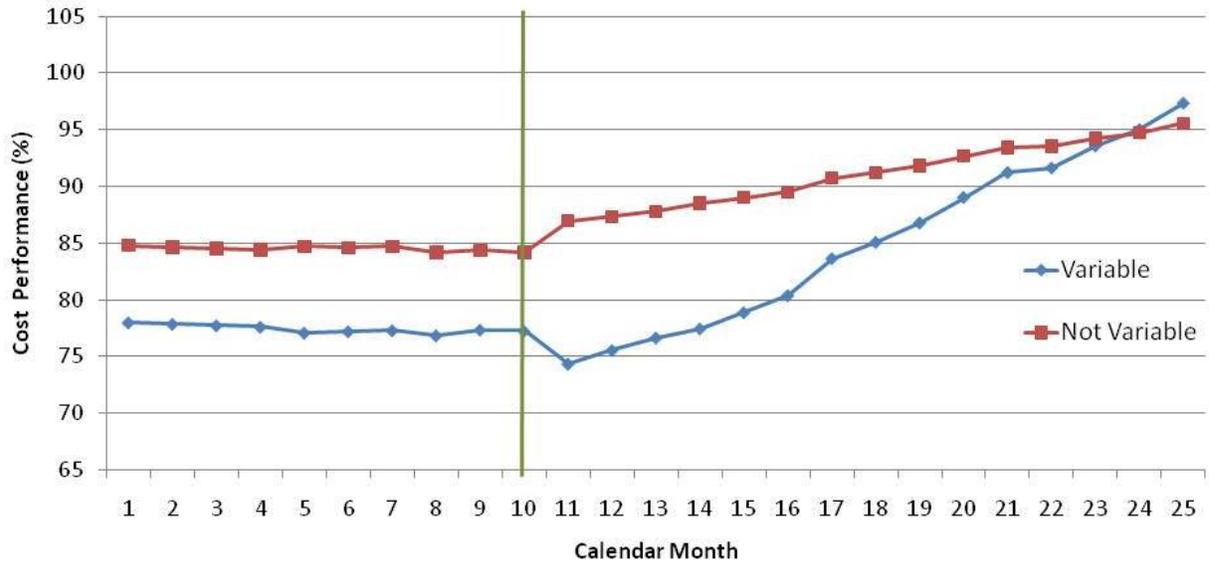
However, my results also show that the negative effect of process standardization for variable tasks attenuates over time. To test hypothesis 4, the impact of process standardization on performance for variable tasks over time, I differentiate the model with respect to standardization, time since standardization, and variability as follows: $[\partial^3$ performance $/ \partial$ standardization ∂ time_since_standardization ∂ variability $= \beta_9 + \beta_{10} \times$ cost]. For quality performance, the rate of change for variable tasks over time due to process standardization is β_9 = 0.013, p = 0.008. For cost performance, the rate of change for variable tasks over time due to process standardization is $\beta_9 + \beta_{10}$ = 0.013 + 0.225 = 0.239, p = 0.000. Thus, H4 is fully supported for both quality and cost outcomes. For cost outcomes, the negative effect of the interaction between task variability and process standardization (-1.682) is approximately 7 times greater than the positive interaction between task variability and time since standardization (0.239), measured in months. This suggests that after approximately seven months, the positive temporal effect of process standardization on cost performance will have "caught up" with the initial negative decrease demonstrated by the results for hypothesis 4. Figures 4.2 and 4.3

illustrate that the rate of performance improvement for variable tasks after process standardization has occurred is greater than the rate of improvement for non-variable tasks, for both quality and cost outcomes.

4.4.1. Robustness Checks

I have conducted three sets of additional analysis to test the robustness of the model to different specifications. First, one concern might be that the time trend variable to control for learning over time might be a weak measure since it is continuous and highly correlated with the measure of time since standardization. To check this possibility, I substituted for this measure by inserting dummy variables that indicate the calendar quarters in the sample. Results using this specification are reported in Column 4 of Table 4.3. For brevity, I have omitted the dummy variables from the results; like the original time trend variable, none of them were statistically significant. With the dummy variables I lose statistical significance on the main effect of standardization, but it remains in the expected direction. In addition, the remaining variables remain in the expected direction and continue to be statistically significant.

Second, another concern may be the entry and exit of different performance outcomes in the sample. All performance outcomes in my analysis are present both before and after standardization. However, there are some outcomes for which I do not have observations through the final month of the sample period. To control for the possibility that the absence of these outcomes may be affecting the results, I ran an additional analysis while removing all outcomes that were not present in the sample *at least eight months* after standardization occurred. Results for this analysis are reported in Column 5 of Table 4.3. After removing these outcomes, the results are essentially unchanged. In fact, many of the coefficients in this analysis increase in magnitude compared with the original specification. The exception is the interaction between

time since standardization and task variability for cost outcomes, which remains in the expected direction but loses statistical significance.

Finally, as noted earlier I have conflicting tests regarding the presence of autocorrelation in the data; the main results do not correct for autocorrelation. I ran an additional analysis correcting for autocorrelation at the general (not panel-specific) level; results using this specification are reported in Column 6 of Table 4.3. When correcting for autocorrelation I lose statistical significance on the main effect of standardization, but it remains in the expected direction. In addition, the remaining variables remain in the expected direction and continue to be statistically significant. In other words, the results correcting for autocorrelation are very similar to the results using the dummy variables for quarters.

4.5. Discussion

My findings indicate that, on average, process standardization results in a significant improvement in performance. The presence of this improvement shortly after standardization occurs suggests that in the course of implementing standardized processes, the organization improves these processes and removes unnecessary or wasteful steps. Additional improvement as a result of standardization also occurs over time. While quality performance improves modestly over time after standardization occurs, cost performance improves dramatically. The differences in these patterns may indicate that different types of learning are occurring. For quality performance, process standardization helps the organization to engage in repetitive, exploitative learning (Sitkin et al, 1994). Exploitative learning is a conservative process by which organizations make incremental improvements designed to utilize existing procedures or routines (March, 1991). The reduced variation that process standardization imparts to quality performance can help to facilitate this learning process. In contrast, while cost performance

initially suffers after process standardization occurs, it improves over time to a great extent. This pattern of improvement may arise from two sources. First, improvements in quality are expected to result in better cost performance over time as the organization encounters fewer errors and exceptions. The fact that cost performance improves significantly over time supports the notion that cost performance improvements may be an indirect result of improved quality performance, as suggested in prior research on the cost of quality (Crosby, 1979). This increase in cost performance theoretically should lag behind increases in quality performance (Reed et al, 1996). The second source of cost performance improvement is organizational adaptation to the process improvement framework. As employees learn the new processes, they can adapt the processes to meet their specific needs, particularly for variable tasks. This suggests that for cost performance, the organization may also be engaging in directed, continuous improvement where new routines and rules are examined (Ittner et al, 2001). Directed efforts such as this often take place when the organization perceives a gap between actual and potential performance (Sitkin et al, 1994), as the research site experienced after the initial implementation of the process improvement framework.

The fact that task variability resulted in generally lower performance has been demonstrated in prior studies and by itself is not surprising. However, the results demonstrating the increase in performance over time for variable tasks after process standardization has occurred are interesting. First, variable tasks show a significant drop in cost performance immediately after standardization occurs. This suggests that the standardized processes impart some rigidity on task performance, so that individuals carrying out variable tasks have difficulty adapting to changing requirements. Over time though, the rate of improvement for variable tasks increases more quickly than the rate of improvement for non-variable tasks, suggesting a faster rate of learning. These results suggest that after an initial period of negative adjustment in cost

performance, the organization has developed new routines and learned to adapt to the new processes over time. Figures 4.4 and 4.5 illustrate this pattern further. For the first 9 months after standardization, task variability has an even greater impact on cost performance than it did prior to standardization. For the period including the 10th month after standardization and later, the negative effect of task variability has disappeared. As illustrated in Figure 4.4, the differing effects of task variability over time on cost performance suggest that after an initial period of difficulty, the organization learns to effectively deal with task variability. Although cost performance exhibits the highest rate of improvement over time for variable tasks, quality performance improves over time for variable tasks as well. Figure 4.5 demonstrates that prior to standardization, task variability is associated with a significant decrease in quality performance. For the first 9 months after standardization, task variability has less of an impact; and for the period 10 months after standardization and later, task variability has even less of an effect. This illustrates that although cost performance is expected to increase at a greater rate over time, quality performance as a result of process standardization has the ability to increase as well.

Figure 4.4: Effect of task variability × process standardization over time for cost performance
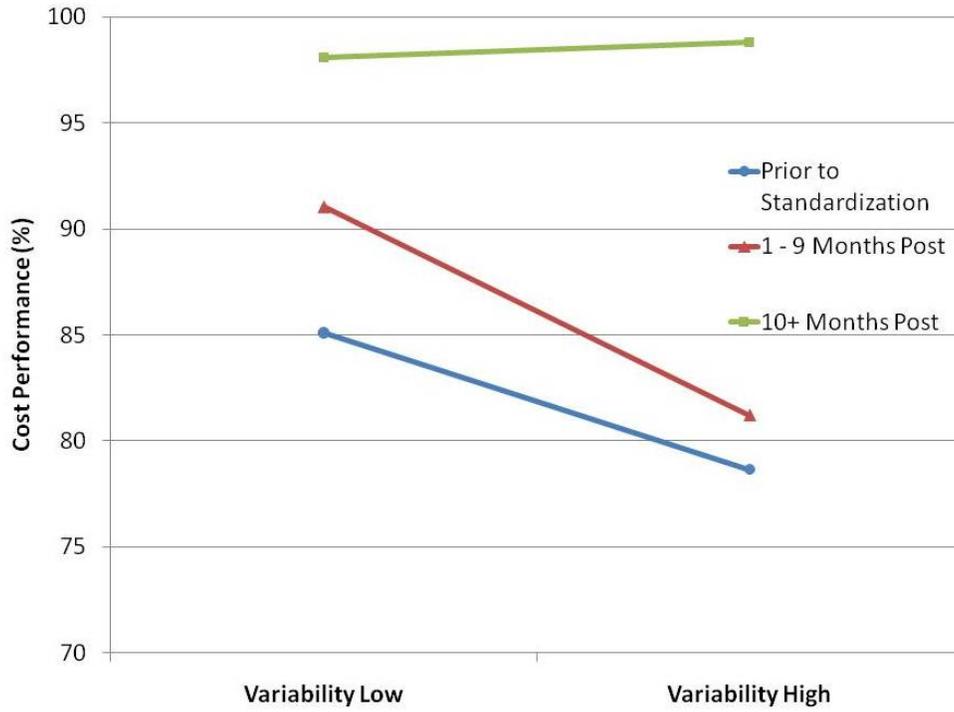
Figure 4.5: Effect of task variability × process standardization over time for quality performance
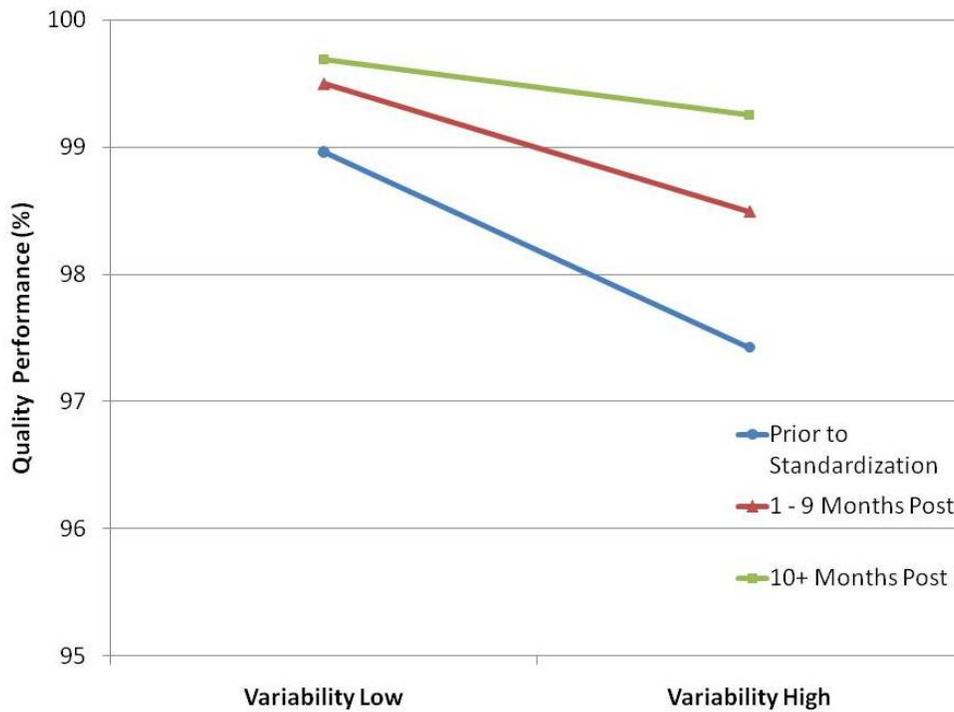
The difference between the initial effect of standardization and the effect over time suggests a tension between variability and consistency in terms of their influence on task performance. This tension may be analogous to recent work on task *variety* and performance. For example, Narayanan et al (2009) find an inverse U-shaped relationship between task variety and performance, suggesting that some task variety may facilitate learning while too much may impede learning. Boh et al (2007) also suggested that task variety may impede learning at an individual level but may increase learning at the group level. Similarly, my results may indicate that while the initial level of variability for some tasks may be too high at first for learning to occur, process standardization reduces this variability over time, facilitating learning and increasing performance. In contrast, tasks that are not variable may not have as much room to improve. While the inherent consistency of these tasks should be associated with increased learning through experience, process standardization will not have as great of an impact for these tasks as it does for variable tasks.

My results have implications for service practitioners that are considering process improvement frameworks. Service organizations that are experiencing quality issues are more likely to receive immediate benefits from process standardization. However, there is not a corresponding short-term cost improvement; in fact, cost performance may suffer. This suggests that service organizations should have sufficient capital to cover the short-term cost hit during the initial adjustment period. This is particularly true for service organizations that must deal with high levels of task variability or uncertainty. Also, service organizations should make a concerted effort to record and retain information that will enable them to improve cost performance over time. Ideally, the process improvement framework in question will prescribe practices to facilitate knowledge retention, as the eSCM-SP does.

Finally, my findings should be encouraging to service providers who are considering adoption of the eSCM-SP or other quality frameworks. Performance improvements following the adoption of the model appeared for a wide variety of services in all functional areas of the organization. Although cost performance initially suffers post-standardization, this reduction occurs because the organization must adjust to new processes and adapt them to fit the organization's specific needs. A new organization or organizational unit that is able to implement these processes from its inception may be able to avoid this short-term decline in cost performance.

4.6. Conclusion

In summary, the implementation of a process standardization framework resulted in significant performance improvements for the research site. Process standardization generated performance gains in two ways: first, an average improvement after the adoption of standardized processes, and second, an increase in the rate of performance improvement over time. While variable tasks experienced an initial decrease in performance after standardization occurs, the rate of improvement over time for variable tasks was greater than that of non-variable tasks. The performance drivers also appear to be different for quality and cost performance in my results. For the research site, quality performance appeared to increase as a direct result of the new processes in the framework. Cost performance appeared to increase as an indirect result of improved quality, and also as a result of the organization adapting processes over time to deal with variability more effectively.

This study contributes to existing literature in three ways. First, I advance the understanding of when and how process standardization is most likely to generate performance improvement. Specifically, I examine the impact of process standardization and task variability

on two categories of improvement that are particularly important to service organizations – cost performance and quality performance. I use a comprehensive, longitudinal dataset that allows me to explore the dynamics of process improvement over time. Second, I extend theory on process standardization and performance by incorporating the literature on different types of learning and organizational routines. The preponderance of labor as an input to production in services makes the development and adaptation of routines a particularly salient characteristic of process improvement in this setting (Tucker et al, 2007). Finally, I quantify the benefits of process standardization in a setting that has not been extensively studied in the literature: the delivery of IT and business services.

A potential limitation of my study is that it focuses on a single organization. However, focusing on a single organization enables me to better isolate the effects of process improvement and task variability, independent of firm-level or industry-level variation. In addition, my dataset covers over 100 different outcomes across a number of business lines and organizational tasks that are used by many large service providers. Therefore, the results should be generalizable to a number of organizations that provide IT and business services.

CHAPTER FIVE: SUMMARY AND CONCLUDING REMARKS

My dissertation has the potential to make significant contributions to the literature on process standardization and improvement, service management, and organizational learning. Study One contributes to our understanding of the factors that make the implementation of process improvement frameworks most efficient. I demonstrate the effects of KR, personnel transfer and process reuse in the context of a multiple-stage process implementation, which is a commonly chosen methodology among organizations. Specifically, my results show that knowledge transfer mechanisms are differentially effective in initial process implementations –

which are focused on knowledge creation – and subsequent implementations, which are focused on knowledge reuse (Markus, 2001). My results also show that the need to customize processes negates the positive effects of the knowledge transfer mechanisms I examine. The significant influence of knowledge repository usage on implementation times is another important finding. Much of the existing research on KR uses perceived KR quality or KR usage as the outcome of interest (e.g. Bock et al, 2006). To the best of my knowledge, the effect of KR on objective performance outcomes such as implementation times has not been demonstrated.

Prior studies have examined the relationship between process standardization and performance, with mixed results. Study Two attempts to clarify this literature further by examining some specific mechanisms that moderate this relationship. First, the results show that the positive effects of standardization on performance tend to emerge over time, after the organization has obtained sufficient experience with the new processes. Second, task variability also moderates the effect of standardization on performance, and the effect of standardization on performance over time. These results should be particularly relevant to research in the services environment, where task requirements can change rapidly from one iteration to the next or from one customer to the next (Chesbrough and Spohrer, 2005). The ability of organizations to learn over time is also critical to services, since they are labor-intensive but also prone to high turnover rates (Levina and Su, 2008).

The results from the two studies are similar in one respect: they demonstrate that performance enhancements may emerge over time after an initial period of performance decline. In Study One, the use of knowledge repositories resulted in lower performance in the initial implementation, but higher performance in subsequent implementations. In Study Two, process standardization resulted in an initial decline in cost performance for variable tasks, but

performance on these tasks improved over time at the fastest rate. The commonality in these findings supports two general propositions. First, as noted by Slaughter and Kirsch (2006), the implementation of organizational process frameworks is often both challenging and time consuming. The use of appropriate knowledge transfer mechanisms in the initial and repeated implementations of processes is critical to implementation efficiency. Furthermore, difficulty in the implementation of processes is also relevant to ongoing organizational performance. Although eSCM-SP Practices were implemented in a directed effort within each business unit at the research site, implementation and formal certification of a process improvement framework are only the beginning of the standardization process. Armed with documented standards, individuals within the organization must put those standards into everyday use while fulfilling their job responsibilities. The requirements of their everyday tasks dictate that the standardized processes must adapt and change over time. In other words, the standardized processes at the end of the implementation cycle may be considered the *ostensive* aspect of the routines, while the performance and adaptation of those processes may be considered the *performative* aspect of the routines (Feldman and Pentland, 2003). In spite of this (or any) organization's best efforts, during the process implementation cycle it is difficult to anticipate all of the variations in routines that may occur through everyday use; the process must be executed "in the real world" many times before optimal efficiency is achieved.

The second proposition is that oftentimes, performance difficulties can spur an organization to positive action (Sitkin et al, 1994; Ittner et al, 2001). In Study One, the entry of artifacts into the knowledge repository was associated with longer durations in the initial implementation. For subsequent implementations, however, the presence of these artifacts was associated with shorter durations. In Study Two, cost performance on variable tasks improved

very quickly after process standardization resulted in a significant drop in performance. Both cases are consistent with an organization that perceived a differential between actual and potential performance, and took measures to reduce that differential. The eSCM-SP contains several Practices that specifically facilitate the tracking of performance and subsequent adjustments (Hyder et al, 2004b); perhaps these Practices were instrumental to the corrections made by the research site.

My examination of process standardization and offshoring will extend beyond this dissertation in one important area – the impacts of process standardization on the delivery of IT and business services directly to the clients of service providers. In contrast with internal activities, these services may be more client-specific and thereby less amenable to process standardization. Thus, examining the fit between process standardization and the characteristics of external services will provide an important extension of my model. In addition, looking at performance in service delivery to clients will enable me to take a truly longitudinal view of process improvement in services. To the best of my knowledge, no published studies have traced a process improvement framework from implementation, through internal improvement, through external improvement in this manner. Examining a single firm through several stages of process improvement may give us additional insights into the way that service organizations learn and improve from internal and external knowledge. This concept is particularly relevant to services because both internal processes and external service delivery are substantially based on personal interaction (Rai and Sambamurthy, 2006). The nature of customer feedback is also different with services than with products (Bowen and Ford, 2002), and this may also carry implications for the way service organizations search for and absorb external knowledge. In addition, by taking a longitudinal view I may be able to integrate the findings from these studies more closely. For

example, how does implementation timeliness, or the degree of internal performance improvement, relate to the degree of external service delivery improvement? These questions present many opportunities for further research.

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APPENDIX A: TACITNESS QUESTIONNAIRE

Instructions: Please read the description of each Practice and its corresponding activities. Then, answer the following questions for each Practice. Indicate your answer by circling the appropriate numbered response.

1. **How much knowledge about factors internal to the organization would you need in order to implement this Practice?**

1   2   3   4   5
Very little   A moderate amount   A lot

2. **How much knowledge about characteristics of the organization's external environment would you need in order to implement this Practice?**

1   2   3   4   5
Very little   A moderate amount   A lot

3. **To what extent is the intent of this Practice clearly defined?***

1   2   3   4   5
Not clearly   Somewhat   Very clearly

4. **To what extent would the implementation of this Practice require innovative or creative thinking?**

1   2   3   4   5
Not at all   A moderate amount   Very much

5. **To what extent do the steps for performing this Practice need to be altered or tailored when performing it for different types of services?**

1   2   3   4   5
Not at all   Somewhat   Very much

6. **How much would the steps for performing this Practice need to be altered or tailored to meet the needs of specific clients (engagements)?**

1   2   3   4   5
Very Little   A moderate amount   A lot

* indicates questions that were reverse-coded