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Knowledge Transfer and Quality Practices in the Implementation of a Sourcing Capability Model

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Abstract

This study adopts a knowledge transfer framework to examine the implementation and assimilation of a process improvement program for outsourcing service providers. Our theoretical model identifies the factors affecting knowledge transfer during both the initial implementation stage and the subsequent stage of full assimilation of improved outsourcing processes into organizational practice. We evaluate our theoretical model using detailed archival data collected on the implementation of an outsourcing capability model in the offshore delivery center of a large service provider. Findings indicate that knowledge transfer characteristics affect the time to implement the improved processes in the delivery center, but do not significantly relate to the likelihood of full assimilation. We also find an unexpected curvilinear relationship between implementation time and assimilation success such that processes with very low or very high implementation times are more likely to be fully assimilated.

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1. INTRODUCTION

The outsourcing of business services is defined as the procurement of service functions such as accounting from an external provider. While the practice of services outsourcing has always been a facet of modern business, its importance has increased with the maturation of information technology (IT). Networking technology has enabled the delivery of services over a virtually unlimited geographical range; for example, services offshoring has increased significantly in India, the Philippines and many South American countries. Software applications have also widened the scope of services that can be outsourced; using IT as a delivery mechanism, services as diverse as customer call centers, insurance claims processing, medical diagnoses, and human resource functions can be outsourced. However, despite the interest in outsourcing and numerous success stories, more than half of outsourcing relationships fail within five years, and many clients state that outsourcing providers do not adequately understand what is required of them (Ozanne, 2000). Some commonly cited issues include a lack of understanding of success criteria, ineffective practices for service definition and delivery, and poor relationship management.

One way to mitigate the risks inherent in outsourcing relationships is for outsourcing service providers to adopt a common set of effective processes, methods and technologies for service delivery in their delivery centers. However, implementing such practices can be extremely difficult. Process improvement of any kind is not simply a matter of individuals embracing incremental changes, and does not lend itself to automation or repetition. Instead, individuals in various roles and units must fundamentally rethink their work patterns and relationships, develop new cognitive frameworks and schemas (Spencer 1994; Mitki, et al. 1997) and embed these new structures into their work practices (Slaughter and Kirsch 2006; Ravichandran and Rai, 2003). Improvement emanates from a deep and broad understanding of work processes, their patterns and implications. Because process methodologies are often implemented across multiple work locations within an organization, cultural and business conditions specific to particular sites must also be considered. Developing this kind of understanding requires knowledge transfer about improved processes between individuals occupying various organizational roles and located in different work units.

Knowledge transfer is a dyadic exchange in which a recipient learns and applies knowledge transmitted from a source (Argote and Ingram, 2000; Ko et al, 2005). Knowledge can be transferred via mechanisms such as training, technology, and personnel movement (Darr et al., 1995; Argote, 1999; Alavi, 2005). Recent research in information systems (IS) has focused on knowledge transfer as an important factor differentiating firms that simply adopt innovations from firms that fully assimilate innovations into everyday use (Cooper and Zmud, 1990; Fichman and Kemerer, 1997; Ko et al, 2005). In this study, we use the knowledge transfer lens to examine the implementation process of an improvement framework for outsourcing service providers – the eSourcing Capability Model for Service Providers (eSCM-SP; Hyder et al,

2004a; Hyder et al, 2004b). Specifically, we focus on factors that affect knowledge transfer between the quality team and the organization as well as factors that affect infusion of the knowledge into organizational practices. Following the general framework for knowledge transfer of best practices as prescribed by Szulanski (1996), we study the characteristics of the knowledge, characteristics of the source and recipient, and characteristics of the organizational context. We also examine how previously implemented quality practices affect the transfer of new practices.

Our findings suggest that knowledge transfer factors are associated with significant reductions in implementation times for the improved outsourcing practices. Specifically, an increase in a quality team member's experience by one week is associated with a reduction in implementation time of 4.4%. The rotation of team members across quality teams reduces implementation times by up to 73%, and this percentage is higher when the relevant processes require more tacit knowledge to implement. Further, compatibility between the eSCM-SP and previously implemented quality practices reduces average implementation times by 16.1%. Interestingly, knowledge transfer factors affected the time to implement processes but were not associated with a higher likelihood of process assimilation into everyday use. Instead, we discovered an intriguing (and unexpected) U-shaped relationship between initial implementation time and the likelihood of full assimilation, suggesting that processes with relatively low or high implementation times are more likely to be assimilated. Because there is little research examining the relationships between stages of assimilation, this finding represents a potentially significant theoretical contribution.

In the following sections, we first describe the particular outsourcing capability model examined in this study. We then draw on the literatures on knowledge transfer and implementation to develop our theoretical model and hypotheses.

2. BACKGROUND

2.1 eSsourcing Capability Model for Service Providers (eSCM-SP)

The eSCM-SP v2 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. The Model consists of 84 "best" practices for services outsourcing, each consisting of a set of activities that must be implemented before the Practice is considered to be complete. An example of a practice is "Select Suppliers and Partners" (rel02). This Practice involves establishing and implementing procedures to select suppliers and partners based on their ability to meet the identified requirements. Each Practice may be characterized along several dimensions, including:

- *Capability Area*: one of ten logical groupings that represent critical outsourcing functions (e.g., Contracting, Technology Management, or Service Design and Delivery).
- *Capability Level*: 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 outsourcing lifecycle where the Practice is used (Initiation, Delivery, Completion, or Ongoing).

For example, the Practice "Select Suppliers and Partners" is in Capability Area "Relationship Management", at Capability Level 2, and is an Ongoing Practice in the Sourcing Life Cycle. Service providers can achieve certification in the Model through evaluations conducted by a third-party ITSqc-authorized external team that reviews evidence of implementation of the Model Practices. The team's findings are reviewed by the ITSqc who makes the final decision on certification. Once a certification is given it is valid for up to two years.

2.2 Assimilating Innovations

Much of the literature on IT implementation, dating back to Cooper and Zmud's (1990) seminal work, has focused on the differences between an organization's simple adoption of a technology and the infusion of the technology into everyday use. Organizations that more fully assimilate innovations can be expected to derive greater benefits from them (Fichman, 2004a). This literature often distinguishes distinct phases or stages of implementation. Following in this vein, we characterize the assimilation of the eSCM-SP v2 as a multi-stage process.

In the first stage, the implementation stage, a quality team that has received training in the Model works with process owners throughout the organization. Knowledge about the Model is transferred from the quality team members to the process owners. This is analogous to Cooper and Zmud's "Adaptation" stage whereby the technology is installed but not necessarily used.

In the second stage, the certification stage, the process owners work with their respective departments to ensure that the Practices in the Model are fully incorporated within the organization's processes. The process owners work with end users to transfer knowledge about the Practices. In addition, a central "Quality Team" is responsible for ensuring compliance on an organizational level. This stage is analogous to Cooper and Zmud's "Routinization" stage whereby the Model is used in a comprehensive and integrative manner. Certification in the

eSCM-SP cannot occur until this second stage is complete. For certification, an independent audit team performs a formal evaluation to determine if the organization is in compliance with a Practice. Each Practice can receive a rating of Satisfied, Partially Satisfied, or Not Satisfied during an evaluation. Organizations often choose to perform one or more internal evaluations between the initial implementation stage and final certification.

Our study is unique in that we are able to separately identify and examine factors relating to the completion of each of these stages. In addition, we are able to examine both knowledge transfer characteristics and outcomes at the Practice level, making more granular analyses possible.

Between the Adaptation and Routinization stages is Cooper and Zmud's "Acceptance" stage, where organization members are encouraged to use the application and the application is initially employed in organizational work. While we do not explicitly model the Acceptance stage, it is implied within the transfer from the first stage to the second stage. Indeed, encouragement of eSCM-SP v2 usage and its employment in daily tasks are among the necessary certification requirements.

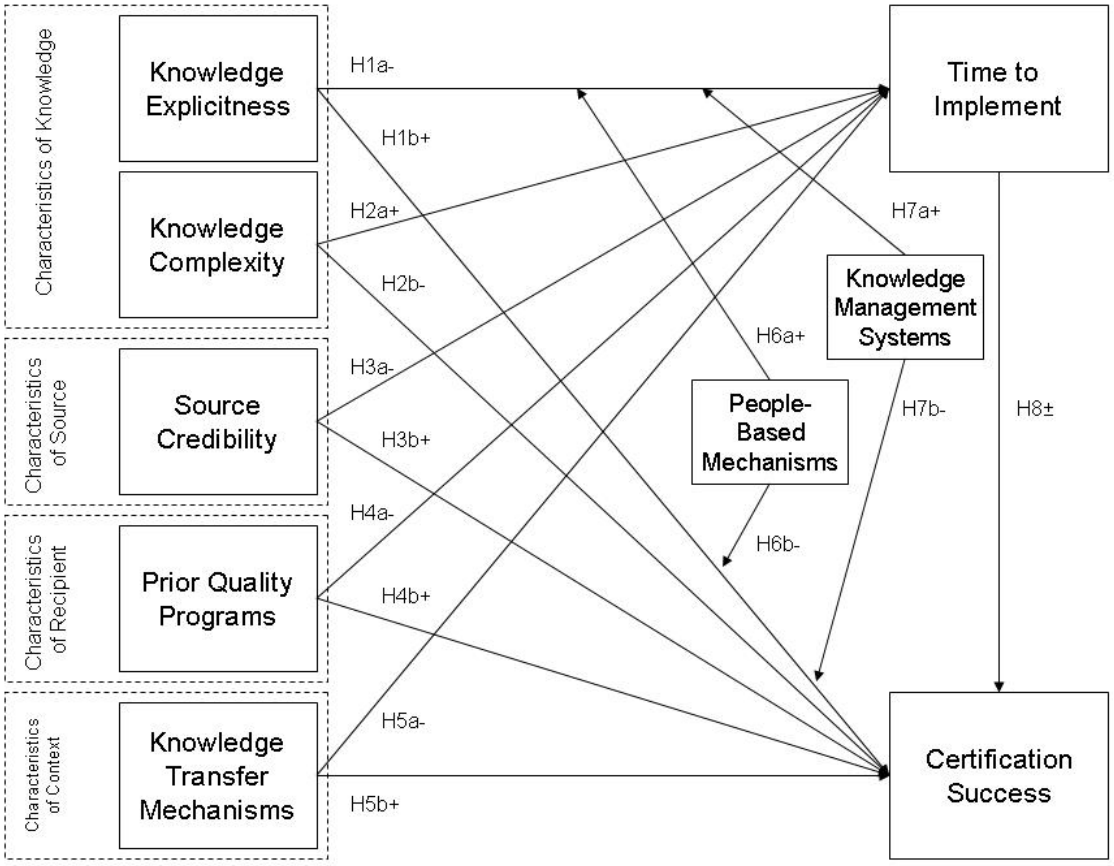
Because we wish to examine each of the assimilation stages separately, each of our hypotheses below is stated twice: once in terms of the implementation (adaptation) stage and once in terms of the certification (routinization) stage. For the implementation stage, our primary outcome of interest will be the actual time required to implement each Practice, controlling for initial estimates of the time to implement. For the certification stage, our primary outcome of interest will be the likelihood that a Practice receives a "Satisfied" rating during its first evaluation.

3. THEORETICAL MODEL AND HYPOTHESES

The literature has identified the importance of knowledge factors in the implementation of innovations. For example, Attewell (1992) argued that with complex organizational technologies, firms need to overcome initial knowledge barriers before they adopt an innovation; however, the technology can be assimilated once those barriers are overcome. Hardgrave et al (2003) demonstrated empirically that many of the cognitive factors that predict the degree of information technology assimilation also affect the assimilation of process methodologies. Fichman and Kemerer (1997) showed that companies with prior related knowledge and a greater diversity of knowledge are better able to adopt and assimilate technological innovations. Assimilation is less costly for these organizations because prior knowledge and diversity of knowledge make it easier for knowledge transfer across the organization to occur.

A large and growing body of research has shown that the transfer of knowledge within organizations may be affected by characteristics of the organization and characteristics of the knowledge itself (Argote, 1999). Szulanski (1996) categorizes factors affecting knowledge transfer into four categories: characteristics of the knowledge, characteristics of the source of knowledge, characteristics of the recipient of knowledge, and characteristics of the organizational context. The research framework for our study (Figure 1) adopts these categories. In the following sections, we discuss the characteristics in each category and the associated hypotheses linking the knowledge characteristics and the implementation outcomes.

Figure 1. Conceptual Model



3.1 Characteristics of the Knowledge

Tacit knowledge is knowledge that is difficult to formalize and articulate. It often has a personal quality that requires a common understanding to communicate effectively. Explicit knowledge refers to knowledge that is easily codifiable and transmittable in formal, systematic language. Much of the knowledge management literature has likened explicit knowledge to declarative knowledge, the knowledge of facts, rules or formal procedures – the "what to do" component of a task. Declarative knowledge is often contrasted with procedural knowledge, the "how to do" portion of the task, which is often likened to tacit knowledge (Anderson, 1985, 1993).

In the context of a process-oriented innovation like the eSCM-SP, we consider three aspects of tacit knowledge (Sternberg 1986). These aspects include the degree of prior organizational knowledge required to implement the Practice, the degree to which creative or innovative thinking is required to implement the Practice, and the degree to which the Practice must be customized or adapted to meet engagement- or service-level requirements. Practices that require a higher level of prior organizational knowledge, more creativity or greater customization are more tacit. For example, consider two Practices in the Relationship Management Capability Area of the Model. The first Practice is "Select Suppliers and Partners" (rel02). This Practice involves establishing and implementing the procedures to select suppliers and partners based on their ability to meet identified requirements. The second Practice, also in the Relationship Management Capability Area of the Model is "Value Creation" (rel08). This practice involves proactively identifying opportunities for value creation and communicating them to the client. While both practices would benefit from prior organizational knowledge in their implementation, clearly the second Practice (Value Creation) would require a higher level of creative thinking for organizational members to be proactive in identifying value creation opportunities; this Practice is likely to also require a higher level of customization to particular engagements or services because the process of identifying value creation opportunities may be specific to an engagement or service. Thus, the Practice to create value would be more tacit than the Practice to select suppliers.

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. This leads us to hypothesize that:

H1a. Practices that contain more tacit knowledge will take longer to implement.

H1b. Practices that contain more tacit knowledge are less likely to be satisfied in their initial assessment.

The complexity of knowledge also affects its transferability; in general, more complex knowledge is more difficult to transfer. Aside from the explicitness dimension, complexity can be defined in terms of the volume of information or the degree to which the knowledge is interdependent with other knowledge that is being learned simultaneously (Hansen, 1999). Knowledge that is more interconnected with other knowledge must be understood in larger "chunks" in order to be absorbed effectively, and this makes the learning process more difficult and time-consuming. For example, consider the Practice "Security" (thr04). This Practice involves establishing and implementing procedures to meet security requirements, and is attached to only one other Practice in the model. Contrast the Security Practice with the Practice "Plan Design and Deployment" (sdd03) which involves planning and tracking the design and deployment of the service; it is attached to five other Practices within the Model. To implement this Practice requires some knowledge of all these other practices as well as an understanding of the potential impact of this Practice on the other practices. This Practice is considerably more complex than the Security Practice.

As we have noted, the literature suggests that complex knowledge is more difficult to transfer. Gailbraith (1990) showed that the transfer of more complex manufacturing technology was associated with larger losses in initial productivity than the transfer of simple technology. Ouinjan and Carne (1987) also showed that increased complexity reduced the rate of knowledge diffusion. Thus, we would expect that:

H2a. Practices that are more complex will take longer to implement.

H2b. Practices that are more complex are less likely to be satisfied in their initial assessment.

3.2 Characteristics of the Source

Analyses of knowledge transferability related to the source of knowledge have centered largely on credibility and trust. Sources that are seen as more competent or trustworthy can more easily transfer knowledge to the recipient (Szulanski, 1996). Levin and Cross (2004) found that trust based on competence or benevolence was the primary factor that increased knowledge transfer among individuals with established relationships. Perceived competence in performing a task is often a function of experience performing related tasks. In addition, perceived credibility may be enhanced when the source and recipient have a close relationship. Close relationships between the source and the recipient have repeatedly been shown to increase the ability to transfer knowledge (Uzzi, 1997; Reagans and McEvily, 2003).

The positive impact of credibility and trust has been demonstrated in the acceptance of both product and process innovations (Tsai and Ghoshal, 1998; Hattori and Lapidus, 2004). Tenkasi and Chesmore (2003) found that the presence of a close relationship was an effective predictor of success in organizational process reengineering projects. Trust in the relationship may increase knowledge receptivity particularly under conditions of causal ambiguity, where the precise reasons for the success or failure of a capability in a new setting cannot be precisely determined (Szulanski et al, 2004). In summary, effective knowledge transfer in a process improvement setting should be facilitated when the source is perceived as credible and trustworthy. This suggests that:

H3a. Practices transferred by a less credible source will take longer to implement.

H3b. Practices transferred by a less credible source are less likely to be satisfied in their initial assessment.

3.3 Characteristics of the Recipient

The absorptive capacity of the recipient has been shown to be a primary determinant of the ability to transfer knowledge (Cohen and Levinthal, 1990; Tsai, 2001). This capacity is generally related to the recipient's preexisting stock of knowledge (Szulanski, 1996) because the recipient may be able to associate the new knowledge with what they already know. From an IS implementation perspective, Worley et al. (2005) demonstrated that preexisting business-related knowledge facilitated knowledge transfer during a PeopleSoft implementation. This example may be particularly relevant because the implementation of Enterprise Resource Planning packages such as PeopleSoft usually involves some business process reengineering, similar to a quality methodology. Prior technological knowledge may also lead to a higher degree of post-adoptive use of the technology (Ravichandran, 2005; Lippert and Forman, 2005). In addition, prior experience with a technology has been shown to increase post-adoptive use (Jasperson et al, 2005). Gailbraith (1990) demonstrated that previous experience with the transfer of technology reduced productivity loss during the transfer of new technology. Absorptive capacity may also increase an organization's flexibility in using technology and the pursuit of strategic follow-on investments or refinements (Fichman, 2004b).

The existence of previous related knowledge may not always have a positive effect on knowledge transfer. Szulanski (1996) found that a recipient's ability to retain previously learned knowledge was negatively related to the ability to absorb new knowledge. This may be because the previous knowledge has been embedded into organizational routines and must be unlearned before the new knowledge can be implemented (Rampersad, 2004). Purvis et al (2001) found that adoption of a prior methodology reduced the degree of assimilation of a new methodology. However, compatibility between a prior methodology and a new methodology has been shown to increase the degree of assimilation (Purvis et al, 2001; Reimenschneider and Hardgrave, 2002).

Because the eSCM-SP v2 was designed in part to complement existing methodologies, we believe that the existence of prior methodology knowledge will have an increasing, rather than a decreasing, effect on knowledge transfer.

This study will examine the absorptive capacity of the recipient largely as a function of the recipient's previous experience in implementing quality practices. Prior research has revealed that quality programs such as ISO 9000 increase an organization's ability to codify knowledge at both the individual and organizational levels (Benezech et al, 2001). Mukherjee et al (1998) showed that the implementation of quality practices increased both conceptual learning (assessment and design of abstract concepts) and operational learning (implementing and observing changes). Linderman et al (2004) argue that quality programs help organizations to create and retain future knowledge; the effective creation of this knowledge is a primary driver of the benefits the organization receives from implementing the practices. The codification of knowledge and its embedding into organizational routines has been shown to increase success in the implementation of quality practices such as those embodied in the CMM (Ravichandran and Rai, 2003). The progression of technology usage behaviors into habits or routines is also a significant predictor of post-implementation success (Jasperson et al, 2005). In summary, the existing research suggests that the prior implementation of quality practices would facilitate the implementation of new quality practices, especially when the practices are complementary. However, this relationship has not been explicitly tested using two formalized quality programs.

In our setting, different areas within the research site had varying experience with implementing other quality programs. Prior experience with these programs may affect knowledge transfer within those areas, such that:

H4a: Practices transferred to a recipient with less experience in quality practices will take longer to implement.

H4b: Practices transferred to a recipient with less experience in quality practices are less likely to be satisfied in their initial assessment.

3.4 Characteristics of the Context

Characteristics of the context for knowledge transfer include the organizational structure and environment as well as the presence of specific knowledge transfer mechanisms. Knowledge may be transferred through the movement or sharing of individuals among teams or organizational units (Allen, 1977; Rothwell, 1978). The movement of personnel may be a particularly effective mechanism when the knowledge to be transferred is tacit in nature (Barry and Broadbent, 1987). Knowledge may be transferred through regular meetings or other forms of communication (Darr et al, 1995). It may also be transferred via indirect observation or through direct training, particularly if individuals are in the same location (Argote, 1999). In addition, knowledge may be easily stored and transferred in the form of knowledge management systems or other information repositories (Alavi et al., 2005).

At this research site, several knowledge transfer mechanisms were used. Directed training and other forms of face-to-face communication were a primary component of knowledge transfer. In addition, some quality teams shared members, facilitating the transfer of knowledge across teams. Weekly and bi-weekly meetings also facilitated knowledge transfer between teams and process owners. Finally, the research site made use of two separate knowledge management systems.

The frequency of usage of any knowledge transfer mechanism can be referred to as its intensity of use. While a very high intensity of use 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. Therefore, we would expect that more intense use of these mechanisms would facilitate knowledge transfer, such that:

H5a: Practices will take longer to implement the less intense the use of knowledge transfer mechanisms.

H5b: Practices are less likely to be satisfied in their initial assessment the less intense the use of knowledge transfer mechanisms.

While the intense use of mechanisms should generally facilitate knowledge transfer, some knowledge transfer mechanisms may be even more effective than others depending on the type of knowledge that is being transferred. For knowledge that is tacit and not easily codified, people-based mechanisms (such as direct person-to-person training, face-to-face communication, and sharing team members) are usually more effective methods of transferring knowledge (Nonaka, 1994). In contrast, knowledge that is explicit and can be easily codified may be effectively transferred using knowledge management systems (Zander and Kogut, 1995). This implies that:

H6a: Greater alignment of people-based transfer mechanisms and tacit knowledge will reduce the time to implement a Practice.

H6b: Greater alignment of people-based transfer mechanisms and tacit knowledge will increase the likelihood that a Practice is satisfied in its initial assessment.

H7a: Greater alignment of knowledge management systems and explicit knowledge will reduce the time to implement a Practice.

H7b: Greater alignment of knowledge management systems and explicit knowledge will increase the likelihood that a Practice is satisfied in its initial assessment.

3.5 Relationship Between Stage Completions

To this point, we have been examining knowledge transfer as an antecedent to implementation and certification success. While characteristics of knowledge transfer are expected to affect each of these stages, the specific relationship between the stages remains unclear. Thus far, there remains little understanding in the literature about how the completion of one assimilation stage may influence the completion of subsequent stages. Understanding this relationship may be particularly important for process-driven innovations because greater assimilation of the processes into everyday use is so critical to success.

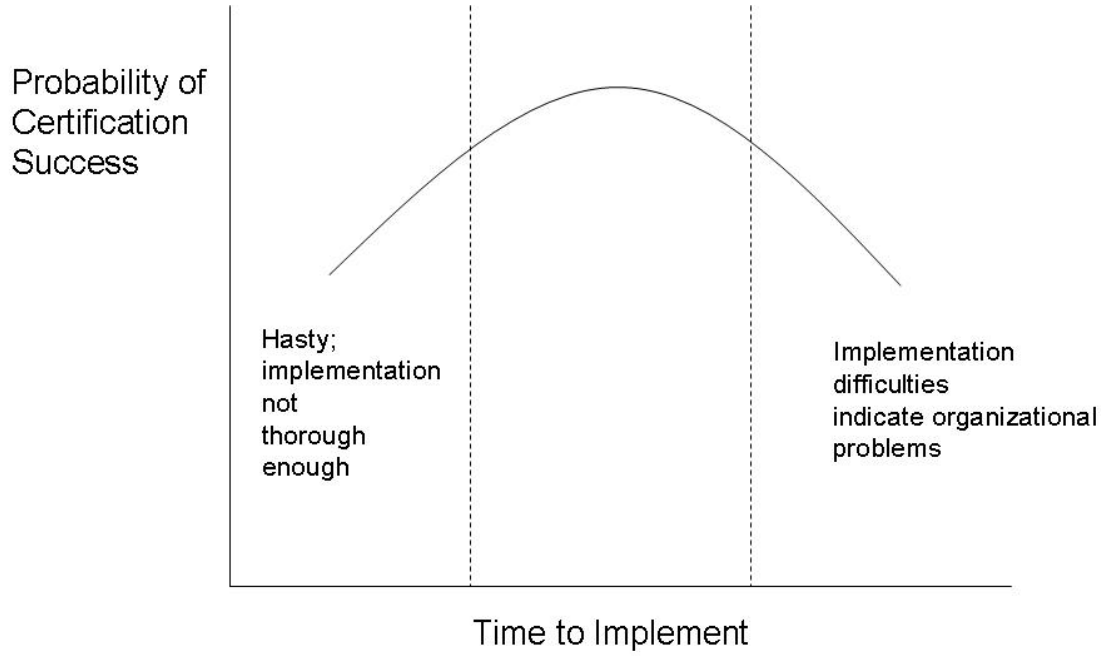
For our model, we contrast eSCM-SP Practices that take a relatively short time to implement with Practices that take a relatively long time to implement. Controlling for other factors (complexity, tacitness, etc.) a shorter implementation cycle may indicate that the implementation stage was performed hastily or in a manner that was not thorough. This would suggest that further assimilation of the Practice to the point of certification would take longer or be less likely to occur. Similar patterns have been documented in the implementation of ERP systems (Robey et al, 2002) and electronic procurement systems (Nahuis, 2004) where an initial implementation stage was decoupled with subsequent organizational process changes. Conversely, an extremely long implementation cycle (controlling for other factors) may indicate that the organization encountered some difficulties implementing the Practice; for example, the processes contained within the Practice may be significantly different from the organization's existing processes. Therefore, a lengthy implementation may also suggest that full assimilation

would be less likely to occur. In contrast, Practices with intermediate implementation times may have a higher rate of certification success.

The preceding discussion suggests a concave (i.e., inverted U-shaped) relationship between the time to implement and the likelihood of certification success (Figure 2):

H8: Practices with relatively short or long implementation times will have a lower likelihood of certification success, than practices with an intermediate implementation time.

Figure 2. Hypothesized Relationship Between Implementation and Certification



4. RESEARCH DESIGN

4.1 Setting

Our study examines detailed project records and documentation on the implementation of the eSCM-SP v2 in an offshore service delivery center of a large, multinational company. This

site has several thousand employees and has received certification in the eSCM-SP v2. Two different units in the offshore delivery center (Financial Services and Human Resource Services) implemented the Model. We evaluate the implementation of the eSCM-SP v2 in each of these organizational units.

4.2 Data and Measures

In the sections below we describe the operationalization of our dependent and independent variables.

4.2.1 Implementation Timeliness. The primary dependent variable used to test hypotheses 1a through 7a is the actual time to implement each Practice within the eSCM-SP, log-transformed. This variable is measured using internal project plan documents from the research site. As noted, the implementation of the Model at the site was conducted in two distinct efforts: one for the financial services business unit and one for the human resources business unit. We have a total of 74 observations for each implementation effort, covering each of the 48 Level 2 and 26 Level 3 Practices. Due to underlying differences between the two efforts, we will analyze the data separately for each. For example, most of the participating resources were different between the projects, and the business scope for the financial services unit was larger than that for the human resources unit. In addition, the human resources implementation effort was initiated after the financial services effort was completed, so learning effects may be present.

4.2.2 Certification Success. The primary dependent variable used to test hypotheses 1b through 7b will be whether or not each Practice receives a Satisfied rating in its initial evaluation. Practices may be deemed Satisfied, Not Satisfied, Partially Satisfied, or Not Applicable. A Practice may be deemed Not Applicable, for example, if it does not relate to

delivered services; Not Applicable Practices are dropped from the analysis. As with hypotheses 1a through 7a, we have a total of 74 observations for each project.

4.2.3 Independent Variables.

4.2.3.1 Tacitness. (TACIT) Each Practice was assigned a tacitness rating from one (low) to three (high) by a subset of the authors. Guidelines for coding the level of tacitness were derived primarily from three factors: 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- or service-level requirements (Sternberg, 1986). For example, each Practice within the eSCM-SP v2 contains between three and fifteen documentation activities. The description of one activity in the Knowledge Management area (knw02.b1) reads "Identify the information needed by personnel to perform their work". This activity contains a high level of tacit knowledge because it requires a prior understanding of relevant business processes and the types of information and personnel that are needed to execute those processes. In contrast, the activity "Provide the information to appropriate personnel" (knw02.b8) is a more automatic task that requires little or no outside information, given the fact that appropriate personnel and information have already been identified. Practices with more activities requiring tacit knowledge would be more likely to receive high tacitness ratings. The tacitness ratings were averaged to generate a mean tacitness score for each Practice. Interrater agreement was calculated using the R_{WG} index (James et al, 1984); the mean correlation was satisfactory at 0.66.

4.2.3.2 Complexity. (COMPLEXITY). The primary measure of complexity used is the degree to which the Practice is related to other Practices within the Model. This level of relatedness was calculated using UCINET (Borgatti et al, 2002), a prominent social network

analysis tool. A map of dependencies among Practices was generated by two of the eSCM-SP v2 authors. Based on these dependencies, UCINET was used to generate a number of centrality measures indicating the degree of interrelatedness for each practice (node) to all others in the model (network). The complexity measure used for this study is Eigenvector Centrality, which indicates 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. A greater number of ties indicates a higher level of complexity.

4.2.3.3. Credibility. (CRED) Traditional measures of source credibility include organizational tenure or job title. However, in this case there is little variation among implementation team members; many were hired into the organization specifically for the eSCM-SP implementation. Instead, we used total time spent on the implementation project among team members implementing a Practice as a proxy for credibility. For each Practice, we calculated (in days) the amount of time the responsible team member had spent on the project before starting the implementation of that Practice. It is possible that this measure does not identify only credibility but also other factors that may affect knowledge transfer such as individual learning. As a robustness check, we also tested a binary measure of credibility – a variable indicating whether the resource was hired for the implementation or had worked at the organization previously. The use of this variable did not qualitatively change the results.

4.2.3.4. Prior Quality Practices. (CMMI, EXPERIENCE) The effect of prior quality practices on model implementation and assimilation has two dimensions. First, each organizational unit within the research site had adopted at least one and sometimes several quality methodologies prior to involvement with eSCM-SP v2. Second, each Practice within the

model is designed to be compatible with an existing quality methodology or set of methodologies. Binary variables were generated for each methodology with 0 indicating no prior quality practices in the recipient's work unit and 1 indicating prior quality practices in the recipient's work unit. In addition, binary variables were generated for each methodology and Practice combination indicating partial or full compatibility.

The impact of quality practices from prior methodologies is investigated in two ways. First, we test for differences based on whether the Practice is compatible with the CMMI or SW-CMM methodologies. CMMI and SW-CMM were chosen because they are widely used within IT-enabled sourcing companies; in addition, significant variation among team members at the research site existed for these two programs. Second, we test for the effects of absorptive capacity based on whether the implementation team member has direct experience with CMMI or SW-CMM. In many instances, team members with prior experience in these methodologies participated in the implementation of Practices that are explicitly compatible with these methodologies. These instances are indicated with a binary variable formed by multiplying together the compatibility indicator for each Practice with the experience indicator for each team member. Individuals experienced with CMMI or SW-CMM should be expected to more readily implement or assimilate Practices that are compatible with these methodologies.

4.2.3.5. People-based Knowledge Transfer. (TEAM_SHARE) Many implementation team members participated in multiple teams, enabling knowledge transfer across Practices. A binary variable was created for each Practice indicating whether members of its implementation team had also participated in other teams. This variable is analyzed both as a main effect and as an interaction with tacitness.

4.2.3.6. Knowledge Management Systems. (KM_DOCS) The implementation site used one knowledge management system (KMS) as a prominent tool during the eSCM-SP implementation process. The number of documents in this system related to each eSCM-SP Practice was tabulated in order to generate a count for each Practice. Although the number of documents present for each Practice does not necessarily indicate ongoing usage of the system, this variable serves as a useful proxy for overall usage. This variable is analyzed both as a main effect and as an interaction with tacitness.

4.2.3.7. Control Variables. (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 more temporal in their use. Thus, the implementation outcomes for ongoing practices may differ from practices in other phases of the sourcing life cycle, and we control for these effects.

4.2.4 Statistical Model and Analysis. The data was analyzed in two phases: first for the implementation stage, and then for the certification stage. The fully specified linear model for the implementation stage for Practice *i* is

$$\begin{aligned} \mathbf{LOGDURATION_i} = {} & \boldsymbol{\beta_0} + \boldsymbol{\beta_1}\mathbf{TACIT_i} + \boldsymbol{\beta_2}\mathbf{COMPLEXITY_i} + \\ & \boldsymbol{\beta_3}\mathbf{TIME\_ON\_PROJECT} + \boldsymbol{\beta_4}\mathbf{CMMI_i} + \\ & \boldsymbol{\beta_5}\mathbf{EXPERIENCE} + \boldsymbol{\beta_6}\mathbf{KM\_DOCS} + \\ & \boldsymbol{\beta_7}\mathbf{TEAM\_SHARE} + \boldsymbol{\beta_7}\mathbf{TACIT_i} * \mathbf{TEAM\_SHARE} + \\ & \boldsymbol{\beta_8}\mathbf{TACIT_i} * \mathbf{KM\_DOCS} + \boldsymbol{\beta_9}\mathbf{ONGOING_i} + \boldsymbol{\varepsilon_i} \end{aligned} \quad \mathbf{(1)}$$

We use a probit model to examine the factors influencing likelihood that the practice is satisfied in its initial assessment. In particular, we assume that the likelihood of satisfaction of Practice *i* can be written as:

$$\begin{aligned} \mathbf{SATISFIED_i} = \quad & \beta_0 + \beta_1 \mathbf{TACIT_i} + \beta_2 \mathbf{COMPLEXITY_i} + \\ & \beta_3 \mathbf{TIME\_ON\_PROJECT} + \beta_4 \mathbf{CMMI_i} + \\ & \beta_5 \mathbf{EXPERIENCE} + \beta_6 \mathbf{KM\_DOCS} + \beta_7 \mathbf{TEAM\_SHARE} + \\ & \beta_8 \mathbf{TACIT_i * KM\_DOCS} + \beta_9 \mathbf{TACIT_i * TEAM\_SHARE} + \\ & \beta_{10} \mathbf{ONGOING_i} + \\ & \beta_{11} \mathbf{LOGDURATION_i} + \\ & \beta_{12} \mathbf{LOGDURATION^2_i} + \varepsilon_i \end{aligned} \qquad \textbf{(2)}$$

Assuming the error terms are independent and identically distributed, we can estimate the parameters of the model using a probit.

For the models testing certification success, one concern might be that the finish date of the initial implementation would affect the likelihood of receiving a Satisfied rating. Presumably, eSCM-SP Practices that have implementations that finish earlier would have more time to become embedded into everyday use, promoting a greater likelihood of success. However, this is controlled for in part by including the logged duration as one of the dependent variables in the probit models, so the finish date is not specified separately.

5. RESULTS AND DISCUSSION

5.1 Time to Implement

Coefficients and standard errors for linear regression analyses are reported in Table 1.

Table 1: Time to Implement Results

Variable	Hypothesis	Financial Services	Human Resources

TACIT	1a	-0.023 (0.074)	-0.161* (0.065)
COMPLEXITY	2a	0.004 (0.003)	0.009** (0.003)
CRED	3a	0.009** (0.001)	-0.027~ (0.015)
CMMI	4a	-0.176* (0.075)	-0.182 (0.114)
EXPERIENCE	4a	0.188 (0.164)	0.251* (0.110)
TEAM_SHARE	5a	-1.329** (0.128)	0.391** (0.104)
KM_DOCS	5a	0.003 (0.009)	0.012 (0.009)
TEAM_SHARE_X_TACIT	6a	0.142 (0.144)	-0.104~ (0.064)
KM_X_TACIT	7a	0.001 (0.017)	0.006 (0.014)
ONGOING		-0.058 (0.106)	
Constant		4.722** (0.126)	3.321** (0.107)
Observations		74	74
R-Squared		0.84	0.46

~ significant at 10% level; * significant at 5% level; ** significant at 1% level

Knowledge Explicitness. For both the Financial Services and Human Resources implementations, as tacitness increased, the time to implement the Practice decreased. This result is in the opposite direction than was predicted in hypothesis 1a. In addition, for the Human Resources implementation this relationship was statistically significant. Therefore, hypothesis 1a is not supported.

This finding is somewhat surprising because the positive link between knowledge explicitness and transferability has been well established in prior literature. It does appear that the amount of explicitness within each Practice varies considerably, both by Capability Area and Sourcing Life-cycle. This coefficient is relatively small, for example, a change from a 1 (low)

rating to a 3 (high) rating would result in a decrease in implementation time of just 1 day. It may be that since the steps within each Practice are codified each Practice is by nature somewhat explicit and that the variation in tacitness that does exist is immaterial.

Knowledge Complexity. For the Financial Services implementation, as complexity increased, the time to implement the Practice also increased, but this result is not statistically significant. For the Human Resources implementation, as complexity increased, the time to implement increased as well, and the relationship is statistically significant at the .01 level. Therefore, we have partial support for hypothesis 2a. Increased linkages between the Practices appeared to make the implementation of those Practices more difficult and time-consuming.

Source Credibility. For both the Financial Services and Human Resources implementations, the time to implement the Practice decreased the longer the source (implementation team member) had served on the project. This result is statistically significant at the .01 level for the Financial Services implementation and marginally significant for the Human Resources implementation. Therefore, hypothesis 3a is fully supported. The possibility that an implementation team member is credible and trustworthy is critical to success, particularly when the project involves uncertainty. Changes to business processes or roles such as the ones prescribed in the eSCM-SP v2 are often stressful for employees, so trust in the implementation team's abilities are particularly important.

Prior Quality Programs. For the Financial Services implementation, compatibility between the Practice and CMMI / SW-CMM reduced the time to implement; this result is statistically significant. Curiously, this reduction was weakened when the implementation team member also had direct prior experience with these methodologies. Results for the Human Resources implementation ran in the same direction. Compatibility with CMMI / SW-CMM

reduced implementation times while direct experience with these methodologies increased implementation times; the effect of experience was statistically significant. Therefore, support for hypothesis 4a is mixed. Compatibility with these methodologies reduced implementation time, but prior experience with the methodologies increased it.

The opposing signs on the coefficients of these variables provide an interesting contrast. Prior research (Purvis et al, 2001; Reimenschneider and Hardgrave, 2002) showed that compatibility between a new methodology and an existing methodology would promote assimilation; that conclusion is supported here. Since all personnel at the site had experience with prior quality programs, to an extent they had all been exposed to a "process-driven" method of working, Practices that were compatible with an existing methodology may have seemed more familiar. However, in those areas where personnel were *most* familiar with the methodology – those experienced with CMMI or SW-CMM – the implementation times actually increased. This may support Szulanski's (1996) finding that some processes may need to be unlearned before others are learned (especially when new and old processes are not complementary), and this may take additional time. In this case, we only had data to specifically test experience with CMMI and SW-CMM, and this experience was confined to only a few areas. Further testing with other methodologies will be necessary to fully understand this relationship.

Knowledge Transfer Mechanisms. For the Financial Services implementation, when team members were shared across teams the time to implement was reduced. This result was statistically significant at the .01 level. For the Human Resources implementation, the sharing of team members actually increased the time to implement; this result was also statistically significant at the .01 level. Therefore, we have partial support for hypothesis 5a. Differences in the effects of team sharing between the Financial Services and Human Resources

implementations are somewhat surprising and bear further investigation. Because implementation times per Practice were generally lower for the Human Resources implementation, it is possible that the coordination costs relative to the total duration did not outweigh the benefits of knowledge transfer via personnel rotation. Understanding the exact nature of this relationship may be important to future implementers of quality models such as the eSCM-SP. For large implementation projects, the division of the project team into groups or sub-teams is a common practice. Sharing team members across teams may increase knowledge transfer among teams and reduce the time required to implement, but only if it is done efficiently.

For both the Financial Services and Human Resources implementations, the use of KMS increased implementation times, although the effect was not statistically significant. The magnitude of the coefficient in both cases was relatively small, suggesting that the increased implementation time may have simply resulted from the additional effort needed to produce the documents and enter them into the KMS. The interesting issue then becomes whether the short-term costs of entering the information would be outweighed by the long-term benefits of having the information available in the system. A longitudinal analysis of the research site will probably be needed in order to answer this question effectively.

People Based Mechanisms. For the Financial Services implementation, the interaction between tacitness and team sharing was positive, suggesting that as team sharing increased for Practices that contained a higher degree of tacit knowledge the implementation time also increased. Although this relationship was not statistically significant, it ran against expectations. For the Human Resources implementation the interaction between tacitness and team sharing was negative, suggesting that as team sharing increased for Practices that contained a higher

degree of tacit knowledge the implementation time decreased. These results were in the expected direction and marginally significant (at the 0.10 level). Therefore, hypothesis 6a was weakly supported. The inconsistency of these findings is not surprising given the counterintuitive relationship between tacitness and implementation time that has already been discussed. A further understanding of the differences between the Financial Services and Human Resources implementations would probably help to elucidate this discrepancy.

Knowledge Management Systems. For both the Financial Services and Human Resources implementations, the interaction between tacitness and KMS use was positive, suggesting that as KMS usage increased for Practices that contained a higher degree of tacit knowledge the implementation time also increased. Although this relationship ran in line with expectations, the magnitude of the coefficient was small and not statistically significant. Therefore, hypothesis 7a was not supported. Similar to hypothesis 6a, the inconsistency of these findings is not surprising given the counterintuitive relationship between tacitness and implementation time that has already been discussed.

5.2 Certification Success

In this section we discuss the results our of certification success model. Marginal effects and standard errors for all probit analyses are reported in Table 2.

Table 2: Certification Success Results

Variable	Hypothesis	Financial Services	Human Resources
TACIT	1b	-0.130 (0.092)	0.012 (0.079)
COMPLEXITY	2b	-0.001 (0.005)	-0.005 (0.011)
CRED	3b	-0.000 (0.002)	-0.257 (0.389)
CMMI	4b	-0.052 (0.076)	-0.960~ (0.167)

EXPERIENCE	4b	(Dropped)	0.125 (0.265)
TEAM_SHARE	5b	-0.450 (0.384)	0.197 (0.301)
KM_DOCS	5b	-0.002 (0.017)	-0.009 (0.021)
TEAM_SHARE_X_TACIT	6b	0.058 (0.160)	0.091 (0.191)
KM_X_TACIT	7b	0.025 (0.028)	0.026 (0.045)
LOGDURATION	8	-6.247** (2.195)	-30.202* (41.335)
LOGDURATION_2	8	0.789** (0.276)	4.487* (6.135)
ONGOING		-0.038 (0.037)	
Observations		74	74
Pseudo R-Squared		0.28	0.74

~ significant at 10% level; * significant at 5% level; ** significant at 1% level

The results presented in Table 2 demonstrate that there is virtually no significant relationship between any of the knowledge transfer factors in the model and certification success (hypotheses H1b through H7b). Compatibility between the eSCM-SP and the CMMI was only marginally significant and only for the Human Resources implementation. The fact that many of the examined knowledge transfer factors affected implementation times but not certification is somewhat surprising. Because implementation is a more directed, short-term process than assimilation and certification, knowledge transfer characteristics such as complexity and personnel movement may play a more prominent role.

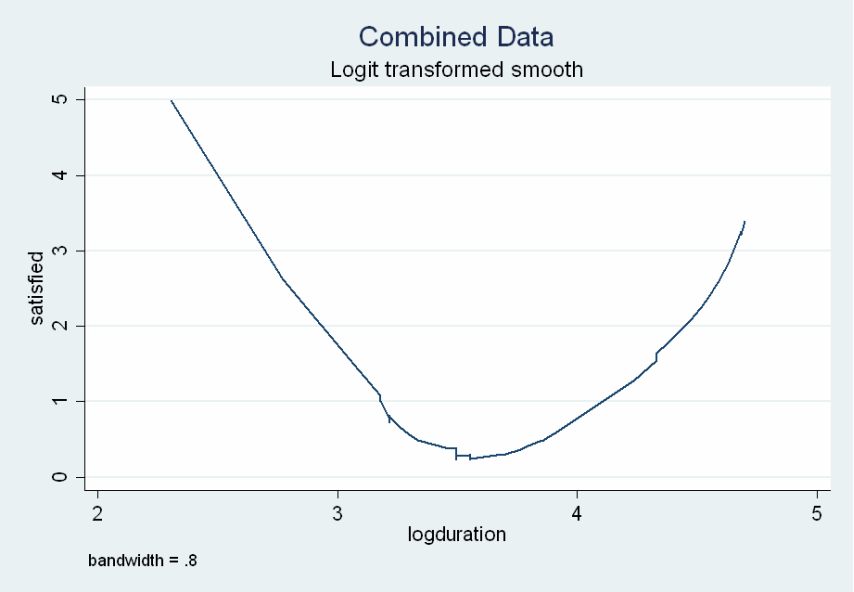
5.3. Relationship Between Stage Completions

Before introducing a quadratic term for logged duration into the probit models, we wanted to examine the underlying data to ensure that the assumption of a quadratic relationship was appropriate for our data. To perform this analysis we used the logit method of the Lowess

smoothing function within Stata. This function graphs a locally weighted regression of a single independent variable on the dependent variable (Royston, 1991). Analyses on the Financial Services dataset, the Human Resources dataset and the combined dataset all demonstrated a curvilinear relationship between certification success and logged duration.

For both the Financial Services and Human Resources efforts, the relationship between implementation duration and certification success appeared to be a U-shaped curve, but in the opposite direction from the hypothesis. Figure 3 shows this data for the combined dataset of the Financial Services and Human Resources implementations (graphs of the individual implementations yield qualitatively similar results). The linear term was negative and statistically significant while the squared term was positive and significant. This suggests that Practices with either short or long implementation durations were more likely to attain a Satisfied rating while Practices with intermediate durations were less likely. For the combined dataset, the same relationship also occurred and was statistically significant. Therefore, we must reject hypothesis 8.

Figure 3. Actual Relationship Between Implementation and Certification



To better understand why this inverse relationship exists, we broke the data into three groups: a left and right portion (low and high implementation durations, respectively) and a central portion with intermediate implementation times. We then performed some exploratory analyses of each of these regions for Financial Services and Human Resources separately. For Financial Services, the mean tacitness and complexity scores were highest in the middle region and lowest in the left region, although this difference in means was not statistically significant ($p = 0.16$). In addition, the middle region had a significantly higher proportion of Level 3 Practices ($\chi^2 = 5.05$, $p = 0.08$). Level 3 Practices are geared towards managing organizational performance, and generally require the greatest amount of change to organizational processes and structures. The presence of these necessary changes, combined with a higher level of tacitness and complexity, may provide a plausible explanation as to why these Practices were less likely to become fully assimilated. In the left-side region, the main differentiating factor is the Sourcing Life-cycle. For the Financial Services business unit, all of the low-duration Practices belong to the Completion, Initiation or Delivery phases. According to the eSCM-SP v2 developers, most of these Practices contain processes or procedures that most experienced outsourcing providers would already be doing prior to implementation. These Practices may constitute "low hanging fruit" for that business unit – Practices that are easily implemented and certified.

For Human Resources, tacitness and complexity scores increased significantly going from the left to the middle region and from the middle to the right region, suggesting the counterintuitive notion that Practices that are more complex overall would be more likely to become certified. In addition, the sharing of members across teams is lower in this region. This is easily reconcilable with the fact that implementations in this region take longer, but not with

the fact that certification is more likely. However, we also discovered that the implementation teams working on the Practices in this region had fewer Practices assigned to them on a per-resource basis. This raises two possibilities. First, the management team at the site may have recognized that these Practices would be more difficult and consequently assigned what they believed to be the most capable resources to these Practices. These capable resources would do a better job of ensuring that the implementation and certification of these Practices was performed in a satisfactory manner. At the same time, because these Practices were more difficult they would take longer, resulting in higher duration times. A second explanation may result more from the Practice itself. Because these Practices are more tacit, they are more likely to be dependent on organizational-level knowledge coming from outside of the implementation team. Because they are more complex, they are also more likely to have ties to other Practices that are being concurrently implemented. In short, both tacitness and complexity may necessitate that more individuals from either the external organization or other implementation teams are involved in the implementation of the Practice in some way. This may create an implicit system of checks and balances, leading to a higher level of thoroughness that would increase the likelihood of certification. Level 3 Practices were spread evenly throughout the regions for Human Resources, so the effect of increased organizational change as described with the Financial Services implementation would not be present in a particular region. In addition, some of the necessary organizational process changes had already taken place as part of the Financial Services implementation, so any effects from unobserved organizational complexity would be less likely to exist.

These differing explanations for Financial Services and Human Resources are consistent with the comments of one of the key quality team members at the research site. In his view, the

implementation teams tended to "knock out" the Practices that were perceived to be easier and focus greater attention on Practices that were perceived to be more difficult. As a result, the Practices that were of an intermediate difficulty tended to get overlooked or postponed until later stages of the implementation when the certification deadline was looming. This may have precipitated a hastier, less thorough implementation and a lower likelihood of assimilation.

It is possible that the logged duration variable may be partially capturing the effects of the implementation finish date; in other words, the left-side Practices may be more successful at certification because their implementations finished earlier and they had more time to become institutionalized. However, this reasoning would not work for the right-side Practices, since they would also have a high probability of certification success in spite of the fact that they had less time to become institutionalized. If anything, the implicit inclusion of the implementation finish date via duration would bias the results away from being able to detect this U-shaped relationship.

6. CONCLUSION

This research is innovative in a number of ways. First, we integrate previous research in knowledge management and transfer, quality management practices, and information systems implementation. In contrast to prior work which utilized survey methods to capture a broad cross-section of users, this research design involves the in-depth investigation of implementation practices within one large service provider. While this potentially limits our ability to generalize results, it enables us to control for cross-sectional differences across firms and to isolate how differences in the characteristics of knowledge, source, and recipient interact with knowledge transfer mechanisms to impact implementation success. Second, the research setting is novel. Services science is an area that is capturing increasing interest in business and academia (Lohr

2006), and major IT firms such as IBM have identified services sciences as a priority area for research and hiring (Wladawsky-Berger 2006). The eSCM-SP v2 is a relatively new framework but has already received much attention from outsourcing practitioners and seems well positioned to become a widely adopted standard. Understanding the issues that affect the implementation of models such as the eSCM-SP and its performance implications is important from the perspective of both research and practice. Finally, our study leverages several primary data sources: detailed implementation project schedules and documentation collected from one early user of the eSCM-SP v2.

In this study we have uncovered several notably counterintuitive results that bear further investigation. Is tacitness a meaningful construct to relate to a quality methodology whose purpose is to codify information and processes? Based on previous research and our knowledge of such methodologies we believe that it is, but the results of our analysis are somewhat equivocal. The existing literature on tacitness does not possess a general instrument that can be used to measure it; measures of tacitness generally seem to be context-specific. The development of an instrument or scale that can be used to assess the tacitness or codifiability of quality methodologies in general would be useful for both researchers and practitioners. In addition, prior research into the effect of previous quality methodologies on the acceptance of new methodologies is somewhat mixed, and the results as presented here have not contributed much to the resolution of this issue. More detailed measures with a greater variety of accepted methodologies are needed. A greater understanding of this issue would aid both practitioners and researchers who may want to develop or refine a quality methodology for a specific purpose.

IS research examining the different assimilation stages of innovations, technologies, and methodologies is very robust and has a history that spans the IS literature. However, there exists

relatively little research examining the *transitions between* different assimilation stages and the influence that the completion of one stage may have on another. Intuitively, one would expect that if one stage is delayed or takes an excessive amount of time, future stages would also be delayed or take a longer amount of time. In actuality, our results show that this relationship is not that simple; the difficulty of an early stage is not a linear predictor of success in a later stage. Moreover, our results were in exact opposition to what seems a reasonable hypothesis, emphasizing the potential complexity of this relationship. It is possible that the relationship between stages is heavily mediated by organization-level factors that may make the development of a general model somewhat difficult. Additional research is needed to understand this important dynamic.

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