Spring 2013

Implicit Knowledge Transfer Use in Virtual Healthcare Information Systems Project Teams and Its Association With Successful Project Outcomes

Nadene A. Chambers
DePaul University, nacpao@yahoo.com

IMPLICIT KNOWLEDGE TRANSFER USE IN VIRTUAL HEALTHCARE INFORMATION SYSTEMS PROJECT TEAMS AND ITS ASSOCIATION WITH SUCCESSFUL PROJECT OUTCOMES

BY

NADENE ALECIA CHAMBERS

A DISSERTATION SUBMITTED TO THE SCHOOL OF COMPUTING, COLLEGE OF COMPUTING AND DIGITAL MEDIA OF DEPAUL UNIVERSITY

IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF

DOCTOR OF PHILOSOPHY

DEPAUL UNIVERSITY

CHICAGO, ILLINOIS

2013

DePaul University
College of Computing and Digital Media

Dissertation Defense Report

I have read the dissertation written by:

Name NADENE CHAMBERS SSN 091-64-5736

(***To the advisor***): The following dissertation title is identical to the one on the title page of the draft returned to the student. This title is approved by me and it is to be used when the final copies of the dissertation are prepared.

Title of dissertation:

IMPLICIT KNOWLEDGE TRANSFER USE IN VIRTUAL HEALTHCARE INFORMATION SYSTEMS PROJECT TEAMS AND ITS ASSOCIATION WITH SUCCESSFUL PROJECT OUTCOMES

Advisor's Initials LVK

☒ Acceptable. Candidate may proceed to make final copies

☐ Pass, with revisions stated below:

☐ Not Acceptable. Please explain:

LINDA KNIGHT	Linda Knight	5/3/2013
Advisor (Print Name)	Signature	Date
THERESA A STEINBACH		05.03.13
1st Reader (Print Name)	Signature	Date
RAFFAELLA SETTINI		5/3/2013
2nd Reader (Print Name)	Signature	Date
IDA M. ANDROWICH		3 May 2013
3rd Reader (Print Name)	Signature	Date
TOM MUSCARELLO	Tom Muscarello	5/3/2013
4th Reader (Print Name)	Signature	Date
APRIL H REED	April H Reed	5.3.13
5th Reader (Print Name)	Signature	Date

IMPLICIT KNOWLEDGE TRANSFER USE IN VIRTUAL HEALTHCARE INFORMATION SYSTEMS PROJECT TEAMS AND ITS ASSOCIATION WITH SUCCESSFUL PROJECT OUTCOMES

ABSTRACT

This dissertation focuses on implicit knowledge transfer in virtual information systems project teams in the healthcare industry and the association of such knowledge transfer with successful projects. The use of virtual teams is expected to continue to increase, particularly because of the passage of the HITECH Act of 2009, calling for the computerization of medical records in the United States. Although the healthcare industry has had experience with virtual teams and the use of those teams is expected to increase, there has been little research done on how implicit knowledge transfer is linked to successful projects.

A successful IT project is one that completes on time, on budget, meets requirements and user specifications, and satisfies stakeholders. This study identified and evaluated implicit knowledge transfer techniques, determining which forms of knowledge transfer were most often associated with successful projects. Four techniques were studied: communities of practice (CoP), after action reviews (AAR), mentoring and storytelling. Of these techniques, CoP and storytelling were most often associated with project success in four of the five success measures (ie. on time, meets requirements and user specifications, satisfies stakeholders). Additionally, the study evaluated when implicit knowledge

transfer techniques were used (ie. “initiate”, “plan”, “execute”, “control”, “close” project phases) and project participant types (ie. team members, team leads, project managers and vendors). The study is the first to examine all these project dimensions (ie. project success, project type, project phase, and project participant types) and consider the interrelationships among these dimensions, as well as project success.

Recommendations based on study results include:

a) Storytelling and CoP are technique types that healthcare organizations should consider using because they were shown by this study to have statistically significant associations with success in virtual IT project teams in enterprise and non-enterprise projects.
b) Healthcare organizations may wish to begin the use of storytelling and CoP in the “initiate” phases of their projects because these techniques were shown by this study to be positively associated with project success when started in this phase.
c) CoP is a technique that should be strongly considered, since when used early and by the full project team, CoP was found by this study to be significantly associated with project success.

.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

Terminology

The following definitions will be useful for understanding key concepts as used in this document.

After Action Review (AAR): an implicit knowledge transfer technique where the team that worked on a project reflects on and learns from its experiences.

AHIMA: American Health Information Management Association. This organization has over 59,000 members specializing in privacy and security, coding, electronic health records, reimbursement, compliance, etc. The organization also has a community of practice for its membership.

CDTE: last completed distributed team experience. This refers to the last project that respondents worked on that had some members non-collocated.

Communities of practice: (CoP) groups that are comprised of any combination of novices, mid-level professionals and experts who share their expertise on various job-related subjects. It is a method used in implicit knowledge transfer.

Declarative knowledge: factual knowledge; "things/events/processes", their attributes, and the relations among these "things/events/processes"; "*know what*".

EHR/EMR: Electronic Health Record/Electronic Medical Record. This is a computerized legal medical record created in an organization that delivers medical care, such as a hospital, hospital system or physician's office.

Explicit knowledge: documented knowledge, or knowledge that has been written down. It is often referred to as "knowing about" something (as compared to tacit knowledge which cannot be written down, and implicit knowledge that resides in the human mind but not yet made explicit).

HIMSS: Health Information and Management Systems Society. HIMSS is a membership organization comprised of over 470 corporate members and more than 85 not-for-profit organizations. The organization represents over 30,000 individual members.

HITECH Act of 2009: a component of the American Recovery and Reinvestment Act of 2009. HITECH is intended to ensure that all of the medical records in the United States are computerized, in an attempt to minimize waste in the system and reduce costs.

Implicit knowledge: knowledge that resides in the human mind that is not yet explicit, but which could be made explicit (as compared to explicit knowledge, which is knowledge that has been written down, and tacit knowledge that cannot be written down).

Mentoring: an implicit knowledge transfer technique in which a more senior professional (mentor) transfers critical work-related knowledge to a less-senior professional (protégé) by sharing the mentor's experiences with the protégé.

PMI: Project Management Institute. An organization comprised of over 500,000 members in all facets of project management.

Project Manager: one who is responsible for ensuring that the Project Team completes the project; develops the Project Plan with the team and manages the team's performance of project tasks; secures acceptance and approval of deliverables from the Project Sponsor and Stakeholders; is responsible for communication, including status reporting, risk management, escalation of issues that cannot be resolved in the team, and ensuring the project is delivered in budget, on schedule, and within scope.

Storytelling: an implicit knowledge transfer technique which is a narrative of past management actions and employee interactions that relates those activities in an engaging and entertaining way. Its purpose is to pass knowledge on in order to motivate action or communicate cultural values.

Successful IT project: one that completes on time, on budget, meets requirements and user specifications, satisfies customers and satisfies management.

Tacit knowledge: knowledge that is neither explicit nor implicit. It is the knowledge that is not written down and that cannot be written down. It is often referred to as "knowing how" to do something (as compared to explicit knowledge, which is written down, and implicit knowledge that resides in the human mind but has not yet been made explicit).

Team Lead: one who provides task and technical leadership on a project by facilitating problem solving and focusing the team on the tasks.

Team Member: one who is responsible for executing tasks and producing deliverables as outlined in the project plan and directed by the Project Manager, at whatever level of effort or participation has been defined for them.

Virtual Team: is defined on a continuum where, at a minimum, one or more members of the team consistently work in a different geographic location than the rest of the core team, and at a maximum, all members of the team are geographically dispersed with no defined "core".

CHAPTER 1 INTRODUCTION

Overview

This study examined the effects of implicit knowledge transfer techniques on virtual project teams, particularly as they are associated with successful IT projects. Specifically, the study asked whether or not using the "storytelling", "mentoring", "communities of practice" and "after action reviews" implicit knowledge transfer techniques were associated with virtual IT project success.

Information technology (IT) implementations have had a history of failure and have been well studied in the project management literature (Barker & Frolick, 2003; Ginzberg, 1981; Heeks, 2002; G. Pan, Hackney, & Pan, 2008). Virtual teams have been used widely in IT implementations (R. Evaristo & van Fenema, 1999; Kanawattanachai & Yoo, 2002; Massey, Montoya-Weiss, & Hung, 2003; Powell, Piccoli, & Ives, 2004) as they provide access to project manpower and expertise over a wide geographical area. Virtual teams have been shown to suffer from a number of risks including communication risks (DeSanctis & Monge, 1998; Grabowski & Roberts, 1998; Robey, Khoo, & Powers, 2000; Shachaf, 2008) which may potentially jeopardize project success. The combination of IT project implementation failures and communication risks on virtual IT project teams creates a compelling case for research, but understanding the types of techniques that are most often associated with successful project outcomes can offer the project management community insights on how to

approach future IT implementation projects.

The industry that served as the backdrop for this research is the healthcare industry. Because of its size, complexity, and the recent passage of the Health Information Technology for Economic and Clinical Health (HITECH) Act of 2009, a bill enacted with the intention of ensuring that all medical records in the United States are computerized in an attempt to minimize waste in the system and to reduce costs, this industry was appropriate for study. Healthcare has increased its IT project implementations as a result of the HITECH Act, and has been using virtual IT project teams. It is an important industry for study because IT project failures in the healthcare industry can have substantial ramifications ranging from debilitating financial losses to patient death. The potential benefit of understanding which knowledge transfer techniques are associated with successful projects, an understudied area in the healthcare industry, offers additional motivation for this research.

Background and Research Problem Introduction

In the last two decades, the use of virtual teams has become commonplace in large part because companies have been working to find ways to control costs and assemble the expertise needed for specific projects by locating those resources external to the organization. This means that the study of virtual teams is becoming increasingly important to businesses. Major companies are documented to have used virtual teams (ie. teams where one or more members works in a separate location from other members of the team), including Sun Microsystems, Electronic Data Interchange, Eastman Chemical Company,

Hewlett Packard, Intel, Microsoft, Apple Computer and NCR (Lipnack & Stamps, 1997), (Schindler & Eppler, 2003) to name a few. Whether called "virtual teams", "distributed teams" or "non-collocated teams", these groups have become a mainstay in today's businesses. They are seen as enabling organizations to become more flexible by providing increased productivity of teams in environments where teamwork would have once been impossible (ie. when there is a geographical distance separating team members). They are also a factor in aiding downsizing organizations to find the skills and expertise necessary, wherever those skills and expertise may exist globally (Townsend, DeMarie, & Hendrickson, 1998). Outsourcing is closely related to the performance of virtual teams, since the outsourcing company and its outsourced providers need to cooperate remotely (Xue, Sankar, & Mbarika, 2004/2005).

As a result of the increased use of virtual teams in projects some project management risks have become more important, particularly those related to communication (Reed & Knight, 2009). Project risk occurs when the successful transfer of crucial details between individuals does not take place. This communication challenge is exacerbated by the lack of knowledge transfer in virtual teams, particularly that of implicit knowledge transfer (Chua, 2009). This is a crucial area for study particularly because knowledge and knowledge transfer have been associated with providing firms an essential source of gaining a competitive advantage (Al-Hawamdeh, 2002; Osterloh & Frey, 2000). Studies involving knowledge transfer have tended to be focused at the organization level rather than the individual level. Such studies include the study of knowledge

transfer and multinational corporations (Minbaeva, 2005), knowledge transfer in domestic corporations (Dixon, 2000), and knowledge transfer and technology (Lee & Lee, 2000). However, it is at the individual level (where team members, project managers and team leaders interact) that most knowledge transfer takes place; thus there is a need for study of individual levels of knowledge transfer.

The shaded area in Figure 1 depicts the portion of the Venn diagram representing the area covered by the present research.

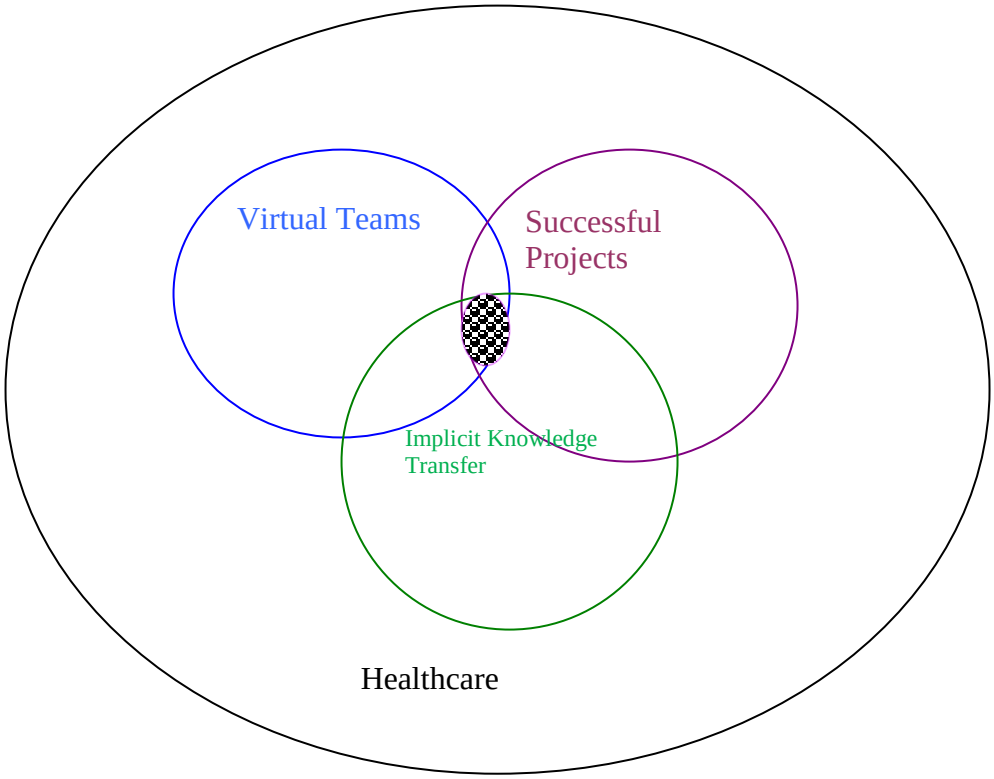


Figure 1: Areas covered by present research (Author's image)

Problem Statement

The researcher proposed to identify and evaluate implicit knowledge transfer techniques in virtual information systems project teams in healthcare to determine which forms were most often associated with successful projects. A successful IT project is defined as one that completes on time, on budget, meets requirements and user specifications, satisfies customers and satisfies management.

Statement of Purpose/Research Goals

The specific objectives of the research project were to:

a) Identify the most prevalent implicit knowledge transfer techniques that have been used in virtual information systems project teams in healthcare.

b) Compare the implicit knowledge transfer methods used in enterprise-wide healthcare projects involving virtual teams to determine those that were most often associated with successful IT projects.

Explicit Research Question and Hypotheses

The following research question was addressed by this study:

> Research Question: How is the use of specific implicit knowledge transfer techniques by virtual healthcare information systems project teams associated with successful projects?

In order to answer this research question the following hypotheses were developed for the study:

Hypotheses

H1: *Enterprise-wide healthcare IT project teams that use implicit knowledge transfer techniques are likely to be more successful than those teams that do not.*

Basis:

The use of knowledge management and knowledge transfer techniques can allow teams to perform better (Dyer & Nobeoka, 2000; Haas & Hansen, 2005). Knowledge creation is difficult and expensive (Ding & Akoorie, 2009), but it is this resource (rather than the availability of raw materials) that affords competitive advantage (Barney, 1991). Knowledge management (and knowledge transfer as a component of knowledge management) is therefore viewed as an important aspect of companies that outperform others (Kotabe, Dunlap-Hinkler, Parente, & Mishra, 2007). Thus, using knowledge transfer was hypothesized to be associated with project success.

H2: *The degree of use of implicit knowledge transfer techniques by virtual clinical and technical project teams in healthcare will be strongly associated with enterprise-wide projects that are successful*.

Basis:

Virtual clinical and technical project teams in healthcare have become almost "a way of life" in information systems within healthcare. Likewise, enterprise-wide (ie. "large") projects are numerous, include electronic medical

records, picture archiving and communication systems (PACS), computerized physician order entry systems (CPOEs), speech dictation and transcription systems, and others. At the enterprise level, these systems require a significant amount of human, financial and technological resources in order to be successful. On the "human" side of the resources needed, knowledge absorption is a significant contributor to the execution and ultimately, to the success of such projects.

The degree to which knowledge is codifiable and conceptually related facilitates absorption of such knowledge into the firm (Zander & Kogut, 1995). "Codifiability" is a key concept in implicit knowledge transfer, so Zander & Kogut were referring to the absorption of some form of implicit knowledge in their study. Mitchell (2006) expanded on the work of Zander & Kogut by studying enterprise-wide projects and knowledge transfer in the context of on-time project completion in the medical sector (Mitchell, 2006) and found that internal knowledge integration is a predictor of on-time project completion in enterprise application integration in medical facilities. Integration in this sense is defined as "the quality of the state of collaboration among departments required to achieve unity of effort by the demands of the environment" (Lawrence & Lorsch, 1967). On-time project completion is a component of the measure of the success of a project, thus the aforementioned studies would suggest the possibility that in a medical context, enterprise-wide projects that are successful might be influenced by implicit knowledge transfer and its techniques. It was therefore hypothesized that implicit knowledge transfer played a role in success of

enterprise-wide projects in healthcare given the above-mentioned supporting arguments on codifiability and integration.

H3: *The greater the depth of use of implicit knowledge transfer techniques by a virtual project team, the more likely the project is to be successful.*

Basis:

In order to obtain the maximum value from any technique, it will be important to use it at more than just a superficial level (ie. with only one group of team members vs. the entire team). Schindler and Eppler (2003) purport that continuous project learning through regular reviews via enforcing debriefings and encouraging project managers to make briefings a strategic priority are essential to knowledge transfer in projects. Schindler and Eppler also state that integrating learning of knowledge goals into the "project phase" of a given company and integrating learning and knowledge goals into overall project goals and metrics are important, further stating that adding knowledge goals to every project step can foster systematic reflection about every milestone. These activities are an extension/expansion of after action reviews, one type of implicit knowledge transfer technique. Furthermore research on the complexities of human interactions and contributions to knowledge management and knowledge transfer strengthen the argument that the depth of a method might yield greater success. For example, the research of Pawar et. al. (2002) asserts that humans (vs. technologies) play a central role in the identification, acquisition, generation,

storage, structuring, distribution and assessment of knowledge (Pawar et al., 2002) and Coleman states that knowledge management relies heavily on the social patterns, practices and processes (S. Coleman, 1998). The research of McLaughlin (2008) supports the research of Pawar et.al. (2002) by demonstrating that creating a suitable knowledge management strategy based on how employees access, create and share knowledge is necessary for competitive advantage (McLaughlin & Paton, 2008). The complex tasks cited in knowledge management and knowledge transfer with their focus on human activities vs. technological ones, suggest that the depth of use of a knowledge transfer technique could be important contributors to the success of a team using a particular knowledge transfer technique.

H4: *When consulting firms are used in virtual information systems project teams, there is a greater likelihood that the implicit knowledge transfer techniques of "mentoring" and "communities of practice" will be used than when healthcare organizations do not use consulting firms.*

Basis:

Consultants are an important element because within healthcare, many IT departments have limited project management capabilities (Arlotto, 2009) and rely on vendors with whom they contract for IT-related services to also provide project management tools and techniques. Moreover, IT-vendors in the healthcare market are also believed to have a "value add" when they include

knowledge transfer as a part of their service offering (Ho, 2005) thus demonstrating that knowledge transfer is desirable for healthcare IT departments.

According to Swap, et. al. (2001), mentoring and storytelling more than other informal learning mechanisms, (1) promote the transfer of tacit dimensions of knowledge; and (2) are clearly understood representations of internalization and socialization and relatively easily implemented in organizations (Swap, Leonard, Shields, & Abrams, 2001). Furthermore in the healthcare field, mentoring and communities of practice are knowledge transfer techniques advocated for the nursing profession (L. J. Morgan, Doyle, & Albers, 2005). When vendors/consultants are involved, then, it seems likely that knowledge transfer techniques might be used, and in particular, the ones used would be mentoring and communities of practice since some of the research advocates for the use of these two techniques in specialized parts of healthcare delivery systems.

H5*: The larger the healthcare organization, the greater the likelihood that they will use implicit knowledge transfer techniques in their virtual information systems project teams.*

Basis:

Several large companies have been studied on their use of knowledge management, including Skandia, Hewlett Packard, the US Army, IBM and Xerox (Davenport, DeLong, & Beers, 1999), the US Air Force, Nestle, Colgate-

Palmolive, Chevron-Texaco, and InfoSys Technologies (Jennex, 2005). Companies of these sizes are therefore familiar with, and have applied techniques to capture knowledge, within their organizations. This is in part because their size attracts researchers to study their knowledge management and knowledge transfer practices. Furthermore, electronic collaboration software (or "groupware") is an enabler to the support of knowledge management and transfer, and, in fact, it is encouraged that knowledge management should be integrated with groupware (D. Coleman, 1999; Falbo, Atantes, & Natali, 2004). The infrastructure and financial investment needed for such collaboration software is significant. A 2009 article on costs cites a $99 per user licensing fee (Garza, 2009). For a small healthcare facility of 200 employees this licensing fee exceeds $19,000, but in addition, the organization would incur additional costs for enterprise servers, maintenance costs, etc. Many small healthcare organizations cannot afford this investment, therefore it is plausible that if any healthcare organizations are using knowledge management and knowledge transfer techniques, it will likely be those that are large.

Chapter Summary

This project's broad aims were to evaluate implicit knowledge transfer techniques in virtual information systems project teams in healthcare to determine which forms were most often associated with successful projects. Five hypotheses were developed pertaining to project team types and knowledge transfer technique use, and their associations with project success.

Chapter 2 will review the literature surrounding virtual teams, the healthcare industry's use of virtual teams, and knowledge transfer techniques.

CHAPTER 2 LITERATURE REVIEW

This chapter covers in more depth the existing literature, including a general overview of what is currently known about a) virtual teams; b) communication as a risk factor for project success; c) the healthcare industry and the rationale for using it as the context for this study; and d) implicit knowledge transfer methods. These components comprise the basis for the research, which focuses on the intersection of virtual teams in information systems projects, successful projects, and implicit knowledge transfer techniques (a form of communication on virtual teams) in the healthcare field (see Figure 1 in Chapter 1).

General Overview of Virtual Project Teams

Virtual teams have become popular in businesses because they offer access to human resources that companies would otherwise not have. Global virtual teams, for example, are groups that are recognized by their organizations and members as a team, are responsible for making and/or implementing decisions; are important to the organization's global strategy; use technology-supported communication substantially more than face-to-face communication; and work and live in different countries (Maznevski & Chudova, 2000). Virtual teams are useful for projects requiring cross-functional or cross-boundary skilled inputs (Lee-Kelley & Sankey, 2008) that are not found in members of a traditional collocated team. This is particularly useful as the nature of business has become more complex, competition has increased and the timeframes necessary to "get products to market" have shortened.

The term “virtual team” has been defined by Lipnack and Stamps (1997) as “a group of people who interact through interdependent tasks guided by a common purpose” (Lipnack & Stamps, 1997). Their definition further states that these individuals work across “space, time and organizational boundaries with links strengthened by webs of communication technologies”. Some authors use the term “virtual” only for groups that never meet face to face (Canney Davison & Ward, 1999; Kristof, Brown, Sims, & Smith, 1995). Other authors, however, refer to a virtual team as one that is conducted with the assistance of at least some form of technology (Geber, 1995; Melymuka, 1997; Young, 1998). Generally speaking, teams can take a variety of forms. Lipnack & Stamps (1997) describe these varieties of teams in Table 1.

Spacetime	**Same Organization**	**Different Organization**
Same	Collocated	Collocated Cross-Organizational
Different	Distributed	Distributed Cross-Organizational

Table 1: Varieties of Teams, adapted from Lipnack & Stamps, 1997

Lipnack and Stamps (1997) treat space and time as a single interrelated idea, “Spacetime”. In their matrix, Collocated Cross-Organizational teams comprise people from different organizations who work together in the same place. Distributed teams comprise people in the same organization who work in different places either interdependently (such as in a multisite product development group) or separately (such as branches and local offices).

Distributed Cross-Organizational teams involve people from different organizations who work in different places. Collocated teams work in the same place at the same time.

"Virtualness" of teams exists on a continuum ranging from a team where few individuals are not collocated to one where all team members are not collocated. In this study, "virtual team" is defined on a continuum where, at a minimum, one or more members of the team consistently work in a different geographic location than the rest of the core team, and at a maximum, all members of the team are geographically dispersed with no defined "core".

Beyond the use of virtual teams at the organizational level, such teams have become important at the project level. A significant amount of work being done today in the world's distributed organizations has been accomplished by virtual teams (C. M. Beise, 2004). Projects have moved from being simple phenomena to manage, to more complex entities spanning geographical locations, multiple occurrences, and different organizational affiliations (Desouza & Evaristo, 2004). Adding to the complexity of projects today is the very concept of "distributedness" itself. "Distributedness" has multiple dimensions, including type (of project), structure (of the project's task), perceived distance (among team members), synchronicity (the extent to which people may be working on the same project concurrently), complexity level of the project, culture (how these characteristics of a team may affect a project), information systems methodology (and the need to identify the differences in the needs for management of the project in each phase), and level of dispersion (the perceived distance within the

members of a given stakeholder group) (J. R. Evaristo, Scudder, Desouza, & Sato, 2004). This description of "distributedness" underscores the idea that virtual teams can themselves be complex, while also adding to the complexity of today's work environment. These complexities make them worthy of study.

Despite the industry or degree of "virtualness" of teams, several principles apply to virtual teams that capture the essence of their success: People (independent members, shared leadership, integrated levels), Purpose (cooperative goals, interdependent tasks, concrete results), and Links (multiple media channels, boundary-crossing interactions (ie. different time and place), trusting relationships) (Lipnack & Stamps, 1997). Lipnack & Stamps' research addressed independent members (ie. individuals on virtual project teams), concrete results (ie. the success of projects that used implicit knowledge transfer techniques) and "boundary-crossing interactions" (ie. those teams that were linked over geographic space and time) in an attempt to understand how these areas come together to facilitate the use of implicit knowledge transfer techniques, and how they in turn, affect the success of virtual information systems project teams given the inherent complexities of such teams. Virtual teams can challenge traditional components of project management, and communications in particular is one of the significant areas of challenge. This topic will be discussed next.

Communication as a risk factor for project success

Communication as a risk factor is well documented in the project management literature (Schmidt, Lyytinen, Keil, & Cule, 2001; Schwalbe, 2009;

Solomon, 1995; Sumner, 2000). These communication factors can range from misunderstanding project requirements (Keil, Cule, Lyytinen, & Schmidt, 1998) to ineffective sender/receiver information processing (Kerzner, 2006). A group's success is dependent on effective communications and knowledge sharing among members (Townsend et al., 1998) but within projects, this does not always occur as effectively as is necessary. Consequently, poor/breakdowns in communications have been cited as a key reason for project failure. In 1988 the BULL company conducted research on failures of IT projects in the finance sector. In that survey, poor communications accounted for 40% of the reason for IT project failures by project managers, and accounted for 57% overall of the major causes of project failure (ITCortex). Likewise, Keil, et. al. (1998) show that one of the key project risk factors is a communications-related risk factor: misunderstanding the requirements (Keil et al., 1998).

In an experiment conducted by Xue, et. al. (2004/2005) there was a statistically significant difference between virtual groups and face to face groups regarding their perception of mission clarity, with the face to face group exhibiting a mean value of 4.02/5.00 on a 5-point Likert scale (where 1=strongly disagree and 5=strongly agree) and the virtual group exhibiting a mean value of 2.76/5.00 (Xue et al., 2004/2005). This research further suggests that communication, as measured by mission clarity, is a key factor in the performance of virtual groups. Further corroboration of the need to communicate is documented by Snyder (2003), who states that handling conflict is one of the keys to success in virtual teams, as is the need to "communicate, communicate,

communicate". This need to communicate is important in the virtual team setting because it is easy to miss important components of a message when face-to-face communication is absent. Informal communication is also less likely to occur in a virtual environment.

To further underscore the issue, Cross and Sproull (2004) conducted research which emphasized that the transfer of information from people to other people is critical in teams. Eighty five percent of managers in the Cross & Sproull study "immediately and spontaneously" identified specific people as important components of project success rather than citing computerized "knowledge repositories". And, while the use of computerized tools has been cited as important in the communication of virtual teams, establishing personal relationships with team members is also an important part of ensuring that team members share information, especially with the team's leader (Pauleen & Yoong, 2001). These studies go beyond simply stating that communication is important, attempting to emphasize the necessity of focusing communication strategies at the individual level.

All project teams need to be coached to consider communications a critical and sometimes sensitive process along the path to project completion. Program communications team leads must work intimately with each of the project teams to fully understand their role, their objectives and their outcomes (Haubner, 2007). Reed and Knight (2010) have identified 55 potential risk factors for IT projects, and of that number six were related to communication (ie. "conflict among team members", "cultural and language differences", "insufficient

knowledge transfer", "lack of or inadequate communication", "poorly written, unclear or vague project requirements", and "unclear project objectives"). Of those communication risks, the lack of implicit knowledge transfer stood out as a significantly greater risk on virtual projects (than on collocated projects), as did cultural and language differences. Clearly, communication generally, and implicit knowledge transfer as a specific type of communication risk, are significant risk factors for project success.

The healthcare industry and its expanding use of virtual information technology (IT) teams

The healthcare industry is chosen for this study because of its size, increasing use of virtual IT projects, the fact that project errors can have highly significant consequences, and the recent passage of the Health Information Technology for Economic and Clinical Health Act (HITECH Act) of 2009. The industry's size in the United States, as measured in cost, has grown exponentially since 1960. According to the statistics published by The US Centers for Medicare & Medicaid Services (CMS), in 1960, healthcare costs were $28B while in 2007 they were $2,241B (Centers for Medicare & Medicaid Services, 2007). Total health expenditures in 2008 reached $2.379B (or approximately $2.3 trillion), which accounted for 16.2 percent of the nation's Gross Domestic Product (Centers for Medicare & Medicaid Services, 2010). CMS projects these costs to continue rising, with estimates of total spending in 2011 and 2016 being $2,770B and $3,790B, respectively. These data show that the healthcare industry accounts for a

significant portion of the spending that occurs nationally in the United States (US), and will continue to grow. From an economic standpoint, this industry has significant relevance to the government and, consequently, the citizens of the US.

In recognition of the growing costs of the healthcare industry to the US, the federal government enacted the HITECH Act of 2009. Included in this law is $22 B, $19.2 B of which is intended to be used to increase the use of Electronic Health Records (EHR) by physicians and hospitals (HITECH Answers, 2010). In 2008, the Healthcare Information and Management Systems Society (HIMSS) conducted a survey on the use of EHR/EMR adoption and the results showed that 30% of the respondents in 2008 had an EMR, which was up from 26% in 2006 (HIMSS Analytics, 2008). The results also showed that a major barrier to adoption of EHR/EMR is cost. Given the significant infusion of capital from the HITECH Act into the healthcare system, organizations nationwide can be expected to prepare themselves to take advantage of these funds by either hiring their own or retaining consultative services to implement EHRs and other ancillary technology-related projects (such as those related to privacy, security, interoperability of clinical databases and claims submissions) in their facilities that will be supported/supplemented by EHRs. EHRs tend to be large, enterprise-wide projects, and in the case of large healthcare facilities, these projects can mean implementation of a system that will be distributed over a number of sites, some of which may be interstate. These projects are therefore likely candidates for the use of virtual information systems project teams. While the number of virtual IT projects may increase as a result of the HITECH Act, it must be realized

that the industry, like others, faces difficulty in managing IT projects. They include the lack of adequate clinical input into clinically-related systems (HA Heathfield & Wyatt, 1993), difficulty in communicating with external vendor software and systems developers (A. D. Brown & Jones, 1998), and a failure to recognize that, in some instances, the organization and the technology transform each other during the implementation process (Berg, 2001).

While challenged IT projects are universally faced in all industries, in healthcare, those challenges can have significant consequences. These can include financial losses, facility closure, and patient death. Though the insurance companies, the government, employers and consumers spend significant sums of money in the healthcare industry annually, healthcare organizations tend to operate on fairly thin margins, leaving them particularly vulnerable to financial losses. The American Hospital Association reports that the average total margin for hospitals reporting financial information to Databank fell to 7.8% in fourth-quarter 2008 from 4.6% in fourth-quarter 2007 (AHANewsNow, 2009). Enterprise systems such as electronic health records (EHRs)/electronic medical records (EMRs) can cost between $15,000 and $30,000 for physician practices (Terry, 2003). Gross revenues for multi-specialty physician practices in 2008 was $637,677 but this represents a drop in practice revenues (Stagg Elliott, 2009). This means that even in a multi-specialty practice, acquiring an EHR can be up to 21% of total operating costs, which has to be concerning given lower practice revenues and the impact of the economy. For hospitals, vendor-built, server-based EHR systems typically carry license fees upwards of $75,000 each and overall

costs of $25 to $50 million for a 500-bed hospital (Congdon, 2009). This leaves little room for error if a project of this type fails, and could mean closure of a facility if major losses occur. These risks for healthcare organizations mean that they have: increased liability for medication errors if software fails; responsibility for maintaining the accuracy and privacy of medical records; and responsibility for maintaining round-the-clock life-saving IT applications. Failure of these systems could mean risking the life of one or more patients.

The healthcare industry has begun to participate in outsourcing, a staffing phenomenon that has gained widespread use in IT organizations in industries other than healthcare. The healthcare industry is projected to have an increased use of outsourcing because it is one of the most complex in needs, client essentials, data demands, regulation, legislation, revenue models, market sizes, geographies, core functions, non-patient care functions, and outsourcing niche vendors. Thus healthcare IT outsourcing was projected to be one of the fastest growing segments of outsourcing growth in 2008-2009 (BusinessWire, 2008). Healthcare has also become more distributed across service delivery areas, and consequently, there has been a reliance on project teams that are geographically dispersed for the purposes of harvesting the experience of these individuals into a project (Kimball & Eunice, 1999).

The healthcare industry is subject to governmental regulation (via laws), policy changes (via recommendations from various medically-related societies and agencies), price and payment adjustments (via insurance carriers), changes in the manner that care is delivered (via clinicians), and changes in available service

options (via consumers). The complexities of this industry make it one of the most challenging to manage, and the information systems departments in most healthcare delivery organizations face the daunting task of assisting their parent organizations to satisfy the above-mentioned requirements, while having to maintain departmental efficiencies and managing the applications used to support their enterprise. The information technology applications themselves are unique primarily because they are not only complex, but the data they produce require enhanced security measures (via government encryption standards (HIPAA-Encryption.com, 2010)). This is due to the sensitivity of the data and the significant lengths of time for keeping medical data (which range from 3-27 years (AHIMA Body of Knowledge)). Furthermore these applications exist as part of a fragmented system, which limits or prevents the timely and/or accurate transfer of data from one member of the industry to another because there is no mandatory standard for electronic data interchange in healthcare. Ensuring that applications in the healthcare system work, and indeed, ensuring that the system of healthcare itself works, requires the extensive use of teams. The goal of these teams is to work towards a common shared objective of improving care for the patient, and to this end, communicate effectively via the transfer of knowledge to achieve this objective (Clements & Helmer, 2006). Yet, despite the uniqueness of the applications used in the healthcare industry and the complexity of the industry itself, there is a dearth of literature on studies done in healthcare with respect to knowledge transfer involving virtual teams.

The healthcare industry has used a number of types of virtual information systems project teams. The forms these take can include the following:

a) Global teams:

In this type of team an IT development group may exist in one or more countries with a project office in the United States coordinating the group's activities, for example.

b) Clinical and Technical:

In this type of team clinical specialists may reside in a team in one hospital, physicians in another facility, and technology services (perhaps via a vendor) in another location. This distributed group would potentially work on an enterprise-related technology project, such as an EMR.

c) Large-scale information network

In this case, multiple healthcare and payor organizations collaborate either in a video-conferencing medium or "in the cloud" to deliver a comprehensive solution to provide access to patient information across multiple facilities and institutions. A regional health information organization (RHIO) offers such an example.

These types of groups are not mutually-exclusive; for example, it is possible to have a clinical and technical team with a global component. Each of these types of virtual teams can be complex; therefore the industry has a heavy reliance on vendors and consultants. A recent search revealed over 170 "leading healthcare IT vendors and consultants" (OnLine Consultant Software, 2000-2007). The list includes vendors such as GE, Siemens, Cerner, IBM and SAP—

all companies which have a presence in consulting for general business and industry as well as in healthcare. These are companies known to have outsourced functionality with their general business and industry clients, and have similarly outsourced some of the work they do for healthcare clients. This level of activity demonstrates that the virtual information systems project team has arrived in the healthcare industry.

An inquiry by the researcher in May 2010 to the project management special interest group (SIG) of the Healthcare Information and Management Systems Society (HIMSS) on the use of virtual teams revealed that many of the SIG's represented organizations use virtual teams in healthcare IT including GE Healthcare, Eclypsis, Medical Data Solutions, Hewlett Packard, United Health Group, North Bronx Healthcare Network, Parkland Health and Hospital System, US Department of Defense, US Department of Veterans Administration, and AllScripts. Yet, there is little information on their effectiveness and best ways to optimize virtual teams in the healthcare IT literature.

The healthcare industry, with its use of outsourcing and virtual teams in IT projects, then becomes an appropriate one for study particularly because in addition to a scarcity of literature in virtual IT teams in healthcare, the industry also lacks literature in the use of knowledge transfer. The topic of knowledge transfer will be discussed next.

Knowledge and Knowledge Transfer

Knowledge has been described in different ways in the literature. It can be described as thick (rich, arcane, wide-ranging) (Holden, 2002), complex (Simonin, 1999), highly contextual (Doz, Santos, & Williamson, 2001), often tacit (Polyani, 1966) and related to the cognitive dimension of tacit knowledge (Nonaka & Takeuchi, 1995). Knowledge is also described as declarative, procedural, conditional, axiomatic and relational. Berthoin Antal (2000) categorizes 5 knowledge types as follows: "know what", "know how", "know when", "know why" and "know who" (Berthoin Anthal, 2000). Declarative knowledge is focused on knowing facts (*know what*); procedural knowledge (*know how*) refers to the skills needed to do something (Anderson, 1983); conditional knowledge (*know when*) determines when and how declarative and procedural knowledge should be used (Paris, Lipson, & Wixson, 1983); axiomatic knowledge (*know why*) refers to reasons and explanations of why things occur, which also play a part in knowing when to transfer knowledge (Sackmann, 1992); relational knowledge (*know who*) relates to the development of valuable social networks that facilitate knowledge transfer.

These types of knowledge indicate that knowledge is not a commodity that can be easily captured and transferred across contexts, and therefore a people-centric view of knowledge transfer has developed. Any approach to knowledge sharing must be predicated on the individual (Fernie, Green, Weller, & Newcombe, 2003). Knowledge management itself has been a topic of interest by a number of authors (Hedlund, 1994), (Alavi & Leidner, 2001), (Leibowitz, 1999), (Ruggles,

1998), (Teece, 1998). One definition of it is from Davidson (1996) who states that knowledge management enhances an organization's ability and capacity to deal with, and develop itself in, these four dimensions: a) Mission: What is the organization trying to accomplish? b) Competition: How does the organization gain a competitive edge? c) Performance: How does the organization deliver the results? d) Change: How does the organization cope with change? (Davidson, 1996). The true value of knowledge management, then, on a global level is that it enables an organization to potentially function such that every situation is addressed with the sum total of everything anyone in the organization has ever learned about a situation of a similar nature (Bellinger, 2004) to maximize the full benefits of that knowledge. While this is not completely realistic for very large organizations, it is a goal to which an organization might aspire.

Generally speaking, knowledge retention strategies typically include several components: IT applications to capture, store and share knowledge; human resources processes and practices; knowledge recovery initiatives; and implicit and tacit knowledge transfer practices (DeLong, 2004). This research project will focus on the component "implicit and tacit knowledge transfer practices".

According to Desouza & Evaristo (2004), knowledge related to projects can be categorized in the following ways:

1) knowledge <u>in</u> projects (ie. looking at insights generated within each individual project, such as schedules, milestones, meeting minutes, and training manuals),

2) knowledge <u>about</u> projects, (ie. from the macro perspective, an organization

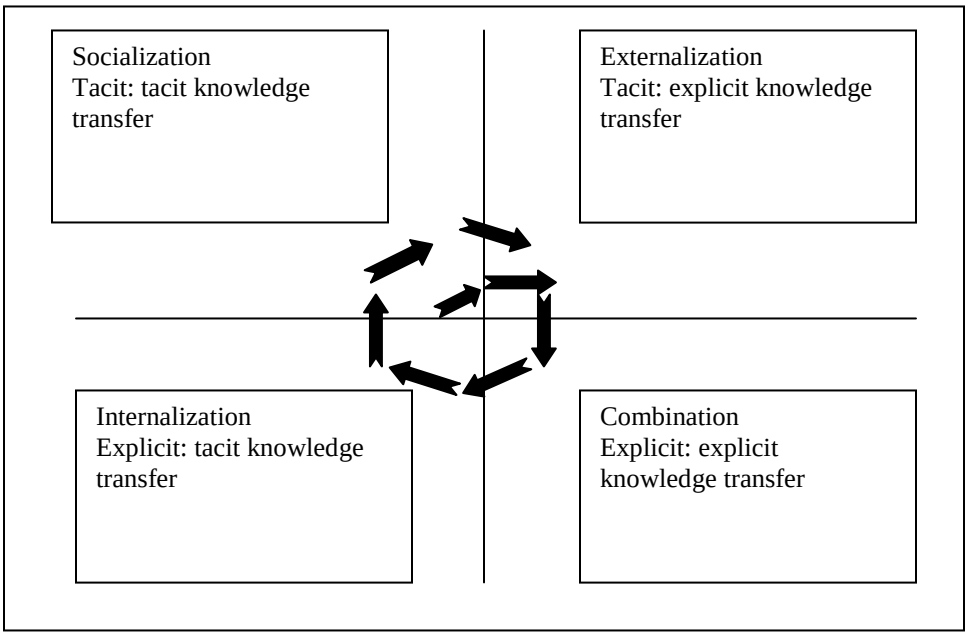
must have an inventory of all projects underway at any given time), and 3) knowledge from projects (ie. a post hoc analysis and audit of key insights generated from carrying out projects).

With respect to virtual team members and leaders (ie. the individuals who are the target subjects of this research), knowledge in projects and knowledge from projects are of most interest for this study.

Insufficient knowledge transfer was found to have a significantly stronger negative impact on virtual software projects than on co-located software projects (Reed & Knight, 2009). Of the 55 risk factors insufficient knowledge transfer showed the most significant difference in degree of impact of the communication risks identified on the project between virtual and collocated teams (Reed & Knight, 2010). The researchers state that this is considered a "Magnifier Effect", where a traditional project risk is increased substantially in the virtual environment. Thus insufficient knowledge transfer is considered a "silent killer" for a virtual project.

In previous studies, knowledge transfer was seen to involve 2 types of knowledge: tacit and explicit/declarative (Nonaka, 1994; Nonaka & Konno, 1998; Osterloh & Frey, 2000). Some describe tacit knowledge and explicit knowledge in categorical/distinct terms (Haldin-Herrgard, 2000; Smith, 2001; Wyatt, 2001). Tacit knowledge is the knowledge that is not written down and that *cannot* be written down, and is often referred to as "knowing how" to do something. It is also often referred to as "knowing about" something. Recognition and perception are examples of tacit knowledge. Another is when a technician can tell the health

of a machine from the hum it makes (Choo, 2000). Explicit knowledge is defined as documented knowledge, or knowledge that has been written down. Indeed, one of the seminal works on knowledge transfer is by Nonaka & Takeuchi (1995) where the researchers describe modes of knowledge transfer in terms of internalization (explicit to tacit knowledge transfer—such as learning from a report), externalization (tacit to explicit knowledge transfer—such as a dialog occurring within a team where questions are also answered), socialization (tacit to tacit knowledge transfer—such as team meetings and discussions), and combination (explicit to explicit knowledge transfer—such as emailing a report) (Nonaka & Takeuchi, 1995). Figure 2 shows this spiral of knowledge creation.



Spiral of Knowledge Creation. Adapted from Nonaka & Takeuchi (1995)

Figure 2: Spiral of Knowledge Creation. Source (Nonaka & Takeuchi, 1995)

Knowledge, however exists on a spectrum (Leonard & Sensiper, 1998). More recently it has been realized that knowledge transfer involves a third type: implicit knowledge transfer. Implicit knowledge transfer is believed to be part of a continuum, existing between tacit and explicit knowledge, and though implicit knowledge is not actually declarative, it could be made so (Griffith, Sawyer, & Neale, 2003). Figure 3 is a depiction of the tacit, implicit and explicit knowledge continuum. Tacit knowledge is knowledge that cannot be articulated, and represents a large source of knowledge. An example of tacit knowledge on a project may be that a seasoned project manager within the organization

understands how to successfully recognize and address potential risks and issues on a project before they occur. He/she may not be able to articulate how this information is known. Implicit knowledge is knowledge that can be articulated but has not yet been articulated and comprises a smaller amount of knowledge than purely tacit knowledge. An example of implicit knowledge as it relates to projects is that an organization may follow a specific methodology for executing projects that a seasoned project manager in the organization knows. He/she may not have codified the methodology in a manner than can be shared with others, but it is possible for the project manager to do so. Explicit knowledge is that which has been articulated and/or documented. An example of explicit knowledge as it relates to projects is a formula for how to calculate a cost variance within the project.

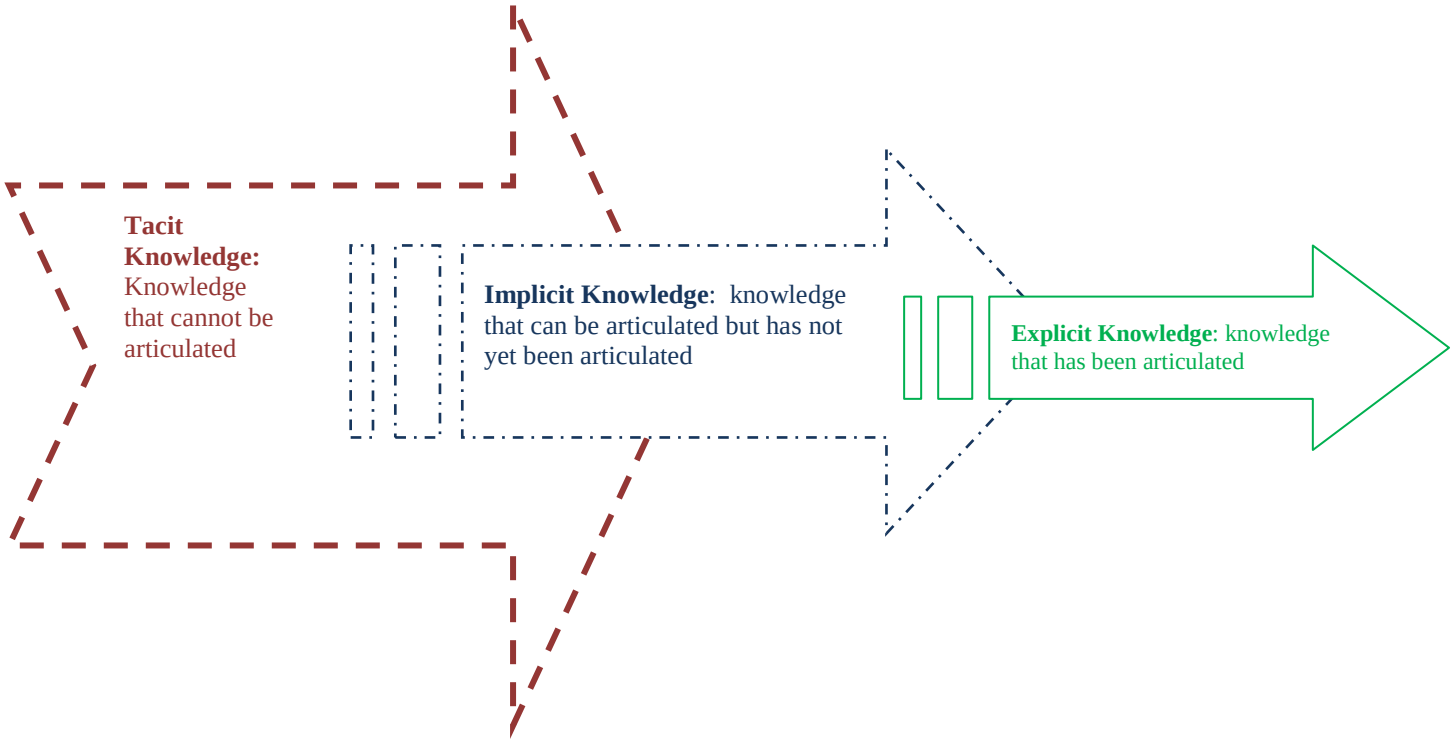


Figure 3: The Tacit, Implicit, and Explicit Knowledge Continuum (Author's image)

Implicit knowledge is also considered as "know how"; knowledge that can be captured and codified as information (Al-Hawamdeh, 2002). Implicit knowledge has been described synonymously with tacit knowledge (Weick & Westley, 1996). Our intention here is to make a distinction between tacit and implicit knowledge, emphasizing that implicit knowledge contains knowledge that exists between tacit and explicit knowledge. Griffith et. al (2003) posit that implicit knowledge can be transferred to explicit knowledge to the extent that a proactive effort is made to verbalize rules, terminologies and descriptions. Implicit knowledge exists at the individual level so its transfer within teams will be focused on conveying it from one individual to another (as opposed to conveying it from an individual level to the organization level).

While explicit knowledge and tacit knowledge have been studied fairly extensively (Haldin-Herrgard, 2000; Leonard & Sensiper, 1998; Nonaka & Konno, 1998; Polyani, 1958, 1966; Wyatt, 2001), the concept of implicit knowledge has been given far less attention. In order to gain a better understanding of how implicit knowledge transfer may be applicable to virtual information systems project teams, it is useful to detail the specific techniques/methods that comprise implicit knowledge transfer.

Implicit Knowledge Transfer

Storytelling, mentoring/coaching, after action reviews and "communities of practice" are methods used in implicit knowledge transfer (DeLong, 2004). Each is considered a "non-canonical" practice. Non-canonical processes are those which happen during work and are the informal processes defined by the relationships, communication and coordination of on-the-job practices (Lee & Lee, 2000). Non-canonical processes are related to the difficult-to-migrate portion of organizational knowledge that is deeply embedded in the complex social interactive relationships within organizations (Badaracco, 1991). Each of these "non-canonical" practices will be discussed in more depth next.

Storytelling

Storytelling is defined by Swap et al. (2001) as a detailed narrative of past management actions, employee interactions, or other intra- or extra-organizational events that are communicated informally within the organization. These stories typically originate from within the organization and thus, reflect organizational

norms, values and culture. Stories are more vivid, engaging, entertaining, and easily related to personal experience than rules or directives (Swap et al., 2001). Thus the research would predict they would be more memorable, be given more weight, and be more likely to guide behavior. Rich contextual details are encoded in stories, making them ideal carriers of the tacit dimensions of knowledge (Schank, 1990), and stories can be effective at transferring both implicit knowledge about how things get done, as well as deeper tacit knowledge that reflects the values shaping behaviors (DeLong, 2004). Delong (2004) further states that while the idea of pursuing storytelling as a knowledge transfer tactic may be considered "flaky" because Western business norms value analysis over narrative, stories are nevertheless a critical building block for transfer, and retention, of the most critical and valuable knowledge in organizations.

The National Aeronautics and Space Administration program (NASA) has a history of using storytelling in its business practices. A visit to its website reveals case studies and the Academy Sharing Knowledge program that documents how storytelling has been used (NASA, 2010). Storytelling is considered to have a number of organizational benefits. According to Boyce (1996) some of storytelling's important benefits include: expressing the organizational experience of members or clients; confirming the shared experiences and shared meaning of organizational members and groups within the organization; orienting and socializing new organizational members; amending and altering the organizational reality; developing, sharpening and renewing the sense of purpose held by organizational members; preparing a group (or groups) for planning,

implementing plans and decision making in line with shared purposes; and co-creating vision and strategy (Boyce, 1996).

Storytelling is most effective when the organization a) is clear about the purpose of the stories (ex. pass on knowledge, motivate action or communicate cultural values); b) creates regular occasions for telling stories (ex. forums and/or workshops); c) makes sure the audience has enough context to interpret the lessons contained in experts' stories (ex. level of experience and/or sophisticated understanding of organizational context); and d) ensures that if stories are not being told face-to-face, that special attention is paid to packaging and how narratives will be accessed (ex. edited narrative into compact and useful video segments) (DeLong, 2004).

Mentoring

Mentoring and coaching are probably the most effective ways of directly transferring critical implicit and tacit work-related knowledge from one individual to another (Zachary, 2000). Mentoring can help to transfer technical, operational, or managerial skills, and also helps the protégé to learn "who does what and how" in the organization (DeLong, 2004).

The recognition of mentoring as an important transfer mechanism of knowledge has increased over time, even though the focus of much literature has been on the desired behaviour of mentors, the structure of the mentor/protégé relationship, and/or on identifying mentoring functions (Swap et al., 2001). Mentors serve as informal teachers who transfer knowledge to their protégés (Allen, Russell, & Maetzke, 1997; Cohen & Prusak, 2000; Kram & Isabella,

1985). The mentoring process encompasses both socialization ("sharing experiences"), and internalization ("embodying explicit knowledge into tacit" and "learning by doing") and information technology is an indispensable tool for peer mentoring, as groups of physically dispersed individuals come together virtually to share knowledge in communities of practice (Swap et al., 2001).

In order for mentoring to be successful DeLong (2004) identifies four areas to address: 1) focus efforts on critical areas (ie. identify mentors and protégés in areas that develop strategically important personnel); 2) anticipate time and resource constraints (and overcome them with strategies, (such as bringing back retired individuals to serve as mentors or designing the responsibility into job descriptions), to ensure mentoring occurs); 3) train mentors specifically on how they can help their protégés (ex. teaching specific skills, general career development advice); 4) create an effective infrastructure to support mentoring (ie. identifying protégés, identifying and training mentors, defining how the program will be managed, etc.). Mentoring is also shown to be associated with those reporting higher levels of learning, particularly in those protégés who have a high level of trust in their mentors (Fleig-Palmer & Schoorman, 2011).

After action reviews (AARs)

When the knowledge that one is trying to retain is less well understood and more likely to exist in a larger group, the transfer of this type of knowledge can better be accomplished by after action reviews (AAR) than mentoring

(DeLong, 2004). AARs are used to generate, retain and reuse knowledge that is a byproduct of ongoing operations. AARs ask (1) "What was supposed to happen?"; (2) "What actually happened?"; (3) "Why were there differences?", and (4) "What can we learn from this to do differently next time?" [(Academy of Program/Project and Engineering Leadership (APPEL), 2006); (Garvin, Edmonson, & Gino, 2008)].

AARs help teams to reflect on and learn from their experiences, and as a result, allow for the generation of new knowledge that is shared by group members and thus, more likely to be retained as the group evolves over time (DeLong, 2004). Project-based experiential knowledge is best captured by holding regular AARs, because when teams wait to hold them, much new knowledge is lost (Dixon, 2000).

AARs are a flexible process that can be used to help groups identify what they need to learn in order to improve performance. This approach improves the dynamics of knowledge transfer between veterans and less experienced employees, in part because it applies expertise directly to current or future problems. Today's volatile work environment demands that new knowledge be constantly created to respond effectively. Therefore when teams are not proactively learning from their experiences they are losing knowledge that could be valuable to the organization (DeLong, 2004).

Communities of Practice (CoPs)

Brown and Druid (1991) state that a reliance on espoused practice

(canonical practice) can cloud an organization's core to the extremely valuable practices of its members (including non-canonical practices such as "work arounds") (J. S. Brown & Duguid, 1991). These non-canonical practices conducted by members of a work team/group form “communities of practice”. “Communities of practice” are built on techniques employed by their members, such as narration (story-telling), collaboration (where individuals work inter-disciplinarily and collectively to learn in the context of the work environment), and social construction (using stories to build a team member’s identity as a team member and reciprocally to construct and develop the community of team members with whom he/she works). These techniques play vital roles in knowledge transfer, and it is because of these forms of knowledge transfer and the continual development of these communities that the shared means for interpreting complex activity get formed, transformed, and transmitted (J. S. Brown & Duguid, 1991).

When organizations are concerned about losing expertise from specific functions or types of employees, or when there is a need to develop important capabilities in new employees more quickly, CoPs can be a vital knowledge transfer solution (DeLong, 2004). Communities of practice are beginning to gain recognition as effective organizational mechanisms, which allow members to voluntarily create and share both implicit and explicit knowledge (Jeon, Young-Gul, & Koh, 2011).

CoPs can a) provide isolated professionals a needed sense of connectedness to the organization; b) encourage employees to share their

expertise more broadly, making this knowledge more likely to survive in the organization after a single expert leaves; and, c) provide resources for bringing new members of the community up the learning curve quickly. CoPs can be small groups or large networks. Members of CoPs can all be experts, or there can be a range of skills (DeLong, 2004).

Several companies have used CoPs including Shell Oil (Wenger, McDermott, & Snyder, 2002), British Petroleum (BP) (SAIC, 2010), Best Buy (Consortium Benchmarking Study, 2002), Xerox (Saint-Onge & Wallace, 2003) and a partnership involving Siemens and BMW (Bader-Kowalski & Jakubetzki, 2002).

CoPs have a lot of potential for supporting long-term knowledge retention needs, but the experiences of companies like BP and Shell Oil raise important issues: 1) that it is more difficult to build social networks across different organizations that are also geographically distributed; 2) language barriers, lack of common terminology and lack of trust all inhibit knowledge sharing, and take considerably longer to overcome; and 3) expecting CoPs to be an important vehicle for facilitating knowledge retention in global organizations requires patience and long-term commitment to support their development (DeLong, 2004).

CoPs are described as having unconscious work norms which guide interactions among members (Leonard & Sensiper, 1998). Sachs (1995) observed that it is through workers' relationships in "communities" and within human

systems that problems are discovered and resolved and work is effectively accomplished (Sachs, 1995).

Saint-Onge and Wallace (2003) describe five characteristics of successful communities:

1. Conversations: All members are encouraged to express opinions, discuss problems, and promote their successors.
2. Collaboration: Providing support of mutual problem solving and knowledge sharing among colleagues in non-hierarchical exchanges.
3. Commitment: Members believe it is important to contribute their time and support to the community's purpose, and believe in the value of the community. Furthermore, senior management expresses commitment to the importance of the community for purposes of knowledge transfer and retention and makes resources available to build and sustain them.
4. Connectivity: Easy ways of connecting people including face-to-face forums/conferences, or by a technology infrastructure that supports electronic communication and collaboration tools.
5. Capabilities: Effective communities continually build, refresh and sustain the skills, attitudes, values and knowledge that organizations need to implement their strategic objectives (Saint-Onge & Wallace, 2003).

Table 2 captures the previously mentioned types of knowledge and how effective various practices are in transferring that knowledge. This study focuses on the shaded area of the table.

Effectiveness of Different Practices on Knowledge Transfer					
	Explicit	Implicit Rule-Based	Implicit Know-How	Tacit Know-How	Deep Tacit
Interviews	3	4	4	1	1
Documentation	4	1	1	1	1
Training	4	3	2	2	2
Storytelling	1	2	4	3	3
Mentoring/Coaching	2	3	4	3	3
AARs	1	3	3	2	3
CoPs	3	4	4	3	3
Legend: 1=ineffective; 2=less effective; 3=more effective; 4=very effective Adapted from (DeLong, 2004)					

Table 2: Effectiveness of Different Practices on Knowledge Transfer

DeLong (2004) describes two versions of implicit knowledge and two versions of tacit knowledge, as shown in Table 2. These are described as follows:

Implicit rule-based knowledge: if, for example, an assembly technician knows that the best way to produce a radar control board contradicts what the manual says, this knowledge is not tacit knowledge. It is simply rule- or fact-based explicit knowledge that has not been articulated.

Implicit know-how: another type of unarticulated knowledge that an individual or group can readily communicate, but does not necessarily lend itself to codification because of the contextual complexity involved. This type of knowledge can be readily transferred if the expert is asked the right questions.

Tacit know-how: true tacit knowledge that is very difficult to verbalize, much less to transfer to others. For instance, "how do you ride a bicycle?" or "how do you close a deal?" are types of knowledge that would fall in this category. The expert's knowledge is borne of experience and it is too complex to readily articulate.

Deep tacit knowledge: This knowledge is developed from "cultural" experiences, constructed from shared beliefs, mental models, and values that determine what individuals view as important and even what they define as relevant knowledge. This knowledge is the most difficult to access and is usually transferred unconsciously through a set of practices that are unique to every organization.

In this study we focused on both types of implicit knowledge described by DeLong (ie. implicit rule-based and implicit know-how) as represented by the shaded area in Table 2.

Project Management Methodology and Knowledge Transfer

PMI is the largest project management membership organization worldwide (Project Management Institute, 2010b), endorsing a methodology comprised of 5 standard processes for managing a project: Initiating, Planning, Executing, Monitoring and Controlling, and Closing (PMI, 2008). PMI offers some guidance on the transfer of explicit knowledge in the PMBOK (Project Management Institute, 2004), but does not do so in the realm of tacit knowledge transfer (Williams, 2007). It is noteworthy that some organizations have

attempted to incorporate their knowledge transfer initiatives into a project management methodology. Eskerod & Skriver (2007) identify one such organization in a case study noting that discussion about knowledge transfer was part of their project management methodology in monthly meetings involving project managers working on different projects (Eskerod & Skriver, 2007). This activity was cited as one that was created in an arena for knowledge transfer. Similarly, the Sedgwick County Division of Information & Operations includes knowledge transfer activities within its project management methodology. In the final phase of the project methodology ("Project Close Out"), it advocates for knowledge transfer with respect to "all documents that have anything to do with the product itself" (Sedgwick County Division of Information & Operations, 2004). In healthcare, HIMSS recognizes the need to use a methodology of some kind in managing projects and developed a taskforce that was convened specifically for outlining the value of using a methodology in healthcare information systems projects. The taskforce specified that integrated communications would be one advantage of using a methodology (HIMSS Project Management Task Force, 2008), suggesting the recognition of some form of knowledge transfer as a necessity in managing projects effectively. When a project methodology is used, the PMI methodology is the likely one employed, but it does not call for implicit or tacit knowledge transfer techniques. One reason may be that these types of knowledge are more difficult to access, and thus, their transfer is also more difficult to accomplish.

Summary of Chapter 2

The literature on knowledge transfer in virtual information systems project teams is minimal. This is particularly true in the case of the healthcare industry. Implicit knowledge transfer has been identified as an area warranting further study in project teams, and the literature identifies 4 major types of implicit knowledge transfer methods: 1) storytelling, 2) mentoring/coaching, 3) after action reviews and 4) "communities of practice". There is no evidence that these methods have been studied extensively in the context of virtual information systems project teams, and in the case of healthcare, they have not been studied at all. The healthcare industry is indeed using virtual project teams for IT projects, and quite possibly, is also using various forms/methods of implicit knowledge transfer techniques in those types of projects. Given the potential of these methods for influencing project success, it is a worthwhile undertaking to evaluate the degree to which these techniques are being used and the extent to which they are associated with successful projects in virtual project teams.

Given the previous description of knowledge, knowledge management and implicit knowledge transfer, it is clear that these concepts and practices might be challenging for individuals and organizations to master. This is particularly true in the case of virtual teams. Knowledge is a problematic, esoteric concept that does not easily lend itself to codification and the fact that it is embedded in specific social contexts compounds its complexity (Fernie et al., 2003). Knowledge management is challenging because these intangible assets (ie.

knowledge in the heads, hands and relationships of people) accumulate in the organization through dynamic, unstructured, and often subtle processes that are not easily codified into formal training programs or captured in information systems (Swap et al., 2001). In the case of virtual information systems project teams in healthcare, knowledge management has not been extensively studied, and has not at all been studied in relation to project success.

In the virtual work environment traditional mechanisms, particularly social ones, that facilitate communication are lost and participants must find new ways to communicate that enable effective teamwork in this virtual context [(Townsend et al., 1998); (Meredith & Mantel, 2011)]. This is particularly true as it relates to the transfer of implicit knowledge, given the complexities involved in this knowledge type.

Tacit knowledge is obtained by internal individual processes, such as experience, reflection, internalization or individual talents. Therefore it cannot be managed and taught in the same manner as explicit knowledge. Tacit knowledge cannot be given in lectures and it cannot be found in databases, textbooks, manuals or internal newsletters for diffusion. It has to be internalized within the human. Different methods such as apprenticeship, direct interaction, networking and action learning that include face-to-face social interaction and practical experiences are more suitable for supporting the sharing of tacit knowledge (Haldin-Herrgard, 2000). Explicit knowledge is the type that can be readily articulated, codified and stored for transmission to others. Implicit knowledge is knowledge that, like tacit knowledge, resides in the brain of an individual. Unlike

tacit knowledge, however, which cannot be expressed, implicit knowledge could be expressed/codified if its owner chooses to do so. Since implicit knowledge is on the continuum between tacit knowledge and explicit knowledge, it stands to reason that some of these methods found in the transfer of tacit knowledge will be useful and necessary in the transfer of implicit knowledge.

The literature is sparse on work that has been done so far in implicit knowledge transfer and virtual teams, particularly in the healthcare environment. Because of this dearth of literature, this research contributes to filling that void, and offers a useful contribution to both the knowledge transfer and virtual teams disciplines, and the healthcare industry as well.

CHAPTER 3 METHODOLOGY

Research Approach/Methodology

This research focused on the audiences of project managers, team leads and project team members who had direct experience working on virtual information systems project teams in the healthcare industry. The researcher first collected and analyzed qualitative data in order to develop additional hypotheses, gather phenomenological data, and identify additional variables for the study. The researcher then collected and analyzed quantitative data in order to test the research hypotheses stated in Chapter 1.

The purpose of the overall research was to identify and evaluate implicit knowledge transfer techniques in healthcare virtual information systems project teams to determine which forms were most often associated with successful projects. In order to address this problem and the previously specified research goal, a mixed method design using two techniques was employed:

a) A focus group, and

b) A questionnaire/survey.

The two techniques of the focus group and the questionnaire were used because it has been shown that the use of multiple methods can enhance the research design. Kraemer (1991) reports, for example, that survey research, while useful, is greatly improved when used in conjunction with other qualitative research methods. Bikson (1991) likewise states that it is always best to use several methods of data collection to adequately address the impacts of information technology. Danziger and Kraemer (1991) further emphasize that

survey research and fieldwork have always been alternative rather than competing sources of evidence and ideas. Finally, Kaplan and Duchon (1988) suggest that multiple research approaches will be needed to further advance information systems as a discipline. Because of the nature of this study, the aforementioned techniques were a reasonable and useful combination as the focus group yielded useful data for the questionnaire/survey.

Each of these techniques will be addressed in more detail next.

Phase I. Data Gathering: Focus groups

Focus groups are a qualitative research technique where groups of people are asked about opinions, beliefs, and perceptions on either concrete or abstract topics. Focus groups can be used as self-contained groups (ie. the opportunity to use this method on its own to study attitudes/perceptions in a qualitative fashion), in conjunction with survey research, in conjunction with experiments, or in conjunction with other qualitative methods (such as informant interviewing or participant observation) (D. L. Morgan & Spanish, 1984). Focus groups are often conducted before the fielding of a large sample survey, and are recognized as effective research methods because exclusive reliance on statistical and mathematical methods may not provide full explanations of behaviour (Folch-Lyon & Trost, 1981). Focus groups are particularly well-suited for examining attitudes and experiences (Kitzinger, 1995), a component of study in this research project.

Calder (1977) articulates 3 different types of focus groups: a) exploratory: this provides a means of generating hypotheses; b) clinical: this provides insights

into participants' unconscious motivations; c) phenomenological: this gives the researcher access to the participants' common sense conceptions and everyday explanations. This study was a combination of the exploratory and the phenomenological types of focus groups.

Benefits of focus groups

Morgan & Spanish (1984) offer several benefits to focus groups. They state that focus groups: give access to certain kinds of qualitative phenomena that are poorly studied with other methods; represent an important tool for breaking down narrow methodological barriers; add to the range of techniques available in qualitative research; offer a way to augment quantitative research; can be conducted in a relatively brief time span; potentially can be conducted with assistants who possess only minimal expertise; afford better communication with respondents; and, can do much to strengthen quantitative approaches to researchers (ie. "experiencing the experiences") (D. L. Morgan & Spanish, 1984). These noted strengths are reasons why a focus group was used in this study.

The purpose of using a focus group here was three-fold:

1) *To develop additional hypotheses*: while there were already hypotheses for this study (see Chapter 1) regarding risks and implicit knowledge transfer techniques used in virtual information systems project teams in healthcare, there was a distinct possibility that other plausible hypotheses could be formed for this study. It was hoped that further hypotheses could be generated and in this regard the focus group in this study was exploratory. Furthermore it has been shown that focus groups outperform un-moderated groups for the generation of ideas (Fern,

1982) and this adds another supporting reason for using the focus group in this manner.

2) *To gather phenomenological data*: the researcher is interested in accessing the participants' views about a) "common sense conceptions" and b) "everyday explanations". "Common sense perceptions" (as they are described by Morgan & Spanish, 1984) include notions such as what "virtualness" meant to focus group members, and how implicit knowledge transfer was used in those, and other, healthcare virtual information systems projects. "Everyday explanations" include concepts such as how these implicit knowledge transfer methods impact project risk; the focus group members' opinions on industry preference for the term "distributedness" over "virtualness"; and the roles and influence of outside vendors in virtual information systems project teams.

3) *To identify additional variables for inclusion in the study:* by asking focus group participants to comment on questions developed for the questionnaire up to that point, and then asking for their opinions about "what is missing?" from the list of questions, a more complete and appropriately worded questionnaire was developed. This approach is supported by the research conducted by Folch-Lyon & Trost (1981), who advocate that in-depth information can be obtained through exploratory groups for use in developing content and language for use in questionnaires for quantitative research surveys (Folch-Lyon & Trost, 1981).

Participant recruitment

Focus group participant recruitment can take a number of forms: word of mouth (Burgess, 1996), through the use of key informants (Gibbs, 1997),

advertising (Holbrook & Jackson, 1996), social networks (Gibbs, 1997), and/or via professional networks. This study recruited heavily from a professional network, the Healthcare Information and Management Systems Society (HIMSS). HIMSS is a "comprehensive healthcare-stakeholder membership organization focused on providing global leadership for the optimal use of information technology and management systems for the betterment of healthcare" (HIMSS, 2010). The organization has a total of 23,000 members. The organization has 9 special interest groups (SIG), one of which is in project management. The group also has a Chicago-based chapter consisting of 2000 members (Halonen, 2010). Focus group participants for this study were experienced virtual information systems project managers, project team leads and team members in the Chicago area. An electronic pre-focus group survey was used to elicit information on the number and types of virtual information systems project teams worked on, types of healthcare delivery projects worked on (ex. software upgrade, new development, etc.), and size and type of healthcare organization currently employed by. We sought project managers, team leads and team members of virtual information systems projects who had at least 2 years of experience working on clinical and technical virtual information systems project teams of any size, and who had experience working on at least one enterprise-wide virtual information systems project.

Participants were selected from Chicago-based HIMSS members who also belonged to the project management SIG. This was done for 2 reasons: 1) the researcher is located in Chicago, thus a local group of participants was

convenient, and 2) Chicago HIMSS has a representation of all types of healthcare delivery sites, project types and virtual IT team types that would be found nationally.

Method

A focus group of 5 experts was formed for the purpose of eliciting iterative, controlled feedback to questions on virtual information systems project teams, project risk, implicit knowledge transfer and on the survey instrument. The focus group took place in a conference room at DePaul University and was conducted in defined modules. These modules are defined next.

Risk module: In the first module of the focus group session, the group brainstormed on the types of risks that they experienced or heard about in virtual information systems project teams. Individuals within focus groups ranked these risks separately, in terms of greatest to least risk.

Implicit Knowledge Transfer module: In the second module, the group was given a list of implicit knowledge transfer techniques along with descriptions, and then asked to cite the types of these techniques they have used in past projects, or that they knew had been used in projects in which their companies had been involved. They also identified technologies (ex. groupware) that had been used in these processes to facilitate the transfer of implicit knowledge in virtual information systems project teams.

Virtual Teams module: In the third module the focus group panel was shown a list of types of virtual information systems project teams (ie. global

teams, clinical and technical teams, and large scale information network teams). They were asked to brainstorm to add more types of virtual healthcare information systems project teams to the list and then to rank in order of most frequent to least frequent the types of virtual teams they have worked on personally, or that their companies have worked on, and from most to least, the types that are likely to be important ones for future healthcare virtual project teams.

Questionnaire module: In the fourth module participants were given a list of survey questions which had been developed for the next phase of this study, and their feedback was elicited. Specifically, the focus group was asked to comment on question clarity, survey comprehensiveness and for "what is missing?" from the questionnaire. The focus group was also used to pilot the questionnaire.

Table 3 provides a summary of how the modules of the questionnaire relate to the three purposes of the focus groups.

	FOCUS GROUP PURPOSES		
Module	***Develop additional hypotheses***	***Gather phenomenological data***	***Identify additional variables for inclusion in the study***
Risk	✓	✓	✓
Implicit Knowledge Transfer	✓	✓	✓
Virtual Teams	✓	✓	✓
Questionnaire			✓

Table 3: Focus Group Purposes

The focus group lasted approximately 2 hours, and was audio-recorded and transcribed. The transcript was used to inform the finalization of the questionnaire. The researcher received training on focus group facilitation and served as the moderator for the sessions.

Data preparation and editing

The researcher randomly selected segments from the transcripts and checked against the recordings to ensure that the transcript was accurate.

Analysis of focus group data

Carey (1995) states that there is no one, stable exact reality to be discovered when using focus group analytical techniques, but that the goal of the researcher is to explore and discover the variations in perceptions. One technique that can be used to evaluate focus group data is phenomenology (van Manen, 1990), and is

described as a technique which purports that to get at the meaning of text, which is organized in terms of structures of meaning or themes; it asks for the “very nature of a phenomenon for that which makes a some-'thing' what it is”.

Another technique is qualitative content analysis. Qualitative content analysis (D. L. Morgan, 1993) addresses “why” and “how” the patterns in question came to be, and is appropriate when the available data and research goals call for a description of patterns in the data and an interpretation of why those patterns are there.

Qualitative content analysis is built upon: grounded theory, content analysis and narrative analysis. Grounded theory (Glaser & Strauss, 1967) involves a process where key points are marked with a series of codes, which are extracted from the text of a study. The codes are grouped into similar concepts in order to make them more workable. From these concepts, categories are formed, which are the basis for the creation of a theory. Grounded theory is sometimes viewed as opposite to the traditional research model, where a theory/hypothesis is first developed and then data are collected and evaluated to determine if they support or refute the theory/hypothesis. Content analysis (Krippendorf, 1980) focuses on answering the questions “what” and “how”. It is a quantitative approach. Narrative analysis (Reissman, 1993) relates to the creation of a story based on interviews, observation, and documents; these require interpretation when used as data in research. Thus qualitative content analysis represents a fusion of the quantitative components of content analysis, and the qualitative components of grounded theory and was used for the analysis of the focus group data in this

study.

Phase II. Data Gathering: Questionnaire/Survey

An investigator developed questionnaire was used for the next component of data gathering in this study. Its primary purpose was to gather data that could be quantitatively analyzed in order to test the research hypotheses stated in Chapter 1. Questionnaires are appropriate for gathering quantitative data and explaining how many people hold a particular opinion (Kitzinger, 1995) or have had a particular experience. Questionnaires can also accurately document the norm, identify extreme outcomes, and delineate associations between variables in a sample (Gable, 1994). A questionnaire was a good option for gathering data for the quantitative analysis conducted in this study.

Based on the results from the expert focus group, a full survey was developed for administration to a larger audience of healthcare IT project managers, virtual team leads and virtual team members. The purpose of this survey was to address the previously stated research question by quantitatively analyzing the types and number of implicit knowledge transfer techniques used in clinical & IT virtual teams, and their association with successful IT projects where they were used.

A high quality survey follows appropriate research design, sampling procedures, and data collection methods (Pinsonneault & Kraemer, 1993). These areas will be defined next for the survey used.

Research/Survey design

The questionnaire was designed to elicit specific information from respondents: a) demographics, b) virtual/distributed team experience, c) knowledge transfer techniques used in their organizations and d) risks involved in their last distributed team experience and whether or not knowledge transfer techniques were used in those projects. The questionnaire contained 4 types of questions: 1) dichotomous ("yes/no"), 2) multiple choice, 3) filter/contingency, and 4) qualitative.

Sampling procedures

Participants were selected from 3 professional groups:

1) HIMSS members who also belonged to the project management special interest group (SIG). The number of members in this group nationwide was 543 (Connelly, 2010) as of June 2010. Additional participants were solicited from the general HIMSS membership.
2) American Health Information Management Association (AHIMA) members. AHIMA's membership was over 59,000 in 2010 (AHIMA, 2010).
3) Project Management Institute (PMI)'s healthcare SIG. PMI had over 500,000 members worldwide (Project Management Institute, 2010a), and the healthcare SIG had 2,500 members in 2010 (Project Management Institute Healthcare Specific Interest Group, 2010).

The data collected included information on the organization from which the respondent originated (of the aforementioned professional groups). A sample size was sought of about 200 and comprised of project managers, team leads and team members of virtual IT projects who had at least 2 years of experience working on clinical and technical virtual information systems project teams of any size, and who had experience working on at least one enterprise-wide virtual IT project.

Data collection methods

The survey was administered electronically, using the online survey tool SurveyMonkey™. Participants were invited by HIMSS, AHIMA and PMI to visit the survey site to complete the questionnaire. Data collected via the website was exported as a flat file. Then analysis of the data was conducted using the statistical software, SPSS.

Summary of Chapter 3

This study was conducted using 2 methods: a focus group and a survey. The focus group used a convenience sample of members from the Greater Chicago Chapter of HIMSS and the survey's participants were recruited from three associations: HIMSS, AHIMA and PMI. The purpose of the focus group was to generate additional hypotheses for the study, gather phenomenological data, and identify additional variables for inclusion in the survey. The survey's purpose was to address the research questions previously stated in Chapter 1.

CHAPTER 4 RESULTS

This chapter details the results of a qualitative study (focus group) and a quantitative study (online survey) on the use of implicit knowledge transfer techniques in healthcare's virtual information systems project teams. The analysis evaluated whether or not there is an association between the use of implicit knowledge transfer techniques and successful project outcomes. The study was conducted by holding the focus group first. The results of the focus group were used to construct the language and content of the online survey.

I. Focus Group Findings

The purposes of conducting the focus group were three-fold: 1) To develop additional hypotheses; 2) To gather phenomenological data; and 3) To identify additional variables for inclusion in the study. No additional hypotheses were added to the study as the focus group responses were consistent with the original hypotheses developed. No additional variables were included in the study, but the feedback on the survey instrument offered great insights into how the questionnaire could be improved.

There was a considerable amount of phenomenological data gathered on the 'common sense conceptions' and 'everyday explanations' offered by focus group participants on the challenges they experienced in virtual healthcare IT project teams and how these teams were used in their daily work lives. There were general themes mentioned which are of interest to this study, notable

commentary on project risks and a surprising finding on the influence of vendors in the projects.

Definition of virtual

The participants' definition of "virtual" emphasized geographical dispersion, and one participant cited a difference in the healthcare industry from other industries by stating that there's less opportunity in healthcare to work with end users directly "because they're clinical people". This meant that because end users are at the bedside, IS staff can't be there as they deliver care. It was also stated that "users are more virtual as well" in the way they work because they may work in multiple facilities (ie. hospitals, clinics or physician office practices within the system).

Most participants immediately focused on the difficulty of working virtually, emphasizing that the communication aspects were especially problematic:

> "It's so hard…you need so much more commitment to it to be able to gather everyone virtually"
>
> "It's very difficult not to see everyone, and communication being one of the major success factors as it relates to projects…you need to have that eyeball to eyeball presence every now and again.."
>
> "It's difficult to assess body language and that's an important part of communication that we sometimes tend to forget"

noting that engagement of participants in virtual work was particularly difficult:

> "..I find myself multi-tasking and when I didn't have anybody watching me…[saying] "I'm sorry I missed that. Can you repeat?" "
>
> "…we turned on our video equipment for status calls and it's completely made a difference...because there I am, they can see what I'm doing, I can see them and I feel more engaged and in touch and that keeps me on task"

and even compared the experience to online educational courses

> "I experienced a lot of online classes…sometimes there's just no way to be successful in a project unless you have someone there to tell you "hey we need to do this"

> "I actually went to (a university) and experienced my first time having a class and it was in 2 locations. And the one thing I found interesting about that, and it still plays out in the work world, is it was almost like whoever had the teacher in the room that was where it was more interactive.

Participants stated that the terms "virtual", "distributed" and "collocated" teams are rarely, if ever used in their workplaces. They call this type of work "working remote", or as one participant said

> "We call it 'geographically dispersed' when we're talking about the challenge of it. 'Geographical challenges' I think we usually say".

Challenges

In addition to the communication challenges previously stated, participants discussed other challenges they found in this type of working situation. Top challenges cited were:

a) sharing documentation,

b) managing competing priorities (ie. Having to manage your project with the knowledge that your project's resources are not dedicated to your project exclusively),

c) working with "cultural differences" (ie. Hours kept by IT staff are different from hours kept by clinical staff),

d) lack of engagement when people are working from home,

e) IT project work not being perceived as high priority because in the healthcare environment patient care and patient safety are considered the highest priorities.

Some of these findings were in keeping with what other researchers have discovered about working in virtual teams. For example, Lee-Kelley and Sankey (2008) found that time zone and cultural differences in particular, affected communication and team relations (Lee-Kelley & Sankey, 2008). A propensity for miscommunication (Cramton, 2001) and conflict (Mannix, Griffith, & Neale, 2002) is also supported in the literature.

Risks

Participants were probed for the types of risks they perceived in healthcare virtual IT project teams. Several were cited:

a) **Lack of integration** with all the people needed to solve a problem was considered a risk of virtual teams. As one participant stated:

> "So a task like designing and brainstorming and really coming up with new ideas to solve problems that involve multiple teams really are at risk if you have to do that virtually"

b) **Incomplete participation** was also perceived as a risk because it was thought that valuable time would be lost on the project as a result of it.

c) **Unmanageable time** was also perceived as a risk. One participant stated:

> "Incomplete participation and unmanageable time is when you're working with the teams in India. It's really hard to coordinate that time that everybody's available…if you don't have a certain player in there or available, then you're almost re-doing (work) again when they are available"

d) **Missed milestones**: It was perceived that improper integration and incomplete participation translated into missed milestones, and is a major risk when trying to manage time, scope and cost.

e) **Lack of motivation** for the project: This was previously touched on in the "challenges" component of the focus group session, but was revealed here as more than just a challenge but a risk to the overall success of the project.

f) **Transitioning project responsibilities**: As one participant stated:

> "Handoffs are always difficult…sometimes the interaction you can have in person and what you can accomplish in a meeting…a face to face meeting is definitely more effective than a remote meeting".

This participant believed that the project's risk was increased if these transitions occurred virtually.

g) Where and how the **geographical dispersion** occurs: One participant described this based on her work in the Philippines with a US-based company:

> "It was Thanksgiving Day in the United States and we had no idea what Thanksgiving was and we were waiting for them to do something…and it was delayed".

h) **Emailing instead of meeting**: Several members of the focus group agreed with this statement, considering the act of emailing instead of meeting, posing a project risk. As one participant stated:

> "I think sometimes when teams use that as a [form of] communication because it's sometimes harder to connect otherwise, then you know all you do all day then is work email….I'll have 30 messages of the same subject and I just don't even look at the string and I say 'Hey, this deserves a meeting.' "

These risks stated by the focus group participants aligned with the risk categories found in Reed & Knight's research (Reed & Knight, 2010). Specifically, alignment was shown in the categories of Resources, Planning, Project Management and Communication.

Focus group participants were asked to prioritize these risks from most important to least important. The top 4 rankings were:

#1) Missed milestones

#2) Transitioning project responsibilities/difficult handoffs

#3) Lack of integration with all the people needed

#4) Unmanageable time

Interestingly, "geographical dispersion" did not rank in the top 4 risks by these participants, perhaps because their experiences on widely geographically teams (such as global teams) were limited--only a single focus group participant had this experience.

Knowledge transfer

A major component of this study was to determine the types of knowledge transfer techniques being used by participants. Rather than referring to them by their academic terms of “storytelling”, “mentoring”, “communities of practice” and “after action reviews”, they were referred to as “sharing stories”, “mentoring”, “community” and “reflecting on project experiences”. Each technique was described so that participants had a clear understanding of the technique. Also, the formal term “knowledge transfer” was not used—instead

"knowledge sharing" was used. Titles were substituted to allow participants to focus on the relatable aspects of the experience vs. the potentially unfamiliar title with which they might have had limited or no exposure.

Each participant had experienced the use of the aforementioned techniques on at least one healthcare virtual IT project on which they served. When probed about why these techniques were used participants had several reasons.

In "storytelling", this technique was perceived to be one that was an important part of creating a personalized/human connection on the team. Sharing stories create sympathy, provide context (so that team members could relate to the point being made), and are used for sharing lessons learned. In "mentoring" this technique was used to ensure that less-skilled team members understood how to get what they needed from end users, and was particularly useful in one case to groom a project consultant based in India. It was also used on a team by another participant for bringing knowledge "in house" where the consultant mentored the recipient(s) of that knowledge for purposes of supporting a system. Upon further probing of the group by the facilitator, participants reported observing mentoring activities occurring in several ways:

- from a trainer to an end user;
- from a consultant (as team leader) to the project team;
- from a project team member to the business owner.

In "community of practice" this technique was used to preserve knowledge (for purposes of cross training to "get beginners up to speed"), generate ideas on how to tackle a similar problem, for recognition and for

collaboration between beginners and specialists/experts. In "after action reviews" this technique was used as a "natural phase of closing a project", according to one participant. In his organization it is a component of continuous quality improvement. This technique was also said to be used in the closing of cycles of testing, adding to a knowledge base and "building the process" or process improvement. One participant stated:

> "..every time we do a group we do a 'how did it work?' 'how did it go?' so we can improve the process as we keep doing the project. That way then we build into the process and then it's like 'cookie cutter' ".

Of the four techniques, the respondents stated that "after action reviews" was used the least frequently, but that "storytelling", "mentoring" and "community of practice" were used in some combination almost daily. Interestingly, "after action reviews" appeared to be used during the project after key phases or activities by some of the participants rather than after the entire project was completed. The use of this technique by these focus group participants is different from the way in which it was defined by its originators ((Academy of Program/Project and Engineering Leadership (APPEL), 2006)).

Other types of knowledge sharing cited were:

- Formalized training—people were hired to conduct this type of knowledge sharing to the project team, and
- Observations—this was cited by one participant as an on-boarding technique, particularly with respect to observing end users with a system so project team members can learn "on their own a little bit (about) how it's used".

Software

These focus group participants were using a variety of software to share knowledge. SharePoint® (Microsoft), "a shared network drive", Google Docs™, WebEx™, CA Clarity™, "email" and "telephone" were stated. Also the "track changes" feature in Microsoft® Word was used, as well as Skype™, Google Chat™, Macola™, and Method M® (by Cerner). While the majority of these systems are communication-based, there was little use of "group-ware" or collaboration software (aside from SharePoint® and Method M®). These modes of knowledge transfer were cited regularly at the beginning of the millennium (Roberts, 2000), but presently other forms of knowledge sharing tools have been used in businesses including portals (Fernandes, Raja, & Austin, 2005), intranets, and learning management systems. It was not entirely unexpected that these healthcare industry participants did not use contemporary knowledge transfer systems as the literature does not show much use of collaboration software by this industry.

Vendors

Focus group participants were asked to comment on the extent to which vendors influenced the use of their knowledge sharing techniques. This question was asked because it was hypothesized that since the aforementioned knowledge transfer techniques were used in general business and industry, they may have found their way to healthcare's virtual IT project teams by vendors who worked in the general business and industry space. There was no clear consensus by participants on this topic, however. It appears that the influence of the vendor is

dependent on what the vendor was brought in to do. One interesting point made in the focus group related to vendors and knowledge sharing tools (not necessarily techniques) was that several participants stated that with respect to one vendor, "(their) stuff is proprietary and it's all self-contained" so their willingness to share their tools was less likely.

Table 4 shows a comprehensive listing of the findings the focus group.

Summary of Qualitative Findings	
Focus Group area	**Finding**
Definition of virtual	*terms “virtual”, “distributed” and “collocated” teams are rarely, if ever used in their workplaces. They call this type of work “working remote”.
Challenges of virtual	Top 5 *sharing documentation *managing competing priorities (ie. Having to manage your project with the knowledge that your project’s resources are not dedicated to your project exclusively) *working with “cultural differences” (ie. Hours kept by IT staff are different from hours kept by clinical staff) *lack of engagement when people are working from home *IT project work not being perceived as high priority because in the healthcare environment patient care and patient safety are considered the highest priorities.
Risks of virtual teams	Top 4 #1) Missed milestones #2) Transitioning project responsibilities/difficult handoffs #3) Lack of integration with all the people needed #4) Unmanageable time
Knowledge transfer techniques used on virtual teams	*“after action reviews” was used the least frequently * “storytelling”, “mentoring” and “community of practice” were used in some combination almost daily. *“after action reviews” appeared to be used during the project after key phases or activities by some of the participants rather than after the entire project was completed. (different from the use by originators) Other types of knowledge sharing used: *Formalized training—people are hired to conduct this type of knowledge sharing to the project team *Workshops and conferences *Observations—especially for on-boarding
Software used on virtual teams	SharePoint® (Microsoft), “a shared network drive”, Google Docs™, WebEx™, CA Clarity™, “email”, “telephone” Microsoft® Word was used, as well as Skype™, Google Chat™, Macola™, and Method M® (by Cerner). *little use of “group-ware” or collaboration software (aside from SharePoint® and Method M®).
Vendors in virtual teams	No consensus on the influence of vendors in selecting a knowledge transfer technique Most vendor tools are proprietary and they tend not to share them

Table 4: Summary of Qualitative Findings

II. Survey results

II. a) Definitions, Overview and approach to analyses and techniques

Definition of distributed/virtual team

For purposes of this study, a distributed information systems team was defined on a continuum where, at a minimum, at least one member of the team consistently (>50% of the time) works in a different geographic location than the rest of the core team, and at a maximum, all members of the team are geographically dispersed with no defined "core".

Statistical Analyses

In addition to the data needed to evaluate the hypotheses stated in Chapter 1, several other data were examined. These include the prevalence of the use of implicit knowledge transfer techniques in healthcare IT projects involving virtual teams; the types of implicit knowledge transfer techniques that were associated with successful projects; whether or not specific types of implicit knowledge transfer techniques tended to "cluster;" whether or not a particular form of implicit knowledge transfer technique was used with more frequency when vendors were a part of the project than when they were not; and the types of techniques used by different types of healthcare virtual teams (ie. clinical, technical and administrative teams) and what might have accounted for those choices.

This section covers the demographics of survey respondents, their use of distributed teams and knowledge transfer.

II. b) Demographic Analysis

Demographics

Four hundred forty four (444) people completed the survey. Of that number 394 were useful for analysis (when duplicate and erroneous entries were removed). In several questions, missing data further reduced number of responses useful for analysis.

The size of the IT organization was used as a proxy for organization size for a few reasons. First, IT staff do not necessarily know the revenues, number of beds (hospital/long term care facility), or number of visits (ambulatory facilities) of any given organization in which they have worked, so while these may be standard evaluations of institution size for management types of surveys, this would not be appropriate for this survey of IT staff. Second, the focus group data suggested that IT organization size was a good proxy for the size of the overall organization. The focus group data suggested that team sizes can be quite large so additional categories were developed as a result of that study. In the survey, 213 respondents provided data about the number of FTEs who participated on their last completed distributed team experience. Of this number, 85.9% (N=183) of the teams were under 150 FTE. The largest individual categories were "about 41-80 FTE" (16.4%), "about 6-10 FTE" and "about 11-20 FTE each representing 15% of respondents. Most team sizes tended to range from "about 3-5 FTE" to "41-80 FTE", accounting for 71.3% of responses. Figure 4 is a table of how the total IT staff sizes were distributed for the respondents of this survey.

FTE category	Count	Percentage
None	0	0
1 person < full time	4	1.9
About 1 FTE	3	1.4
About 2 FTE	7	3.3
About 3-5 FTE	27	12.7
About 6-10 FTE	32	15.0
About 11-20 FTE	32	15.0
About 21-40 FTE	26	12.2
About 41-80 FTE	35	16.4
About 81-100 FTE	9	4.2
About 101-150 FTE	8	3.8
About 151-200 FTE	7	3.3
About 201-250 FTE	6	2.8
Greater than 250 FTE	17	8.0
	213	100.0

Figure 4: Last Completed Distributed Team Experience (CDTE) IT Staff Size

Subjects were primarily recruited from 3 professional societies: Health Information and Management Systems Society (HIMSS), Project Management Institute (PMI) and American Health Information Management Association (AHIMA). A total of 288 respondents indicated whether or not they belonged to HIMSS, PMI and/or AHIMA. Of those 288 respondents, most (N=154) reported belonging to HIMSS, with PMI and AHIMA receiving 88 and 48 responses, respectively.

The largest organization type represented at 18.5% was the hospital/multi-hospital system/integrated delivery system. This was not surprising since the composition of most members of HIMSS, PMI and AHIMA were from these types of organizations. Approximately twelve percent (11.7%) reported working in academic/educational institutions, eight percent (8.1%) reported working in an

ambulatory clinic/hospital owned, and 7.6% worked in an ancillary organization. These values are shown in Table 5.

Types of Facilities

Hospital/multi-hospital system/integrated delivery system	18.5%
Academic/Educational Institution	11.7%
Ambulatory clinic/hospital owned	8.1%
Ancillary	7.6%
Ambulatory clinic/independent	7.4%
Consulting firm	7.4%
Academic Medical Center	6.9%
Long term care	5.1%
Payer/Insurer	4.3%
Home healthcare organization	4.1%
Vendor	3.6%
Community health center	3.0%
Federal/State/Local government	2.8%
Physician Office	2.8%
Professional Society	2.3%
Public health organization	1.3%

Table 5: Types of facilities

The largest percentages of states where most respondents worked were Illinois at 18.4% (N=45), Texas at 11.1% (N=27), California at 10.7% (N=26) and New York at 9.4% (N=23) (Total N=244). The distribution of the most frequent respondents is shown in Figure 5.

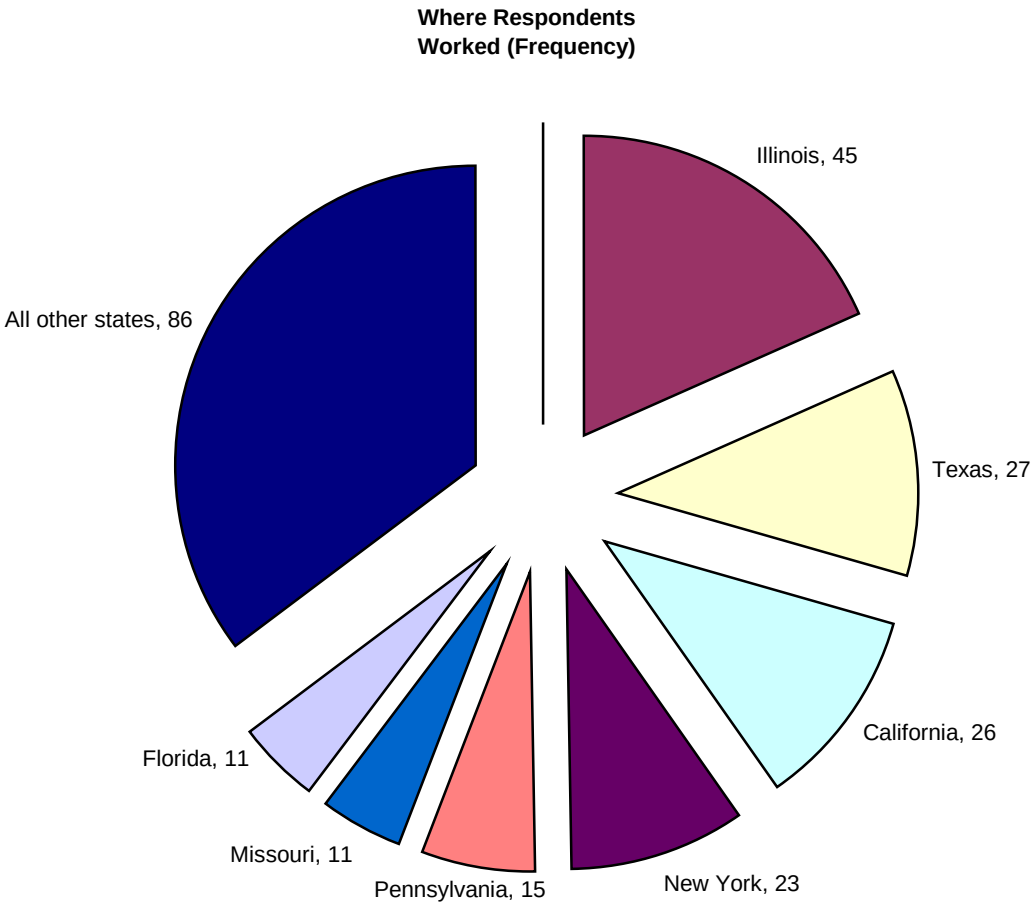


Figure 5: Where Respondents Worked

For this study respondents were asked to consider their last completed distributed team experience (CDTE) when responding to questions in pertaining to the remaining analyses.

Distributed teams

Respondents were asked to categorize their distributed teams experience in terms of “intra-departmental (IRD)”, “inter-departmental (ITD)”, “organizational (ie. involving 2 or more departments that would benefit other departments in the organization beyond the departments working on the project) (ORG)” or “global (ie. involving multiple other departments, that would benefit multiple other departments in the organization, involving international components of the organization) (GLO)”. Figure 6 is a pie chart of completed distributed team experiences and shows that IRD projects accounted for 18.8% of responses; ITD accounted for 34.7% of responses; ORG accounted for 33.8% and GLO accounted for 12.7% (N=213).

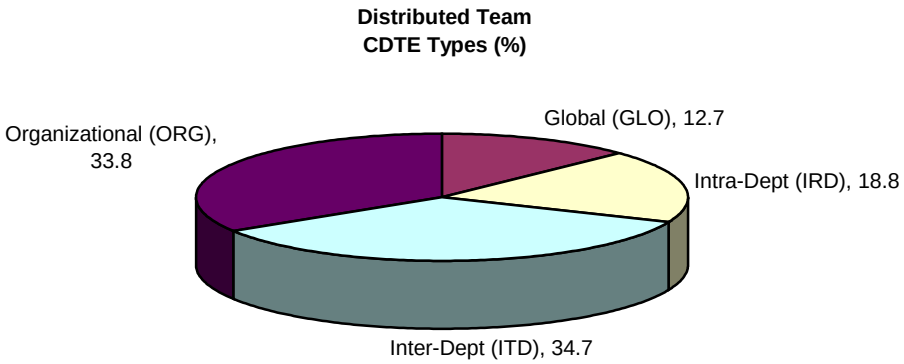


Figure 6: Distributed Team CDTEs Types

The single largest category of the type of project worked on was EMR implementations at 34.8%. This finding was not surprising given that there is presently a significant national effort to digitize medical records. This was

followed by computerized provider order entry (CPOE) systems at 23.9%, e-prescribing at 18.8% and picture archiving and communications systems (PACS) at 16.5%.

The majority (69.5%) of the respondents (N=266) completed their last distributed team experience less than 2 years prior to the survey. The majority of respondents (N=266) reported that they had less than or equal to 6 years total experience working on distributed teams (75.2%) with 65.8% of that number having between 2 and 6 years of experience.

Distributed team sizes had the largest percentages in the categories of 16-30 people (17.9%) and 31-60 people (27.4%). The majority (84.9%) of teams (N=212) were comprised of less than 100 people. The category "7-12 months" shows that the majority (48.3%) of respondents expressed that their last completed distributed team experience (CDTE) length fell in this category (N=211). Almost eighty percent (79.6%) reported that their CDTE was 18 months or less. Most participants spent between "6 months to 1 year" (40.8%) and "1-2 years" on their CDTE (N=206). In fact only 7.8% spent more than 2 years on their CDTE.

Respondents were approximately evenly split in their roles, with almost one third (31.9%) reporting that they were a "project team member", 33.3% stating they served in the role of "team lead" and 34.8% serving in the role of project manager (N=207). Not surprisingly, most respondents conducted their CDTE in a hospital (30.7%). Following at a distant second was the independent

ambulatory clinic, with 9.8% of respondents and the "ambulatory clinic-hospital owned" at 8.8% (N=205). Figure 7 shows these results.

Facility Where CDTEs were Conducted (%)

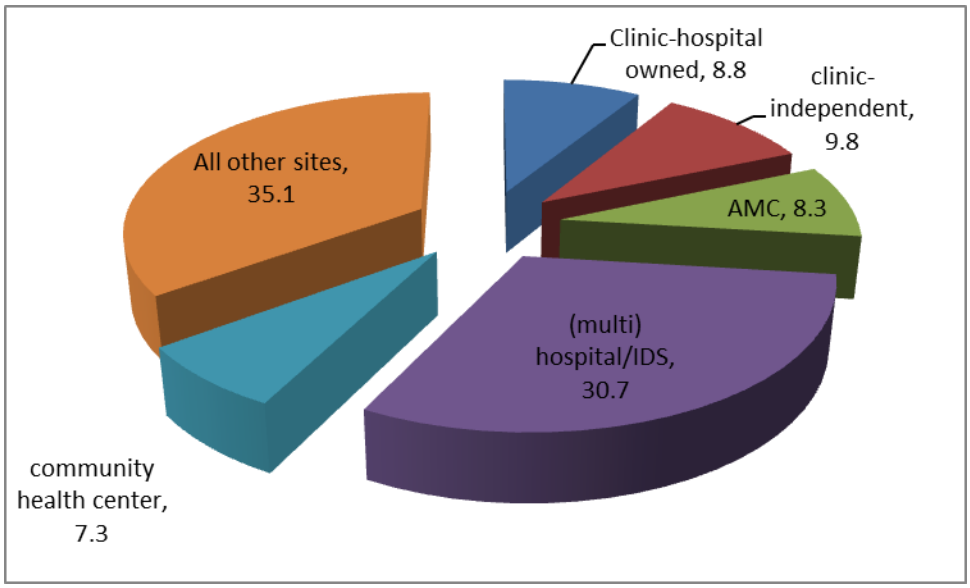


Figure 7: Facilities where CDTEs were conducted

The largest category of CDTE members were located throughout a city/metropolitan area (28.1%), followed by "among 2-3 states" (24%), "throughout a single state" (20.6%) and "across the country" (12.7%). Only 11.3% were across a campus and 3.1% "around the world" (N=291). Most respondents (73.6%) reported having a vendor representative/consultant serve as a project manager, team lead or team member on the CDTE (N=201).

II. c) Exploratory Analysis

Use of knowledge transfer techniques

The knowledge transfer techniques of storytelling, mentoring, communities of practice (CoP) and after action reviews (AAR) were labeled in the

survey as “sharing stories”, “mentoring”, “community of distributed team members”, and “formal reflection of what happened in the project”, respectively. While these labels are longer than the names these techniques have previously been referred to, they were better descriptors and more relatable terms to participants. This was validated by the focus group. The single largest category was CoP with 117 respondents using the technique. Storytelling and mentoring had 107 responses each and AAR had 88 responses (N=394. Respondents were able to select multiple techniques). Figure 8 shows this distribution. While the vast majority (89.9%) had not used any other techniques beyond these 4, a small percent (10.1%) indicated they had.

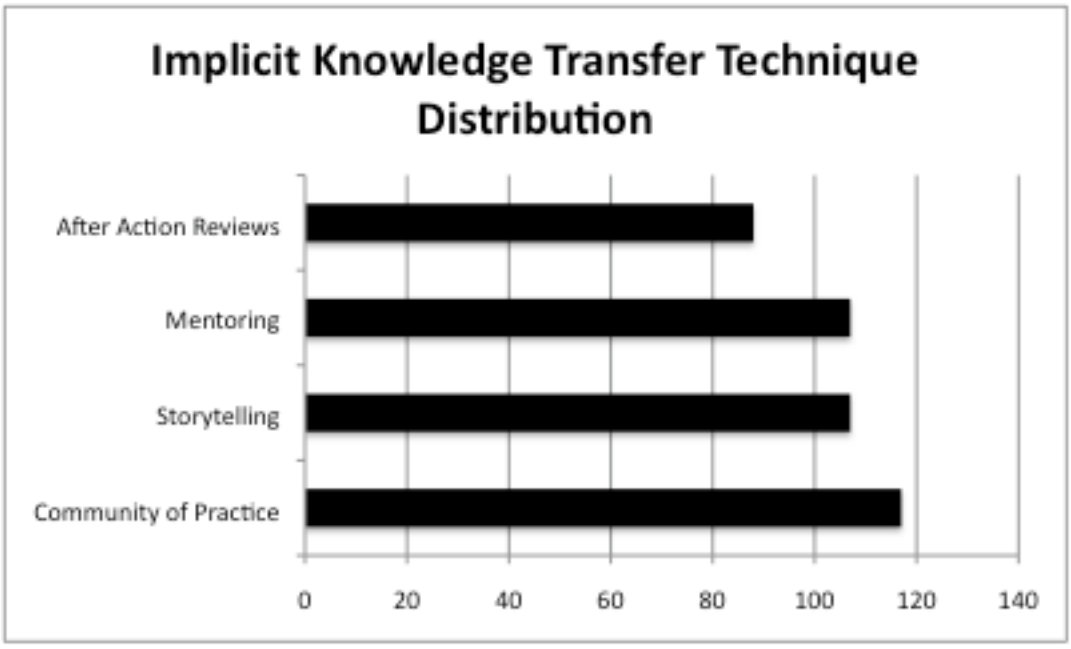


Figure 8: Distribution of implicit knowledge transfer techniques use by respondents

Most of the respondents identified technologies used to support the knowledge transfer function (such as SharePoint®, email, newsletters, progress reports) rather than the use of true techniques (such as training). When asked the specific question of what types of technologies were used to transfer knowledge on virtual teams, similar responses were stated with SharePoint® being most frequently cited (110 responses), Microsoft® Word being the second most frequently cited (108 responses) and use of a shared network drive being the third most frequently cited (99 responses). Several other tools were listed by respondents for knowledge sharing, including GoToMeeting®, Live Meeting™, Skype™ and teleconferences. The use of these technologies is consistent with the virtual team concept as these are tools intended to support communication by geographically dispersed groups.

Surprisingly, many did not mention other tools or technologies that would be considered groupware or collaboration software for transferring knowledge. Several options are available on the market including Microsoft® Project Web Access (and similar proprietary tools by vendors such as Cerner), and Basecamp™, and to name a few. Lotus Notes™, for example, was cited by only 9 respondents. SharePoint® was the preferred tool for knowledge transfer within the organizations of most respondents in the study. This may be the result of Microsoft's increasingly prevalent role in the healthcare marketplace (Liao, Chen, Rodrigues, Lai, & Vuong, 2010; Microsoft, 2011).

The most prevalent choices for why specific knowledge sharing technique(s) were used by respondents are as follows:

- High motivation by the team members to participate in knowledge sharing (28.5%)
- A credible expert in knowledge sharing was on the team and encouraged its use by the team (15%)
- There was support for the knowledge sharing by the team's project manager (14.5%).

This suggests that engagement of team members in knowledge sharing is important for the choice and use of knowledge sharing in virtual teams.

Knowledge transfer participants

Table 6 shows the summary results of participants in the knowledge sharing activities on the CDTE. Respondents stated varying frequencies of who used the specific knowledge transfer techniques. In "sharing stories" (ie. storytelling) the single greatest number of respondents in this category (25%) stated that this technique was used by "distributed team members and project lead, only", while 19.6% stated that this technique was shared by "project manager, team member, project lead, and vendor". For the mentoring technique, the single greatest number of respondents in this category (21.8%) stated that this technique was most often used by the "project lead and project manager, only". For "community of distributed team members" (ie. communities of practice), the greatest single percentage in this category was for "project manager, team member, project lead and vendor", reported at 28.0%. Finally, for the knowledge transfer type "formal reflection of what happened in the project" (ie. after action reviews), the single greatest percentage in this category was 27.7% for "project

manager, team members and project lead, only". For these last 2 categories (ie. "communities of practice" and "after action reviews") the frequencies appeared to be very similar (about 28% in each case), and were the most inclusive types of techniques used by respondents (ie. the most number of individual types involved in these techniques).

Participants in the knowledge sharing activities								
							Other participants	Response Count
			Project manager	Project manager	Project manager	Project manager		
		Project lead	Project lead, only		Project lead	Project lead		
	Distributed team members, only	Distributed team members , only		Distributed team members, only	Distributed team members, only	Distributed team members		
						Vendor		
Type A: sharing stories	7.1% (12)	**25% (42)**	19% (32)	16.1% (27)	10.7% (18)	19.6% (33)	2.4% (4)	100% (168)
Type B: mentoring	15.4% (24)	14.7% (23)	**21.8% (34)**	19.2% (30)	16.0% (25)	10.9% (17)	1.9% (3)	100% (156)
Type C: community of distributed team members	10.6% (17)	14.9% (24)	7.5% (12)	17.4% (28)	19.3% (31)	**28.0% (45)**	2.5% (4)	100% (161)
Type D: formal reflection of what happened in the project	8.1% (12)	10.8% (16)	16.2% (24)	10.8% (16)	**27.7% (41)**	23.6% (35)	2.7% (4)	100% (148)

Table 6: Participants in Knowledge Sharing Activities

Knowledge transfer frequency

Universally, respondents stated with the greatest frequency that each of the techniques was used "weekly". The frequency responses for "weekly" were as follows:

*Sharing stories (ie. Storytelling) 61.3% (N=103 of 168 respondents to the question)

*Mentoring 56.4% (N=88 of 156 respondents to the question)

*Community of distributed team members (ie. Communities of practice) 47.5% (N=77 of 162 respondents to the question)

*Formal reflection of what happened in the project (ie. After action reviews) 38.4% (N=56 of 146 respondents to the question).

In every knowledge sharing category, the next highest frequency reported was “monthly”. In one case - after action reviews - the “weekly” and “monthly” frequencies were similar, 38.4% and 34.9%, respectively, suggesting that in this knowledge transfer technique the frequency of technique usage was approximately the same. This suggests that while for other techniques there is a notable difference between weekly use and other frequencies, for AAR this is not the case. AAR is also the most frequently used “monthly” technique of all the techniques suggesting that AAR is not as frequently used as other techniques. Table 7 shows these results.

Frequency of knowledge sharing technique used (Select the closest frequency)						
	Daily	Weekly	Monthly	2x/year	1x/year	Response Count
Type A: sharing stories	15.5% (26)	**61.3% (103)**	19.0% (32)	1.8% (3)	2.4% (4)	100% (168)
Type B: mentoring	16.7% (26)	**56.4% (88)**	23.1% (36)	3.2% (5)	0.6% (1)	100% (156)
Type C: community of distributed team members	14.2% (23)	**47.5% (77)**	30.9% (50)	3.7% (6)	3.7% (6)	100% (162)
Type D: formal reflection of what happened in the project	10.3% (15)	**38.4% (56)**	34.9% (51)	4.1% (6)	12.3% (18)	100% (146)

Table 7: Frequency of knowledge sharing technique used

Experience with the knowledge transfer techniques used

Respondents who were responsible for using the knowledge sharing techniques tended to have 6 months to a year's worth of experience with the technique. Table 8 shows the results that for:

- storytelling the highest frequency reported was 44.9% (N=75) followed by "<6 months" at 21.0% (N=35);

- mentoring the highest frequency reported was 41.3% (N=64) followed by "<6 months" at 18.7% (N=29);
- community of practice the highest frequency reported was 37.7% (N=61) followed by "1-2 years" at 23.5% (N=38);
- after action reviews the highest frequency reported was 38.8% (N=57) followed by "1-2 years" at 21.1% (N=31).

This suggests that those responsible for using the knowledge sharing techniques overall tended not to have extensive experiences with the use of the techniques and this may account for some of the results found later in the study. It is also interesting that Type B (mentoring), was not started earlier in the project. This may be a helpful technique to start in the Planning phase, particularly if there are newcomers to the project.

If you were responsible for using the technique, how much experience did you have with it?						
	<6 months	6 months-1 year	1-2 years	>2 years	Not responsible for using technique	Response count
Type A: sharing stories	21.0% (35)	**44.9% (75)**	9.6% (16)	16.8% (28)	7.8% (13)	100% (167)
Type B: mentoring	18.7% (29)	**41.3% (64)**	17.4% (27)	18.1% (28)	4.5% (7)	100% (155)
Type C: community of distributed team members	13.0% (21)	**37.7% (61)**	23.5% (38)	19.8% (32)	6.2% (10)	100% (162)
Type D: formal reflection of what happened in the project	15.6% (23)	**38.8% (57)**	21.1% (33)	20.4% (30)	4.1% (6)	100% (147)

Table 8: Experience with implicit knowledge transfer technique

Earliest phase in which technique was used

Table 9 shows that most often knowledge transfer techniques were used either in the "Initiate" or "Execute" phases for the first time on respondents' healthcare virtual IT project teams. In Type A (storytelling), this technique was most often started in the "Initiate" phase with 34.1% (N=57) respondents stating that this was its earliest start phase. For Type B (mentoring), 43.1% (N=66)

stated that this technique was started in the "Execute" phase, which was the single highest reported percentage for mentoring. Likewise for Type C (CoP) and Type D (AAR) the single highest percentages reported were in the "Execute" phase at 45.7% (N=74) and 39.5% (N=58), respectively. In all cases, the majority of respondents stated that the technique started no later than the "Execute" phase.

What was the earliest phase of the project in which the technique was used?						
	Initiate	Plan	Execute	Monitor/Control	Close	Response Count
Type A: sharing stories	**34.1%** **(57)**	30.5% (51)	30.5% (51)	2.4% (4)	2.4% (4)	100% (167)
Type B: mentoring	23.5% (36)	24.2% (37)	**43.1%** **(66)**	6.5% (10)	2.6% (4)	100% (153)
Type C: community of distributed team members	22.8% (37)	19.8% (32)	**45.7%** **(74)**	9.3% (15)	2.5% (4)	100% (162)
Type D: formal reflection of what happened in the project	10.9% (16)	15.0% (22)	**39.5%** **(58)**	24.5% (36)	10.2% (15)	100% (147)

Table 9: Earliest phase technique used

This section of the exploratory analyses covers the success measures and risks reported. Risks were reported in 7 areas: 1) management, 2) project, 3) requirements, 4) team, 5) technical, 6) user/stakeholder, and 7) vendor.

Project Success

Not surprisingly, project risk was regularly assessed and monitored in most respondents' organizations, with 82% stating that it was regularly assessed (N=183).

Figure 9 shows how respondents rated the success of the CDTE projects in the areas of "somewhat met" and "fully met". The highest percent of the:

- "on time" success measure for the CDTE was reported at 28.5% for "somewhat met", matched at 28.5% that this measure was "fully met" (N=200);
- "on budget" success measure for the CDTE was reported at 32% for "somewhat met", followed closely at 30.0% that this measure was "fully met" (N=200);
- "meets requirements/user specifications" success measure for the CDTE was reported at 40% for "fully met", followed at 32% that this measure was "somewhat met" (N=200);
- "user/customer satisfaction" success measure for the CDTE was reported at 36.5% for "somewhat met", followed at 34% that this measure was "fully met" (N=200);
- "management satisfaction" success measure for the CDTE was reported at 43.5% for "fully met", followed at 30.6% that this measure was "somewhat met" (N=193);

Overall, it appears that from the performance standpoint CDTEs "somewhat" to "fully" met expectations in the five aforementioned categories. One note of interest is that while "on time", "on budget" and "meets requirements" all had reports of "did not meet" (4.5%, 4.5% and 1.0%, respectively), no respondent stated that either the "customer satisfaction" or "management satisfaction" performance measure had a "did not meet" outcome. This may be because the distributed teams were comprised of members in each of these categories (ie. customers/end users and managers).

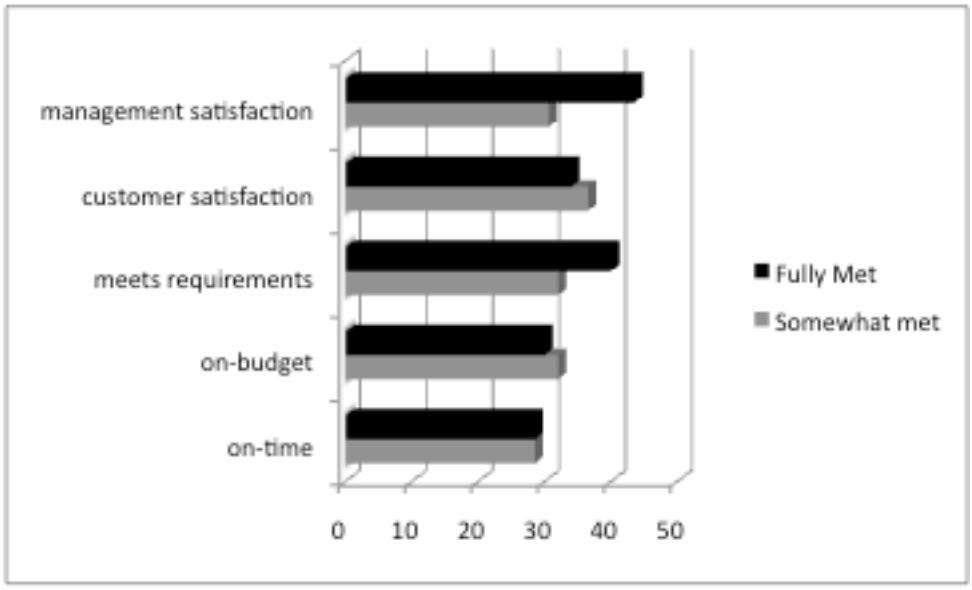


Figure 9: last completed distributed team experience success

There are 3 constraints in project management often represented as a triangle depicting time, cost and scope (see Figure 10). Ultimately, a project manager's goal in managing these triple constraints is to lead to the best quality project outcome possible. The results of this study suggest that system

capabilities (as represented by “scope”) and quality appear to be more important than cost and time in the healthcare field.

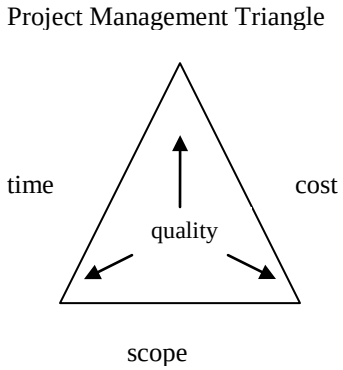


Figure 10: time, cost and scope triangle

Respondents were asked to describe how various risks played the most significant roles in the lack of/minimal success of the CDTE. These risks were in the following categories: management risks, project risks, requirements risks, team risks, technical risks, user/stakeholder risks, and vendor risks. The results of each of these risks will be discussed next.

Risks

Each of the 55 risks in the set had responses from some participants, suggesting that these general risks were found in healthcare virtual IT project teams. Generally speaking, the results showed that respondents saw that in each category the risk set predominantly affected the “within budget” project performance category, implying that the budget is the most likely of the triple constraints to be sacrificed. The detailed report of each risk type follows.

Management risks

Table 10 shows the results of the management risks that significantly affected performance categories. "Company politics" was the single largest risk factor reported in this block with 70 respondents, followed by 61 respondents in each of the risk categories "excessive wait for funding approval" and "inadequate project manager/inexperienced project manager". In the case of "company politics", this risk received the largest number of respondents in the block with 157 responses to this risk factor. The next highest risks were reported in the areas of "excessive wait for funding approval" (N=61) and "inadequate project management/inexperienced project manager" (N=61). In the case of "excessive wait for funding approval" the 61 respondents were reported to affect the "within budget" performance category the most. Again we see that when time conflicts budget is most likely to be sacrificed. For "inadequate project management/inexperienced project manager" the 61 respondents were reported to affect the "business owner satisfaction" performance category the most. This is logical since new project managers typically focus more on tasks than people.

Overall, within the block of management risks the most frequent high scoring responses were found in the "within budget" performance category representing half of all the high scores in each risk category.

Management Risks						
	On time project completion	Within budget	According to requirements/ user requirement	Business owner satisfaction	IT management satisfaction	Response count
Company politics and/or lack of integrity	42	49	**70**	41	27	157
Excessive wait for funding approval	48	**61**	35	41	24	140
Geopolitical issues	36	47	56	**57**	33	134
Inadequate PM/inexperienced PM	36	50	54	**61**	39	141
Lack of commitment from management	47	**56**	41	42	41	138
Poor decision making process	46	**50**	**50**	49	38	144
Project critical to organization	23	**55**	43	49	21	130
PM replaced during project	26	26	38	37	20	106
Total	304	394	387	377	243	

Table 10: Management Risks

Project risks

Table 11 depicts the project risk results. "Creation of meaningless interim deliverables" was the single largest risk factor reported in this block with 61 respondents, followed by 59 respondents in the risk category of "cost overruns" and 57 respondents in the category of "unrealistic estimates/budget expectations". In the case of "creation of meaningless interim deliverables" these 61 respondents

most represented the “within budget” performance category. Interestingly, both “cost overruns” and “unrealistic estimates/budget expectations” also were reported most frequently in the “within budget” performance category.

Overall, within the block of project risks the most frequent high scoring responses were found in the “within budget” performance category, representing 7 of 9 (or 77.8%) of all the high scores in each risk category.

Project Risks						
	On time project completion	Within budget project completion	According to requirements / user specs	Business owner / customer satisfaction	IT management satisfaction	Response count
Cost overruns	27	**59**	49	36	28	136
Creation of meaningless interim deliverables	41	**61**	44	45	33	133
Developed app / product unacceptable	31	**56**	48	45	38	128
Hidden agendas impact project	41	**53**	36	29	36	130
No contingency planning	42	**49**	34	37	36	118
No sponsors/ wrong sponsors	39	**41**	40	43	37	126
Poor quality deliverables	31	45	**46**	38	36	119
Unrealistic estimates/budget expectations	23	**57**	44	38	23	127
Unrealistic time estimate	**36**	34	**36**	32	15	115
Total	311	455	377	343	282	

Table 11: Project Risks

Requirements risks

Table 12 charts the responses about the effect of requirements-related risks on the CDTE. "Developed application or product doesn't satisfy requirements" was the single largest risk factor reported in this block with 69 respondents, followed by 65 respondents in the risk category of "poorly written, unclear or vague project requirements" (along with 59 respondents, also in the risk category "poorly written, unclear or vague project requirements"), and 57 respondents in the category of "too many scope changes/scope creep". In the case of "developed application or product doesn't satisfy requirements" these 69 respondents most represented the "according to requirements/user specifications" performance category. Interestingly, the risks "poorly written, unclear or vague project requirements" and "too many scope changes/scope creep" were most frequently reported to have a bearing on the "within budget" performance category.

Overall, within the block of requirements risks the most frequent high scoring responses were found in the "within budget" performance category, representing 4 of 6 (or 66.7%) of all the high scores in each risk category.

Requirements Risks						
	On time project completion	Within budget project completion	According to requirements / user specs	Business owner / customer satisfaction	IT management satisfaction	Response count
Doesn't satisfy requirements	32	44	**69**	43	18	131
Poorly written, vague, unclear requirements	46	**65**	38	59	39	135
Project scope too limited/vague	37	**48**	**48**	43	44	130
Project scope scaled back from original	51	51	46	**54**	37	134
Too many scope changes/scope creep	41	**57**	42	40	38	134
Unclear project objectives	16	**42**	32	20	24	92
Total	223	307	275	259	200	

Table 12: Requirements Risks

Team Risks

Table 13 depicts the responses of team-related risks on project performance. "Idle people resources" was the single largest risk factor reported in this block with 65 respondents, followed by 61 respondents in the risk category of "personnel turnover" and 60 respondents in the category of "cultural/language differences". In the case of "idle people resources" these 61 respondents were

found in the “within budget” performance category. The risks “personnel turnover” and “cultural/language differences” were also most frequently reported in the “within budget” performance category.

“Insufficient knowledge transfer” (one of the primary components of this study) was a risk found in this block but was not represented in any of the top 5 risks for this block. The largest frequencies for this risk factor were 52 respondents in each of the categories “according to requirements/user specifications” and “IT management satisfaction”.

Overall, within the block of team risks the most frequent high scoring responses were found in the “within budget” performance category, representing 13 of 16 (or 81.3%) of all the high scores in each risk category.

Team Risks						
	On time project completion	Within budget project completion	According to requirements / user specs	Business owner / customer satisfaction	IT management satisfaction	Response count
Conflict among team members	27	43	**56**	36	22	132
Cultural/language differences	36	**60**	38	46	28	122
Idle resources	37	**65**	34	41	40	132
Insufficient knowledge transfer	49	47	**52**	44	**52**	132
Lack of skilled resources	**54**	48	49	41	42	130
Lack of balance or diversity on team	40	**46**	38	34	25	120
Lack of needed training	21	**48**	39	30	22	113
Lack of/inadequate communication	27	**52**	44	40	33	129
Lack of project cohesion	48	**59**	44	43	28	126
Loading project with excess resources	43	**49**	47	41	36	122
Loss of key resource that impacted project	34	**57**	40	47	40	133
Personnel turnover	47	**61**	40	44	32	128
Team members resist change	34	**55**	32	43	31	125
Resource inexperience with company	39	**51**	43	49	25	125
Team members unaccountable for bad decision	31	**53**	46	24	18	116
Too many meetings	24	**32**	22	29	20	99
Total	591	826	664	632	494	

Table 13: Team Risks

Technical risks

Table 14 charts technical risks faced on the CDTE by respondents. "Integration of project components is complex" was the single largest risk factor reported in this block with 64 respondents, followed by 59 respondents each in the risk categories of "unidentified technical constraints" and "inadequate technical resources (ie. hardware processing capability)". In the case of "integration of project components is complex" these 64 respondents stated the risk was most reported in the "within budget" performance category. The risks "unidentified technical constraints" and "inadequate technical resources (ie. hardware processing capability)" likewise were also most frequently reported to be in the "within budget" performance category.

Overall, within the block of technical risks the most frequent high scoring responses were found in the "within budget" performance category, representing 6 of 8 (or 75%) of all the high scores in each risk category.

Technical Risks						
	On time project completion	Within budget project completion	According to requirements / user specs	Business owner / customer satisfaction	IT management satisfaction	Response count
Forced to work within constraints	24	**50**	58	38	36	132
Integration of components complex	50	**64**	49	39	34	139
Lack of knowledge needed to integrate	**48**	45	46	47	41	132
Technical connectivity issues / communication	42	**52**	38	39	51	132
Unidentified technical constraints	31	**59**	46	30	42	135
Inadequate technical resources	40	**59**	51	43	41	136
Technology hardware new to the organization	34	47	**49**	34	26	126
Technology software new to the organization	28	**43**	37	45	31	119
Total	297	419	374	315	302	

Table 14: Technical Risks

User/Stakeholder risks

Table 15 depicts the responses related to user/stakeholder risks. "Catering to desires and wants of a few stakeholders" was the single largest risk factor reported in this block with 61 respondents, followed closely by 60 respondents each in the risk categories of "inexperienced end users" and "lack of end user buy-in". In the case of "catering to desires and wants of a few stakeholders" these 61 respondents stated the risk was most found in the "according to requirements/user specifications" performance category. The risks "inexperienced end users" and "lack of end user buy-in" likewise were also most frequently reported in the "within budget" performance category.

Overall, within the block of user/stakeholder risks the most frequent high scoring responses were found in the "within budget" and "according to requirements/user specifications" performance categories, representing 3 of 6 (or 50%) each of all the high scores in each risk category.

User and Stakeholder Risks						
	On time project completion	Within budget project completion	According to requirements / user specs	Business owner / customer satisfaction	IT management satisfaction	Response count
Catering to few stakeholders	37	52	**61**	44	39	137
Inexperienced end users	47	**60**	46	59	36	144
Lack of end user buy-in	38	**60**	53	59	31	129
Lack of stakeholder involvement	29	**51**	**51**	50	45	134
Misidentification of stakeholders	21	31	**50**	26	30	113
Total	172	254	261	238	181	

Table 15: User and Stakeholder Risks

Vendor Risks

Table 16 shows the reported results of vendor risks on the CDTE. "Lack of coordination among vendors" was the single largest risk factor reported in this block with 71 respondents, followed by a high score of 57 respondents in the risk category of "poor vendor performance" and a high score of 38 in the category of "poor vendor relationship". This block only contained 3 risks, but interestingly the highest frequencies reported were in the "poor vendor performance" category which consistently had higher reported frequencies in every performance measure except one between the other 2 risks in this block.

This suggests that “poor vendor performance” is a particularly important risk in this block.

Overall, within the block of vendor risks the most frequent high scoring responses per risk category were found in the “within budget” performance category, representing 2 of 3 (or 66.7%) of all the high scores in each risk category.

Vendor Risks						
	On time project completion	Within budget project completion	According to requirements / user specs	Business owner / customer satisfaction	IT management satisfaction	Response count
Lack of coordination among vendors	35	**71**	43	41	44	135
Poor vendor performance	**57**	66	53	63	44	139
Poor vendor relationship	26	**38**	36	34	26	114
Total	118	175	132	138	114	

Table 16: Vendor Risks

Consistently, the highest frequencies of risk factors have been reported in the "within budget" performance area. This suggests that in virtual healthcare IT project teams this performance factor should closely be monitored as it appears to be significantly affected by a number of project risks in each of the aforementioned project risk blocks. Again Figure 10 is relevant here. This result offers another example that the cost and time factors may be less important in virtual healthcare IT projects.

With the exploratory and demographic analyses complete, we now turn to the analysis of the hypotheses.

II. D) HYPOTHESES TESTING AND RESULTS

Hypothesis 1 (H1):

Enterprise-wide healthcare IT project teams are likely to be more successful using implicit knowledge transfer techniques than those teams that do not.

To evaluate this hypothesis it was necessary to compare both projects that had used implicit knowledge transfer techniques and those that had not. The data set revealed, however, that only 4 respondents did not use implicit knowledge transfer techniques in their healthcare virtual IT project teams, therefore there were not enough instances of projects that did not use implicit knowledge transfer techniques to evaluate the hypothesis as written. This finding is a good one, however, as it indicates that knowledge transfer techniques are being used extensively in healthcare.

We took the opportunity to drill deeper into the data and further analyzed them to determine if there was any association between "enterprise project type" and "implicit knowledge transfer technique used". Logistic regression (logit) was used (see Appendix 1 for details on the technique) for the analysis. For this logistic regression the dependent variables were the success variables (ie. "on time", "on budget", "according to requirements", "customer satisfaction" and "management satisfaction"), while the independent variables were the implicit knowledge transfer techniques (ie. "storytelling", "mentoring", "communities of practice" and "after action reviews"). Interactions of the variables ("enterprise") by ("storytelling"), ("mentoring"), ("communities of practice") and ("after action reviews") were calculated in SPSS, using 2 variables at a time. For instance,

(“enterprise” * “storytelling”), (“enterprise * mentoring”), etc. were calculated and used in the regression analysis of the individual success performance indicators of “on time”, “on budget”, “meets requirements”, “user/customer satisfaction” and “management satisfaction”. Detailed logit results for this hypothesis are summarized below.

H1A. “on-time” results.

In the baseline measure, 200 cases were included in the analysis with 114 “yes” respondents to the question of whether their last completed distributed team experience (CDTE) “somewhat met” or “fully met” the on-time performance measure and 86 “no” respondents.

After conducting a backward stepwise logistic regression analysis and a manual selection procedure, none of the main effects or interactions showed significance at the 10% significance level.

Summary of “on-time” logistic regression

The data do not provide enough information to draw conclusions on the associations for the “on-time” success measure.

H1B. “on-budget” results.

In the baseline measure, 147 cases were included in the analysis with 98 “yes” respondents to the question of whether their last completed distributed team experience (CDTE) “somewhat met” or “fully met” the on-budget performance measure and 49 “no” respondents.

After conducting a backward stepwise logistic regression analysis and a manual selection procedure, none of the main effects or interactions showed significance at the 10% significance level.

Summary of "on-budget" logistic regression

The data do not provide enough information to draw conclusions on the associations for the "on-budget" success measure.

H1C. "requirements" results.

In the baseline measure, 200 cases were included in the analysis with 144 "yes" respondents to the question of whether their last completed distributed team experience (CDTE) "somewhat met" or "fully met" the requirements performance measure and 56 "no" respondents.

After conducting a backward stepwise logistic regression analysis and a manual selection procedure, none of the main effects or interactions showed significance at the 10% significance level.

Summary of "requirements" logistic regression

The data do not provide enough information to draw conclusions on the associations for the "requirements" success measure.

H1D. "customer satisfaction" results.

In the baseline measure, 192 cases were included in the analysis with 139 "yes" respondents to the question of whether their last completed distributed team

experience (CDTE) “somewhat met” or “fully met” the customer satisfaction performance measure and 53 “no” respondents.

The model for the “customer satisfaction” success performance measure was the following:

Logit(p)=-0.673 + 0.914 (storytelling) + -0.827 (mentoring) + 2.227 (CoP) + 1.486 (enterprise) + -2.197 (enterprise * CoP)

H1-Final Model for Customer Satisfaction Success						
Model	**B**	**S.E.**	**Wald**	**df**	**Sig.**	**Exp(B)**
Enterprise	1.486	.701	4.491	1	.034	4.418
Storytelling	.914	.343	7.102	1	.008	2.495
Mentoring	-.827	.345	5.761	1	.016	.437
CoP	2.227	.991	5.048	1	.025	9.269
Enterprise * CoP	-2.197	1.059	4.307	1	.038	.111
Constant	-.673	.721	.871	1	.351	.510

Table 17: H1-Final Model for Customer Satisfaction Success

The model can be rewritten as two formulas: one for enterprise projects and one for non-enterprise projects:

Enterprise project: Logit(p) = 0.813 +0.914 (storytelling) + -0.827 (mentoring) +0.03 (CoP)

Non Enterprise project: Logit(p) = -0.673 + 0.914 (storytelling) + -0.827 (mentoring) +2.227 (CoP)

Thus the logit model shows that for enterprise projects, increased use of mentoring is associated with lower odds of success (odds of success are 60% lower for any additional increase in use of the mentoring technique). Increased

use of CoP is associated with increased odds of success (odds of success increase by 3% for any additional increase in the use of the CoP technique). Similarly, increased use of storytelling is associated with increased odds of success (odds of success increase by over 200% for any additional increase in the use of the storytelling technique).

For non-enterprise projects, the model shows that an increased use of communities of practice (CoP) is associated with greater odds of success (odds of success increase by over 900% for each increase in the use of the CoP technique). Also, the model shows that an increased use of storytelling is associated with greater odds of success (odds of success increase by over 200% for each increase in the use of the storytelling technique). Finally, the model shows that an increased use of mentoring is associated with decreased odds of success (odds of success are 60% lower for each increase in use of the mentoring technique).

Summary of "customer satisfaction" logistic regression

The data show that the association with p("customer satisfaction" success) is statistically significant for "communities of practice" techniques for both enterprise and non-enterprise project types, and for "storytelling" in the enterprise and non-enterprise project types. In fact, "storytelling" and "mentoring" have the same effect in both enterprise and non-enterprise projects, with the only change being that of "communities of practice" showing the greatest odds of success when used in non-enterprise projects.

H1E. "management satisfaction" results.

In the baseline measure, 193 cases were included in the analysis with 143 "yes" respondents to the question of whether their last completed distributed team experience (CDTE) "somewhat met" or "fully met" the management satisfaction performance measure and 50 respondents that it did not.

After conducting a backward stepwise logistic regression analysis and a manual selection procedure, none of the main effects or interactions showed significance at the 10% significance level.

Summary of "management satisfaction" logistic regression

The data do not provide enough information to draw conclusions on the associations for the "requirements" success measure.

Summary of the H1 results:

There was not enough data to analyze the original hypothesis. However, an analysis was conducted to determine if there was any association to successful project outcomes between "enterprise project type" and "implicit knowledge transfer technique used". While there was not enough data to draw conclusions in the "on time", "on budget", "requirements" or "management satisfaction" success outcome measures, the analyses show significance in the "customer satisfaction" outcome measures.

For "customer satisfaction", association with p for the "communities of practice" technique for both enterprise and non-enterprise project types, and for "storytelling" in the enterprise and non-enterprise project types show statistical

significance. “Storytelling” and “mentoring” have the same effect in both enterprise and non-enterprise projects, with the only change being that of “communities of practice” showing the greatest odds of success when used in non-enterprise projects. The data also show an inverse relationship between “customer satisfaction” and “mentoring” in the non-enterprise project types. That is, the use of mentoring is associated with decreased odds of customer satisfaction success.

Table 18 offers a summary of these findings. The significance and implications of these results will be discussed in the next chapter.

		Storytelling	**Mentoring**	**Communities of Practice**	**After Action Reviews**
On time	**Enterprise**	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data
	Non-Enterprise	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data
On Budget	**Enterprise**	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data
	Non-Enterprise	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data
According to requirements	**Enterprise**	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data
	Non-Enterprise	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data
Customer satisfaction	**Enterprise**	Positive Association	Negative Association	Positive Association	X
	Non-Enterprise	Positive Association	Negative Association	Positive Association	X
Management Satisfaction	**Enterprise**	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data
	Non-Enterprise	Insufficient Data	Insufficient Data	Insufficient Data	Insufficient Data

Table 18: Summary of H1 Findings

Hypothesis 2 (H2):

The degree of use of implicit knowledge transfer techniques by virtual clinical and technical project teams in healthcare will be strongly associated with enterprise-wide projects that are successful.

The approach to this evaluation was to evaluate:

a) (implicit knowledge transfer use of virtual clinical and technical project team types) vs. (non-implicit knowledge transfer use of virtual clinical and technical project team types), and

b) enterprise project teams that were moderate to very successful.

Because only 4 respondents in the study had not used any type of implicit knowledge transfer technique on their healthcare virtual IT project teams, we could not evaluate the non-use of implicit knowledge transfer in enterprise-wide projects. However, we drilled further to evaluate the data related to project team types within enterprise-wide projects to determine if there was any association among these factors as they related to project success.

To conduct this evaluation logistic regression was used. Respondents provided percentages of members who comprised each of their teams (ie. project team types) in the categories of “clinical”, “technical”, “administrative” and “other”. Interactions of the variables (“enterprise”) by (“clinical”), (“technical”), (“administrative”) and (“other”) were calculated in SPSS, using 2 variables at a time. For instance, (“enterprise” * “clinical”), (“enterprise” * “technical”), etc. were calculated and used in the regression analysis of the individual success

performance indicators of “on time”, “on budget”, “meets requirements”, “user/customer satisfaction”, and “management satisfaction”.

Logistic regression

In each of the success performance indicators of “on time”, “on budget”, “according to requirements”, “user/customer satisfaction” and “management satisfaction”, logistic regression (logit) was used (see Appendix 1 for information on the logit analysis technique). For this analysis “enterprise” was used as the independent variable, and “clinical”, “technical”, and “administrative” were used as the dependent variables. Also for this analysis the clinical, technical, administrative and enterprise components of the formula represent the main effects, and the (clinical * enterprise), (technical * enterprise) and (admin * enterprise) components represent the interactions. Detailed logit results for this hypothesis are summarized below.

H2A. “on-time” results

In the baseline measure, 100 cases were included in the analysis with 59 “yes” respondents to the question of whether their last completed distributed team experience (CDTE) “somewhat met” or “fully met” the on-time performance measure and 41 respondents that it did not.

The model for the “on-time” success performance measure was the following:

Logit(p) = -0.102 + 0.068 (clinical) + 0.073 (technical) + 0.718 (enterprise) + -0.103 (enterprise * clinical) + -0.105 (enterprise * technical)

Final Model: On-Time Success						
Model	**B**	**S.E.**	**Wald**	**df**	**Sig.**	**Exp(B)**
Enterprise	.718	.455	2.489	1	.115	2.051
Clinical Team	.068	.039	2.940	1	.086	1.070
Technical Team	.073	.041	3.091	1	.079	1.075
Enterprise * Clinical Team	-.103	.041	6.216	1	.013	.902
Enterprise * Technical Team	-.105	.044	5.782	1	.016	.900
Constant	-.102	.410	.062	1	.803	.903

Table 19: Final Model for On-Time Success

The model can be rewritten as two formulas: one for enterprise projects and one for non-enterprise projects:

Enterprise project: Logit(p) = 0.616 -0.035 clinical - 0.032 technical

Non Enterprise project: Logit(p) = -0.102 + 0.068 clinical+ 0.073 technical

Thus the logit model shows that for enterprise projects, that larger clinical teams are associated with lower odds of success (odds decrease by 3.4% for any additional percentage increase in the clinical team). Similarly larger technical teams are associated with lower odds of success (odds decrease by 3.1 % for any additional percentage increase in the technical team).

For non-enterprise projects, the model suggests a reversed effect. Both clinical and technical teams have a positive effect on the probability of success.

The odds of success increase by about 7% for an increase in either clinical or technical teams.

Summary of "on-time" logistic regression

The data show that the association with p("on-time" success) is statistically significant for "clinical" and "technical" teams in enterprise projects.

H2B. "on-budget" results

In the baseline measure, 97 cases were included in the analysis with 62 "yes" respondents to the question of whether their last completed distributed team experience (CDTE) "somewhat met" or "fully met" the on-budget performance measure and 32 "no" respondents.

The model for the "on-budget" success performance measure was the following:

logit(p)= 0.664 + -0.132 (other) + 0.216 (enterprise) + 0.143 (enterprise * other)

Final Model: On Budget Success						
Model	**B**	**S.E.**	**Wald**	**df**	**Sig.**	**Exp(B)**
Enterprise	.216	.619	.121	1	.728	1.241
Other	-.132	.073	3.245	1	.072	.876
Enterprise*other	.143	.078	3.380	1	.066	1.153
Constant	.664	.566	1.373	1	.241	1.942

Table 20: Final Model for On Budget Success

The model can be rewritten as two formulas: one for enterprise projects and one for non-enterprise projects:

Enterprise project: Logit(p) = 0.88 + 0.011 (other)

Non Enterprise project: Logit(p) = 0.664 - 0.132 (other)

Thus the logit model shows for enterprise projects, that larger "other" teams are associated with higher odds of success (odds increase by 1% for any additional percentage increase in the "other" teams).

For non-enterprise projects, the model suggests a reversed effect. "Other" teams have a negative effect on the probability of success. The odds of success decrease by about 12% for an increase in percentage "other" teams.

Summary of "on-budget" logistic regression

The data show that the association with p("on-budget" success) is statistically significant for "other" teams.

H2C. "requirements" results

In the baseline measure, 100 cases were included in the analysis with 76 "yes" respondents to the question of whether their last completed distributed team experience (CDTE) "somewhat met" or "fully met" the requirements performance measures and 24 "no" respondents.

The model for the "requirements" success performance measure was the following:

Logit(p) = 1.375 + -0.020 (clinical)

Final Model: Requirements Success						
Model	**B**	**S.E.**	**Wald**	**df**	**Sig.**	**Exp(B)**
clinical	-.020	.010	4.459	1	.035	.980
Constant	1.375	.468	8.611	1	.003	3.953

Table 21: Final Model for Requirements Success

The logit model shows that for enterprise projects, larger clinical teams are associated with lower odds of success (odds decrease by 2% for any additional percentage increase in clinical teams).

Summary of "requirements" logistic regression

The data show that the association with p("requirements" success) is statistically significant for "clinical" teams.

H2D. "customer satisfaction" results

In the baseline measure, 99 cases were included in the analysis with 72 "yes" respondents to the question of whether their last completed distributed team experience (CDTE) "somewhat met" or "fully met" the customer satisfaction performance measures and 27 "no" respondents.

After conducting a backward stepwise logistic regression analysis and a manual selection procedure, none of the main effects or interactions showed significance at the 10% significance level.

Summary of "customer satisfaction" logistic regression

The data do not provide enough information to draw conclusions on the associations for the "customer satisfaction" success measure.

H2E. "management satisfaction" results

In the baseline measure, 98 cases were included in the analysis with 74 "yes" respondents to the question of whether their last completed distributed team experience (CDTE) "somewhat met" or "fully met" the management satisfaction performance measures and 24 "no" respondents.

After conducting a backward stepwise logistic regression analysis and a manual selection procedure, none of the main effects or interactions showed significance at the 10% significance level.

Summary of "management satisfaction" logistic regression

The data do not provide enough information to draw conclusions on the associations for the "management satisfaction" success measure.

Summary of the H2 results:

This hypothesis was partially supported. While there was not enough data to draw conclusions in the "customer satisfaction" and "management satisfaction" success outcome measures, the analyses show significance in the other 3 success outcome measures (ie. on-time, on-budget, and requirements).

For "on-time" the results show association with p for "clinical" and "technical" teams. That is, in both cases the odds of "on-time" success are lower for these teams in enterprise projects. For "on-budget", association with p for

"other" teams shows statistical significance – positive association in the "enterprise project type" and negative association in the "non-enterprise project type". For "requirements", association with p for "clinical" teams shows statistical significance. That is, "clinical teams" are associated with lower odds of success for "enterprise project" types.

Table 22 provides a summary of these findings. The significance and implications of these results will be discussed in the next chapter.

		Clinical Personnel Participating	**Technical Personnel Participating**	**Other Personnel Participating**
On Time	**Enterprise**	Negative Association	Negative Association	X
	Non-Enterprise	Positive Association	Positive Association	X
On Budget	**Enterprise**	X	X	Positive Association
	Non-Enterprise	X	X	Negative Association
According to requirements	**Enterprise**	Negative Association	X	X
	Non-Enterprise	Insufficient Data	Insufficient Data	Insufficient Data
Customer satisfaction	**Enterprise**	Insufficient Data	Insufficient Data	Insufficient Data
	Non-Enterprise	Insufficient Data	Insufficient Data	Insufficient Data
Management Satisfaction	**Enterprise**	Insufficient Data	Insufficient Data	Insufficient Data
	Non-Enterprise	Insufficient Data	Insufficient Data	Insufficient Data

Table 22: Summary of H2 Findings

Hypothesis 3 (H3):

The greater the depth of use of implicit knowledge transfer techniques by a virtual project team the more likely the project is to be successful.

For the analysis of this hypothesis, depth of use was considered in 2 major areas:

1) Project phases (ie. “initiate”, “plan”, “execute”, “monitor” and “close”), and

2) Participant types (ie. “distributed team members, only”, “distributed team members and project lead”, “project lead and project manager”, “project manager and team members, only”, “project manager, distributed team, and project lead”, “project manager, team members, project lead and vendor”).

H3-1) Project phase analysis

According to the Project Management Institute’s PMBOK guide (PMI, 2008) there are 5 phases of a project management methodology: 1) initiate, 2) plan, 3) execute, 4) monitor, 5) close. These phases are linear starting with “initiate” and ending with “close”. For this analysis the premise was that the earlier the start of the implicit knowledge transfer technique use, the greater the depth of use of that technique within the project. To evaluate the results, a two-sample proportion test was used. In this analysis the proportions of responses for the success measures (ie. “on time”, “on budget”, “according to requirements”, “customer satisfaction”, “management satisfaction”) were compared to the proportions of responses for the phase measure (ie. started the technique in “initiate” phase or not) for each technique (ie. storytelling, mentoring, community of practice, after action review). Because we were interested in seeing how

projects compared to starting later than "initiate", a 2X2 table was constructed to compare the differences in proportions. The chi-squared test shows if there is a statistically significant difference among the proportions, where the significance level is set at 10%.

Tests comparing the results of two independent sample proportions were run. Two success measures showed a statistically significant difference in proportions.

a) On-time Success: We noticed a statistically significant difference in the proportions when projects started storytelling in the initiate phase as evidenced by p=.081. The percentage of success for projects that used storytelling at initiate was 67% compared to 53% of successful projects that didn't use storytelling at the initiate phase.

b) According to Requirements success: We noticed a statistically significant difference in the proportions when projects started storytelling in the initiate phase as evidenced by p=.084. The percentage of success for projects that used storytelling at initiate was 81% compared to 69% of successful projects that didn't use storytelling at initiate. Results are shown in the following tables.

H3-1A. <u>Results for Storytelling</u>

The p-values for the storytelling two independent sample proportions are found in Table 23. Values marked with an asterisk (*) are statistically significant based on a test of $p < 0.1$.

Summary of P-Values of All Storytelling Results

Success Measure	*P-Value*
On-time	.081*
On-budget	.993
According to Requirements	.084*
Customer Satisfaction	.277
Management Satisfaction	.413

Table 23: Summary of P-Values of All Storytelling Results

Outcomes from the statistically significant tests for storytelling are:

2 Independent Samples Proportion Test **Storytelling Use by On-Time Success**					
			Began Storytelling Use in Initiate Phase		
			No	Yes	Total
On-Time Success	No	Count	67	19	86
		Expected Count	61.5	24.5	86.0
		Std. Residual	.7	-1.1	
	Yes	Count	76	38	114
		Expected Count	81.5	32.5	114.0
		Std. Residual	-.6	1.0	
Total		Count	143	57	200
		Expected Count	143.0	57.0	200.0

Table 24: Storytelling Use by On-Time Success

Chi-Square Test: Storytelling Use by On-Time Success					
	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	3.039	1	.081		

Table 25: Chi-Square Test: Storytelling Use by On-Time Success

2 Independent Samples Proportion Test Storytelling Use by Requirements Success					
			Began Storytelling Use in Initiate Phase		
			No	Yes	Total
Requirements Success	No	Count	45	11	56
		Expected Count	40.0	16.0	56.0
		Std. Residual	.8	-1.2	
	Yes	Count	98	46	144
		Expected Count	103.0	41.0	144.0
		Std. Residual	-.5	.8	
Total		Count	143	57	200
		Expected Count	143.0	57.0	200.0

Table 26: Two independent samples proportion test storytelling use by requirements success

Chi-Square Test: Storytelling Use by Requirements Success					
	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	2.994	1	.084		

Table 27: Chi-Square Test: Storytelling Use by Requirements Success

For the other three success measures (ie. on-budget, customer satisfaction and management satisfaction), data did not provide enough information to determine significance. This is because when the data are categorized in the 2X2 matrix (ie. "initiate"—yes/no and "success"—yes/no) there was not enough data in each individual category to allow comparison.

Summary of Storytelling Results:

Projects that completed "on-time" were more likely to be associated with knowledge transfer via "storytelling" that began in the "initiate" phase of the project. Similarly, projects that produced a final product that were "according to requirements" were more likely to be associated with knowledge transfer via "storytelling" that began in the "initiate" phase of the project. Although our data did not allow us to draw a similar conclusion about the value of "storytelling" to "on-budget" project performance or to "customer" or "management" satisfaction, our results for projects that were "on-time" and "according to requirements" were sufficient to recommend that project managers begin the use of the "storytelling" technique for knowledge transfer at the start of the project lifecycle. This area will be examined further in the discussion chapter of this work.

H3-1B. Results for Mentoring

The p-values for the mentoring technique's two independent sample proportions are as follows:

Summary of P-Values of All Mentoring Results

Success Measure	*P-Value*
On-time	.858
On-budget	.967
According to Requirements	.394
Customer Satisfaction	.579
Management Satisfaction	.934

Table 28: Summary of P-Values of All Mentoring Results

There was not enough information to determine statistically significant differences in the proportions between projects that started in the "initiate" phase and those that did not for the mentoring technique.

H3-1C. <u>Results for Community of Practice (CoP)</u>

The p-values for the CoP two independent sample proportions are found in Table 29. Values marked with an asterisk (*) are statistically significant based on a test of $p < 0.1$.

Summary of P-Values of All CoP Results

Success Measure	*P-Value*
On-time	.738
On-budget	.499
According to Requirements	.077*
Customer Satisfaction	.010*
Management Satisfaction	.576

Table 29: Summary of P-Values of All CoP Results

Outcomes from the statistically significant tests are:

2 Independent Samples Proportion Test **CoP Use by Requirements Success**					
			Began CoP Use in Initiate Phase		
			No	Yes	Total
Requirements Success	No	Count	50	6	56
		Expected Count	45.6	10.4	56.0
		Std. Residual	.6	-1.4	
	Yes	Count	113	31	144
		Expected Count	117.4	26.6	144.0
		Std. Residual	-.4	.8	
Total		Count	163	37	200
		Expected Count	163.0	37.0	200.0

Table 30: Two Independent Samples Proportion Test. CoP Use by Requirements Success

Chi-Square Test: Storytelling Use by Requirements Success					
	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	3.127	1	.077		

Table 31: Chi-Square Test: Storytelling Use by Requirements Success

2 Independent Samples Proportion Test CoP Use by Customer Satisfaction Success					
			Began CoP Use in Initiate Phase		
			No	Yes	Total
Customer Satisfaction Success	No	Count	53	4	57
		Expected Count	46.6	10.4	57.0
		Std. Residual	.9	-2.0	
	Yes	Count	109	32	141
		Expected Count	115.4	25.6	141.0
		Std. Residual	-.6	1.3	
Total		Count	162	36	198
		Expected Count	162.0	36.0	198.0

Table 32: Two Independent Samples Proportion Test CoP Use by Customer Satisfaction Success

Chi-Square Test: CoP Use by Customer Satisfaction Success					
	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	6.706	1	.010		

Table 33: Chi-Square Test: CoP Use by Customer Satisfaction Success

Two success measures showed a statistically significant difference in proportions.

a) According to Requirements success: We noticed a statistically significant difference in the proportions when projects start CoP use in the initiate phase as evidenced by p=.077. The percentage of success for projects that use CoP at initiate is 84% compared to 69% of successful projects that did not use CoP at initiate.
b) Customer Satisfaction success: We noticed a statistically significant difference in the proportions when projects started CoP use in the initiate phase as evidenced by p=.010. The percentage of success for projects that used CoP at initiate was 89% compared to 67% of successful projects that did not use CoP at initiate.

For the other three success measures (ie. on-time, on-budget and management satisfaction), there was not enough information to determine significance.

Summary of Community of Practice Results:

Projects that completed "according to requirements" were more likely to be associated with knowledge transfer via "CoP" that began in the "initiate" phase of the project. Similarly, projects that were completed with "customer satisfaction" success were more likely to be associated with knowledge transfer via "CoP" that began in the "initiate" phase of the project. Although our data did not allow us to draw a similar conclusion about the value of "CoP" to "on-time"

project performance, “on-budget” project performance or “management” satisfaction, our results for projects that were completed “according to requirements” and with “customer satisfaction” were sufficient to recommend that project managers begin the use of the “CoP” technique for knowledge transfer at the start of the project lifecycle. This area will be examined further in the discussion chapter of this work.

H3-1D. Results for After Action Reviews (AAR)

The p-values for the AAR two independent sample proportion tests are as follows:

Phase: Summary of P-Values of All AAR Results

Success Measure	*P-Value*
On-time	.950
On-budget	.764
According to Requirements	.390
Customer Satisfaction	.355
Management Satisfaction	.931

Table 34: Phase: Summary of P-Values of All AAR Results

There was not enough information to determine statistically significant differences in the proportions between projects that started in the “initiate” phase and those that did not for the AAR technique.

H3-1) Summary of Project Phase Analysis

The data show that neither mentoring nor AAR is necessary across the entire scope of a project but it is important for the use of storytelling and CoP to be used over the entire project.

Phase Analysis Summary for 2-Independent Samples Proportion Test

	Storytelling	Mentoring	CoP	AAR
On-time	*	--	--	--
On-budget	--	--	--	--
According to requirements	*	--	*	--
Customer satisfaction	--	--	*	--
Management satisfaction	--	--	--	--

*=statistically significant results produced by 2-independent sample proportion test
--=not enough information to determine significance in the 2-independent sample proportion test

Table 35: Phase Analysis Summary for 2-Independent Samples Proportion Test

The Phase Analysis Summary table shows results for projects where we saw statistically significant differences in the 2-independent sample proportion tests. Differences were seen between projects that started in the "initiate" phase and those that did not for:

a) Storytelling: "on-time" and "according to requirements" success measures, and

b) Community of Practice: "according to requirements" and "customer satisfaction" success measures.

H3-2) Participant analysis

Survey respondents were asked to select the groups of individual types who participated in knowledge sharing techniques on virtual IT project teams. For this analysis the premise was that the more project stakeholders involved when the technique was used, the greater the depth of use of the technique on the team. Team compositions were the following (listed in increasing order of

stakeholder inclusion):

"distributed team members, only",

"distributed team members and project lead",

"project lead and project manager",

"project manager and team members, only",

"project manager, distributed team, and project lead",

"project manager, distributed team, project lead and vendors" -- our "baseline" group.

To evaluate the results, a two-sample proportion test was used. In this analysis the proportions of responses for the success measures (ie. "on time", "on budget", "according to requirements", "customer satisfaction", "management satisfaction") were compared to the proportions of responses for the participant measure (ie. used the technique for the "baseline" participants or not) for each technique (ie. storytelling, mentoring, community of practice, after action review). Because we were interested in seeing how project outcomes compared to those where an implicit knowledge transfer technique was used with "baseline" participants, a 2X2 table was constructed to compare the differences in proportions. The chi-squared test shows if there is a statistically significant difference among the proportions. Statistical significance is based on a test of $p < 0.1$. This threshold was selected because there were not a large number of respondents in this study and a stricter threshold would likely have excluded too much data from consideration.

Tests comparing the results of two independent sample proportions were

run and results are shown in tables related to each implicit knowledge transfer technique.

H3-2A. Results for Storytelling

The p-values for the storytelling two independent sample proportions are as follows:

Summary of P-Values for All Storytelling Results

Success Measure	*P-Value*
On-time	.647
On-budget	.889
According to Requirements	.342
Customer Satisfaction	.292
Management Satisfaction	.499

Table 36: Summary of P-Values for All Storytelling Results

We were not able to determine statistically significant differences in the proportions between projects where "baseline" participants used the technique and those that did not for the storytelling technique. This may, or may not, be a result of the relatively small numbers of participants relative to the large number of categories. More data is needed to resolve this issue.

H3-2B. Results for Mentoring

The p-values for the mentoring technique's two independent sample proportions are as follows:

Summary of P-Values of All Mentoring Results

Success Measure	*P-Value*
On-time	.874
On-budget	.920
According to Requirements	.669
Customer Satisfaction	.953
Management Satisfaction	.730

Table 37: Summary of P-Values of All Mentoring Results

Again, we were not able to determine statistically significant differences in the proportions between projects where "baseline" participants used the technique and those that did not for the mentoring technique. Again, more data would be needed to resolve this issue.

H3-2C. <u>Results for Communities of Practice (CoP)</u>

The p-values for the CoP two independent sample proportions are listed in Table 38. Values marked with an asterisk (*) are statistically significant based on a test of $p < 0.1$

Summary of P-Values of All CoP Results

Success Measure	*P-Value*
On-time	.030*
On-budget	.342
According to Requirements	.035*
Customer Satisfaction	.026*
Management Satisfaction	.028*

Table 38: Summary of P-Values of All CoP Results

Specific outcomes from the statistically significant tests for CoP are detailed in the next eight tables. Following that, conclusions are drawn about these results.

2 Independent Samples Proportion Test CoP Use by On-Time Success					
			Used CoP in Baseline Participants		
			No	Yes	Total
On-Time Success	No	Count	73	13	86
		Expected Count	66.7	19.4	86.0
		Std. Residual	.8	-1.4	
	Yes	Count	82	32	114
		Expected Count	88.4	25.7	114.0
		Std. Residual	-.7	1.3	
Total		Count	155	45	200
		Expected Count	155.0	45.0	200.0
Note: Baseline participants="project manager, distributed team, project lead and vendors"					

Table 39: Two Independent Samples Proportion Test. CoP Use by On-Time Success

Chi-Square Test: CoP Use by On-Time Success					
	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	4.717	1	.030		

Table 40: Chi-Square Test: CoP Use by On-Time Success

2 Independent Samples Proportion Test CoP Use by Requirements Success					
			Used CoP in Baseline Participants		Total
			No	Yes	
Requirements Success	No	Count	49	7	56
		Expected Count	43.4	12.6	56.0
		Std. Residual	.9	-1.6	
	Yes	Count	106	38	144
		Expected Count	111.6	32.4	144.0
		Std. Residual	-.5	1.0	
Total		Count	155	45	200
		Expected Count	155.0	45.0	200.0
Note: Baseline participants="project manager, distributed team, project lead and vendors"					

Table 41: Two Independent Samples Proportion Test. CoP Use by Requirements Success

Chi-Square Test: CoP Use by Requirements Success					
	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	4.460	1	.035		

Table 42: Chi-Square Test: CoP Use by Requirements Success

Chi-Square Test: CoP Use by Customer Satisfaction Success					
	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	4.974	1	.026		

Table 43: Chi-Square Test: CoP Use by Customer Satisfaction Success

2 Independent Samples Proportion Test CoP Use by Customer Satisfaction Success					
			Used CoP in Baseline Participants		
			No	Yes	Total
Customer Satisfaction Success	No	Count	50	7	57
		Expected Count	44.0	13.0	57.0
		Std. Residual	.9	-1.7	
	Yes	Count	103	38	141
		Expected Count	109.0	32.0	141.0
		Std. Residual	-.6	1.1	
Total		Count	153	45	198
		Expected Count	153.0	45.0	198.0
Note: Baseline participants="project manager, distributed team, project lead and vendors"					

Table 44: Two Independent Samples Proportion Test. CoP Use by Customer Satisfaction Success

2 Independent Samples Proportion Test CoP Use by Management Satisfaction Success					
			Used CoP in Baseline Participants		
			No	Yes	Total
Management Satisfaction Success	No	Count	44	6	50
		Expected Count	38.3	11.7	50.0
		Std. Residual	.9	-1.7	
	Yes	Count	104	39	143
		Expected Count	109.7	33.3	143.0
		Std. Residual	-.5	1.0	
Total		Count	148	45	193
		Expected Count	148.0	45.0	193.0
Note: Baseline participants="project manager, distributed team, project lead and vendors"					

Table 45: Two Independent Samples Proportion Test. CoP Use by Management Satisfaction Success

Chi-Square Test: CoP Use by Customer Satisfaction Success					
	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	4.833	1	.028		

Table 46: Chi-Square Test: CoP Use by Customer Satisfaction Success

Thus, as the prior tables show, four success measures showed a statistically significant difference in proportions for "baseline" participants (ie. "project manager, distributed team, project lead and vendors").

a) On-time Success: We noticed a statistically significant difference in the proportions when project teams used CoP as evidenced by p=.030. The

percentage of success for projects that used CoP in “baseline” participants was 71% compared to 53% of successful projects that did not use CoP with “baseline” participants.

b) According to Requirements success: We noticed a statistically significant difference in the proportions when project teams used CoP as evidenced by p=.035. The percentage of success for projects that use CoP at in “baseline” participants is 84% compared to 68% of successful projects that didn’t use CoP with “baseline” participants.

c) Customer Satisfaction success: We noticed a statistically significant difference in the proportions when project teams used CoP as evidenced by p=.026. The percentage of success for projects that used CoP in “baseline” participants was 84% compared to 67% of successful projects that did not use CoP with “baseline” participants.

d) Management Satisfaction success: We noticed a statistically significant difference in the proportions when project teams used CoP as evidenced by p=.028. The percentage of success for projects that used CoP in “baseline” participants was 87% compared to 70% of successful projects that did not use CoP with “baseline” participants.

For the other success measure (ie. on-budget), there was not enough information to determine significance. This is because when the data are categorized in the 2X2 matrix (ie. “baseline”—yes/no and “success”—yes/no) there was not enough data to allow comparison.

Summary of Community of Practice Results:

Projects that completed "on-time" were more likely to be associated with CoP knowledge transfer use in the broader stakeholder category, "baseline" participants. Similarly, projects that produced a final product that were "according to requirements" were more likely to be associated with CoP knowledge transfer use CoP for "baseline" participants. The same held true for projects that completed successfully according to customer and management satisfaction measures. Although our data did not allow us to draw a similar conclusion about the value of CoP to "on-budget" project performance, our results for projects that were "on-time", "according to requirements", "customer" and "management" satisfaction were sufficient to recommend that project managers use the CoP knowledge transfer technique with the most complete team (ie. project manager, distributed team, project lead and vendors). This area will be examined further in the discussion chapter of this work.

H3-2D. Results for After Action Reviews (AAR)

The p-values for the AAR technique's two independent sample proportions are as follows:

Summary of P-Values of All AAR Results

Success Measure	*P-Value*
On-time	.128
On-budget	.773
According to Requirements	.115
Customer Satisfaction	.393
Management Satisfaction	.727

Table 47: Summary of P-Values of All AAR Results

We were unable to determine statistically significant differences in the proportions between projects where "baseline" participants used the technique and those that did not for the AAR technique. More data may have provided a clearer result in this case.

H3-2) Summary of Participant Analysis

The Participant Analysis Summary table shows results for projects where we saw statistically significant differences in the 2-independent sample proportion tests. Differences were seen between projects that used knowledge sharing techniques with "baseline" participants and those that did not for Community of Practice in the areas of "on time", "according to requirements", "customer satisfaction" and "management satisfaction" success measures. We conclude that broad stakeholder involvement in Communities of Practice is associated with

improved project performance. This conclusion will be discussed further in the discussion chapter of this work.

Participant Analysis Summary for 2-Independent Samples Proportion Test

	Storytelling	Mentoring	CoP	AAR
On-time	--	--	*	--
On-budget	--	--	--	--
According to requirements	--	--	*	--
Customer satisfaction	--	--	*	--
Management satisfaction	--	--	*	--

*=statistically significant results produced by 2-independent sample proportion test
--=not enough information to determine significance in the 2-independent sample proportion test

Table 48: Participant Analysis Summary for 2-Independent Samples Proportion Test

Hypothesis 4 (H4):

When consulting firms are used in virtual information systems project teams, there is a greater likelihood that the implicit knowledge transfer techniques of "mentoring" and "communities of practice" will be used vs. when healthcare organizations do not use consulting firms.

There was not enough data in this study of respondents who had used no implicit knowledge transfer technique. Therefore, the analysis of (CoP use and mentoring use) vs. (no technique used) could not be conducted. The approach to analyzing data for this hypothesis therefore was to treat CoP and mentoring as one group and the remaining types of implicit knowledge transfer techniques as a separate group. The test was a chi-square test of association allowing the comparison of 2 attributes in a sample of the data to determine if there was any relationship between them. This test was based on the dichotomy of:

a) (CoP and Mentoring) vs. (storytelling, after action reviews, and "other techniques"), and

b) Use of consultant or non-use of a consultant

The results of the chi-square test in this analysis was X^2 (df=1, N=85)=3.291, p=0.07. A frequency of 67 responses was reported for those who used consultants on their virtual IT project teams. The reported Pearson-Chi Square value was 3.291, with a significance of 0.07. Based on a test of significance of 0.1 the results showed that there was an association between the use of mentoring and CoP as knowledge transfer techniques on healthcare virtual IT project teams and the use of consultants on those teams. Table 49 shows the proportions from this chi-square test. From this table we can also draw a conclusion on the direction of the association. The proportion of teams that used consultants was 63% (ie. 42 respondents used CoP or Mentoring and consultants/67 total respondents) while the proportion that did not use consultants was 39% (ie. 7 respondents used CoP or Mentoring but did not use consultants). Because of the test of significance results, by default these 2 values are sufficiently different to demonstrate a positive direction of association in favour of teams using consultants and the CoP and Mentoring implicit knowledge transfer techniques.

			Used CoP or Mentoring		
			No	**Yes**	Total
Used Consultant	**No**	Count	11	7	18
		Expected Count	7.6	10.4	18
		% of Total	12.9%	8.2%	21.2%
		Residual	3.4	-3.4	
		Std. Residual	1.2	-1	
	Yes	Count	25	42	67
		Expected Count	28.4	38.6	67
		% of Total	29.4%	49.4%	78.8%
		Residual	-3.4	3.4	
		Std. Residual	-0.6	0.5	
		Count	36	49	85
		% of Total	42.4%	57.6%	100%

Table 49: Chi-Square Test Used Consultant by Used CoP or Mentoring

Summary of the H4 results:

The analysis shows that the research data support H4. This result will be analyzed further in the discussion chapter of this work.

H5: ***The larger the healthcare organization, the greater the likelihood that they will use implicit knowledge transfer techniques in their virtual information systems project teams.***

The initial plan was to approach analyzing this hypothesis using a non-parametric testing method given of the unequal distribution of the 2 independent groups:

1) Did not use implicit knowledge transfer techniques (sample size=4)
2) Did use implicit knowledge transfer techniques (sample size=196).

There was insufficient data for this analysis, however. Since there were only 4 respondents who did not use implicit knowledge transfer techniques, this size was too small for any meaningful analysis to be conducted.

Summary of Findings for All Hypotheses

The data showed support for various aspects of H1, H2, H3 and H4. Specifically, for H1 the analysis was to determine if there was any association between "enterprise project type" (ie. enterprise vs. non-enterprise) and "implicit knowledge transfer technique used" (ie. "storytelling", "mentoring", "community of practice (CoP)" and "after action review"). Statistical significance was shown for:

a) the "customer satisfaction" success measure: in the CoP implicit knowledge transfer technique for enterprise and non-enterprise project types;

b) the "storytelling" implicit knowledge transfer technique: in the enterprise and non-enterprise project types;

c) the "storytelling" and "mentoring" implicit knowledge transfer techniques: they had the same effect in both enterprise and non-enterprise projects. Mentoring was shown to decrease the odds of success in both enterprise and non-enterprise project types for the customer satisfaction success measure; and,

d) the "CoP" implicit knowledge transfer technique: this technique showed the greatest odds of success when used in non-enterprise projects.

In H2 the analysis was of the data related to project team types within

enterprise-wide projects to determine if there was any association among these factors as they related to project success. Statistical significance was shown for:
a)“on-time” project success: there was an association between this success measure and “clinical” and “technical” teams;
b)“on-budget” project success: there was an association with “other” teams; and,
c) “requirements” project success: there was an association with “clinical” teams.

For H3 the data was analyzed to determine whether the greater the depth of use of implicit knowledge transfer techniques by a virtual project team was more likely to be associated with project success. For this hypothesis statistical significance was shown in both the “phases” and the “participants” portions of the analysis.

In the “phases” analysis the greater the depth of the use (ie. began using the technique in the “initiate” phase) of the storytelling technique, the more likely the project was to be successful for “on-time” and “requirements” project measures. In the case of the CoP implicit knowledge transfer technique, the greater the depth of use of this technique, the more likely the project was to be successful in the “requirements” and “customer satisfaction” project success measures. In the “participants” analysis the greater the depth of use (ie. used the technique for the greatest number of roles participating in the project) of the implicit knowledge transfer technique, the more likely the project was to be successful for CoP in “on time”, “requirements”, “customer satisfaction”, “management satisfaction” success measures.

For H4, this analysis was about the dichotomy of (CoP and Mentoring) vs.

(storytelling, after action reviews, and “other techniques”), and (use of consultant or non-use of a consultant). The analysis showed that there was an association between the use of CoP and mentoring, and the use of consultants on teams.

For H5, there was insufficient data in the study to conduct this analysis. Table 50 shows a summary of the findings for all 5 hypotheses.

Summary of Quantitative Findings	
Hypothesis	**Result**
H1: successful project outcomes between "enterprise project type" and "implicit knowledge transfer technique used	**Statistical Significances for:** *"customer satisfaction": CoP--enterprise and non-enterprise project types. *"storytelling" in the enterprise and non-enterprise project types. *"Storytelling" and "mentoring" have the same effect in both enterprise and non-enterprise projects. *"CoP" show the greatest odds of success when used in non-enterprise projects.
H2: Evaluate the data related to project team types within enterprise-wide projects to determine if there was any association among these factors as they related to project success.	**Statistical significances for:** *"on-time" association with "clinical" and "technical" teams. *"on-budget", association with "other" teams *"requirements", association with "clinical" teams
H3: The greater the depth of use of implicit knowledge transfer techniques by a virtual project team the more likely the project is to be successful.	**Statistical Significances for:** Phases *Storytelling: on-time and requirements *CoP: requirements and customer satisfaction Participants *CoP in "on time", "requirements", "cust satisf", "management satisf"
H4: Dichotomy of: (CoP and Mentoring) vs. (storytelling, after action reviews, and "other techniques"), and Use of consultant or non-use of a consultant	There is an association between the use of mentoring and CoP and the use of consultants on teams.
H5: The larger the healthcare organization, the greater the likelihood that they will use implicit knowledge transfer techniques in their virtual information systems project teams	There is insufficient data to conduct this analysis

Table 50: Summary of Quantitative Findings

Summary of Chapter 4

This chapter covered the results of analyses in 3 areas: exploratory analysis (survey), hypothesis testing (survey) and focus group results. In the exploratory analysis the data sample size was 394. Respondents reported having worked on distributed teams, with the majority of those teams (approximately 90%) having less than 150 full-time members. The single largest facility category represented in the sample was hospitals with approximately 19% from that facility type. This was not surprising since the majority of respondents were from 3 professional organizations where most of their members are from hospitals. Illinois represented the largest responding state, and this is also an unsurprising finding since the researcher is from that state and heavily recruited participants from it. Almost 69% of respondents reported working on a combination of interdepartmental and organization-wide virtual IT projects, with electronic medical records representing the most common types of projects. Respondents tended to have fairly current experiences on virtual IT project teams with almost 70% having completed their last virtual IT project team experience less than 2 years prior to participating in the study. They tended to be evenly split in their roles with almost one-third each in the roles of project manager, team lead, and team member.

All implicit knowledge transfer techniques (ie. storytelling, mentoring, community of practice and after action reviews) were represented in this study, with the most commonly reported technique being community of practice. Most respondents used SharePoint® and Microsoft® Word as a knowledge sharing

software tool, but many did not use traditional group-ware or collaboration software for sharing knowledge. The primary motivation for using implicit knowledge transfer techniques on virtual IT project teams was because of a high motivation by team members to do so as mentioned by 29% of respondents. The most frequently cited team member types participating in knowledge sharing was "project manager + distributed team + project lead + vendor". This grouping of team members represents the most inclusive of the seven groupings studied. Implicit knowledge transfer techniques were most frequently reported to be used weekly, and for those who led the use of the technique, most had 6 months to 1 year of experience using the technique.

Virtual IT project risks were regularly assessed with most participants citing that their most recent project "somewhat" or "fully met" success criteria as measured by "on time", "on budget", "according to requirements", "meeting customer satisfaction measures" or "meeting management satisfaction" measures.

Risks were further evaluated in the following categories: management risks, project risks, requirements risks, team risks, technical risks, user/stakeholder risks, and vendor risks. The top 2 risks in each category are as follows:

- Management risks: "company politics" and tied in second place were "excessive wait for funding approval, and "inadequate project manager/inexperienced project manager"
- Project risks: "creation of meaningless interim deliverables" and "cost overruns"

- Requirements risks: “developed application or product doesn’t satisfy requirements” and “poorly written, unclear or vague project requirements”
- Team risks: “idle people resources” and “personnel turnover”
- Technical risks: “integration of project components is complex” and “unidentified technical constraints”
- User/Stakeholder risks: “catering to desires and wants of a few stakeholders” and tied in second place were “inexperienced end users” and “lack of end user buy-in”
- Vendor risks: “lack of coordination among vendors” and “poor vendor performance”.

Interestingly, implicit knowledge transfer (a primary component of this study) was not represented as one of the top 5 risks in the “team risks” block. Overall, in every risk category the most frequent high scoring responses were found in the “within budget” performance category (meaning that respondents reported most frequently that these risks affected the “within budget” performance of their projects.)

Hypotheses

Five hypotheses were tested in this study. The analyses showed support for hypotheses 1, 2, 3 and 4 (see Table 47). While the implicit knowledge techniques of storytelling, mentoring and CoP revealed statistical significance throughout these 4 hypotheses to varying degrees, after action reviews (AAR) did not show statistical significance in any of them whether the comparison was to enterprise project types, project team types, project phases, participant types or

the use of a consultant. This finding suggests that this technique may not be a critical one for influencing project success. Interestingly, CoP consistently showed statistical significance in the hypotheses where its evaluation was considered—specifically in H1 ("CoP" show the greatest odds of success when used in non-enterprise projects); H3 (When implemented in the "initiate" phase, "CoP" showed statistical significance with respect to "requirements" and "customer satisfaction" project outcomes, as well as in the "participants" analysis in 4 of the 5 success measures of "on time", "requirements", "customer satisfaction", "management satisfaction"); and H4 (There is an association between the use of mentoring and CoP and the use of consultants on teams). This suggests that CoP is an implicit knowledge transfer technique worthy of consideration by project leadership.

Focus group

One focus group was conducted with representatives from academic medical centers in the Chicagoland area. The challenges they faced on their virtual IT project teams mirrored that found in the literature (ie. communication, culture and managing competing priorities). They noted that healthcare offers a unique challenge in that as IT professionals they have limited ability to observe their customers (ie. healthcare providers) using technologies, because of the nature of healthcare delivery (ie. the need to maintain patient privacy and confidentiality). They described the risks they faced on virtual IT project teams as missing milestones, poor transitioning of project responsibilities, lack of integration with all the people needed and a limited ability to manage their time.

Much as the survey participants reported, the focus group participants frequently reported the use of SharePoint® and Microsoft® Word as tools to facilitate implicit knowledge transfer. Finally, for this group there was no clear consensus on the influence of vendors on their virtual IT project teams. It appears that the influence of the vendor is dependent on what the vendor was hired to do.

The next chapter will be a discussion of the implications of the results and findings, limitations of the study, future research and recommendations.

CHAPTER 5 DISCUSSION AND CONCLUSIONS

This chapter will discuss significant findings and recommendations from the study. The study's results showed that knowledge transfer techniques are being employed on healthcare's virtual IT project teams. We were able to draw conclusions that can be grouped in the following thematic areas:

**Communities of Practice (CoP) and Customer Satisfaction*

**Mentoring and Customer Satisfaction*

**Team Composition and Project Completion According to Requirements*

**Storytelling and Project Success*

**Storytelling, Communities of Practice and Project Management Methodology Phases*

**Communities of Practice and Project Success (with respect to non-enterprise projects, mentoring and the use of consultants on teams).*

These areas are not discrete, however, and discussion in this chapter will show the interconnections among these themes.

The chapter is organized as follows. First, the themes outlined above are discussed. Each theme is explored both in terms of how the relationships uncovered by the study relate to the literature and in terms of their implications for practice. After exploring the themes, the manuscript concludes with a discussion of the limitations of the study, future research, and recommendations.

Communities of Practice and Customer Satisfaction

Summary of results

The results showed that customer satisfaction success was found in organizations using the CoP knowledge transfer technique for both enterprise and non-enterprise project types.

Relating results to the literature

While the literature is sparse on direct ties between the use of CoP and customer satisfaction, there is some evidence implying that the use of knowledge transfer may be linked to customer satisfaction. Goh (2002) argues that focusing on a selected organizational value - such as customer satisfaction - is one way to encourage its use. Employees then focus on capturing knowledge about the customer's needs and preferences. This use of knowledge management then becomes key to organizational success as it can lead to competitive advantage. Similarly, Gupta, Iyer, and Aronson (2000) state that the use of knowledge management contributes to a number of organizational success measures including financial outcomes, business processes, innovation and customer satisfaction. Likewise McCampbell, Clare, and Gitters (1999) articulate that knowledge management allows for an “indirect” benefit of customer satisfaction as knowledge management can lead to customer support processes that improve customer satisfaction in the area of reduced wait time for support services. The CoP technique is intended to capture a depth and breadth of experience from

learnings over various projects, thus it can be argued that if CoP were used, several organizational benefits might be derived, including customer satisfaction. This study's findings showed significance for enterprise and non-enterprise projects and speaks to the fact that CoP appears to be beneficial regardless of project type. This is logical since the concept of customer service is not limited to any particular project type—instead it is an outcome that would be universally desirable. This is the first known study to link CoP with customer satisfaction.

Significance of these results

This finding's contribution to the knowledge management field is that it adds to the literature another application for which CoPs are used. Most significantly, it documents an association with a successful project measure. Also significantly, it adds to the practice of healthcare project management by suggesting that if customer satisfaction is a particularly desirable outcome from a virtual IT project, accountable executives and project staff might wish to consider the use of CoP as a knowledge transfer technique. While the study reported upon here is confined to healthcare, results also can inform project managers in other application areas.

Mentoring and Customer Satisfaction

Summary of results

An interesting finding of this study relates to the negative association between increased use of mentoring and customer satisfaction success.

Relating results to the literature

There are a few possible explanations for this finding. First, the data from this study showed that the use of mentoring largely started in the "execute" phase of the project, which has been shown to be a late start. The research of Kloppenborg, Manolis, and Tesch (2009) shows that when mentoring begins in the initial phase of a project between the project sponsor and the project manager, there is a positive impact on customer focus. Specifically, the Kloppenborg et al., (2009) research shows that the project sponsor's mentoring of the project manager assists the project manager in developing people skills, and as the project manager becomes more skilled and confident, he or she creates better value for the customer. Second, in the study reported upon here, participants were asked if the mentoring technique was used in the project, but participants were not asked to specify who mentored whom. Therefore, although the technique was used, it is not clear if mentoring occurred predominantly between the project manager and the sponsor, as in the Kloppenborg et al. (2009) research, or some other combination of participants. If the latter occurred, it may account for the conflict with Kloppenborg's results. Third, in the current study, mentoring was the third most frequently used technique of the four techniques studied, so its diminished frequency could explain why it did not produce greater benefits in the customer satisfaction success measure. Fourth, since mentoring started relatively late in the study being reported upon here, it is conceivable that such mentoring was added to projects that were already in trouble. This could account for the negative

association found between increased use of mentoring and customer satisfaction success.

Team composition and project completion according to requirements

Summary of results

We evaluated the data related to project team composition in enterprise and non-enterprise project types and found that "requirements" success was associated with "clinical teams".

Relating results to the literature

There is evidence in the literature that clinicians are becoming more heavily involved in development and procurement of IT (Heather Heathfield, Pitty, & Hanka, 1998). In the research study being reported upon here the participants' last completed projects were overwhelmingly clinical (ie. the highest percentages reported were for electronic medical/health records (EMR/EHRs), computerized provider order entry (CPOE) systems, picture archiving and communication systems (PACS), and e-prescribing systems). In these types of projects, clinicians typically are heavily involved in the requirements gathering processes, and such involvement may have contributed to the finding in the study being reported upon here that teams with more clinical staff were associated with "requirements" success. The finding of clinician involvement in the study being reported upon here has support from other studies outside of healthcare, which have shown the importance of end-user/customer involvement in development and/or procurement of information systems. The research of Saarinen and Vepsalainen (1994) shows that the "business knowledge" of developer teams is a

key variable in the development and/or procurement of an information system. This business knowledge is based in part on developer teams' understanding of users' knowledge. Saiu, Long, and Ling (2010) offer a "unified model of information systems development" that includes as inputs to the model "user participation" and "user involvement" as key components which aid information systems development success. Similarly, Ives and Olson (1984) offer a descriptive model of user involvement in computer-based information systems which shows the relationship between user involvement and system quality and acceptance. He and King (2008) conducted a meta-analysis of empirical studies on user participation and found that user participation is beneficial in information systems development, particularly in the area of attitudinal/behavioral outcomes (ie. system acceptance and/or "psychological buy-in"). In research conducted by Vitalari (1985), the relationship between a systems analyst's knowledge base and the success of the analyst in gathering information requirements for an information system is explored. Vitalari's research finds that the highly-rated analysts had a greater incidence and degree of user involvement than their lower-rated counterparts, and that this involvement by users in the system development process (via their interaction with systems analysts) is consistent with research in management information systems (MIS) indicating a relationship between user involvement and MIS success.

Significance of these results

The contribution of this finding is to healthcare IT project management. Significantly, it offers evidence that involving clinicians in the requirements

gathering process may be an important factor in project success, particularly for clinical projects.

We will consider "requirements" success again in the next section as we will show the association between this success measure and the storytelling and CoP results. This is an example of interconnections among themes.

THEMES RELATED TO IMPLICIT KNOWLEDGE TRANSFER TECHNIQUES

Storytelling and Project Success

Summary of results

The study found that storytelling was associated with successful project outcomes in the enterprise and non-enterprise project types. In the evaluation of the depth of the use of a technique by phase, storytelling was associated with "on-time" and "requirements" success measures.

Relating results to the literature

Storytelling: enterprise/non-enterprise projects

Storytelling is seen as an important aspect of moving a project from the planning to the execute stages, and stories can be categorized as "life stories" (ie. the purpose of the project) and "reputation stories" (ie. opinions about the project) (Amtoft, 1994). Amtoft (1994) further encourages team members to articulate explicit aspects of the stories about a project, and encourages the project manager to write a first chapter of the stories gathered, which will become a part of the project description, giving it an official status. While it was not stated by participants in the study reported upon here that such extensive and formal acts of

storytelling occurred on their projects, Amtoft's work suggests that storytelling is not limited to projects of any specific type or scope, adding support for a possible explanation of why storytelling had the same effect in enterprise and non-enterprise projects.

Kamara, Anumba, and Carrillo (2002) outline a process model for transferring knowledge, which include as inputs (in the forms of human, software and paper), identifying the knowledge to be transferred, knowledge sources and the knowledge transfer target, and ending in the selection of a knowledge transfer method (such as storytelling, mentoring, etc.). Depending on the type of project, these inputs may be well known and/or clearly articulated so that the selection of a transfer method may not be a difficult one. Perhaps because the use of storytelling (by participants in the study being reported upon here) was fairly regular, team members had become accustomed to them and used them across both enterprise and non-enterprise project types.

Storytelling, CoP and Project Management Methodology Phases

Storytelling has been discussed by several authors in the context of project management. Schindler and Eppler (2003) describe "learning histories" where a story is written consisting of the main events of a project arranged in chronological order and then content is discussed and applied to related problems. Kull (2005) describes "digital storytelling"—a concept stemming from the use of incorporating digital video into project execution—as a mechanism to aid enterprise knowledge sharing (via success stories, "champion stories" offering

the rationale and motivation for an initiative, and "fireside chats" consisting of periodic updates by senior managers and executives) and project success. Sense (2011) describes storytelling as an aide in bridging the "individual and organizational learning divide" as it can facilitate individual understanding and collective action which can enable that knowledge to become embedded within organizations' "collective memories, structures and processes".

Although the aforementioned works provide support for the use of storytelling in project management, there is nothing in the prior literature linking the use of this technique to the specific success factors of "on-time" and/or "requirements" success, and the study being reported upon here is the first to uncover that relationship. It is unclear, though, why this technique might not similarly be associated with success in the areas of "on budget", "customer satisfaction" and "management satisfaction" as well. It is possible that the focus of stories reported by participants in this study is on topics related to "on-time" and "requirements" success rather than on other topics. It is also possible that in healthcare these areas are not of as much importance as other success measures. This is a possible area of future research. Also, further study of storytelling with a larger number of participants may reveal significance in other success areas.

The study's quantitative results showed that storytelling and CoP were associated with various aspects of project success and the focus group findings likewise showed that storytelling, CoP and mentoring were used in some combination almost daily on the projects that focus group participants described. C. Beise, Carte, Vician, and Chidambaram (2010) state that virtual IT project

teams that developed a shared task vocabulary, improved their technical communication skills, and developed effective strategies for completing their deliverables were likely to be successful. Storytelling and CoPs are facilitators of this type of communication, and for the aforementioned reasons it is possible that these implicit knowledge transfer techniques were associated with project success. Figure 11 depicts the associations of storytelling and project success.

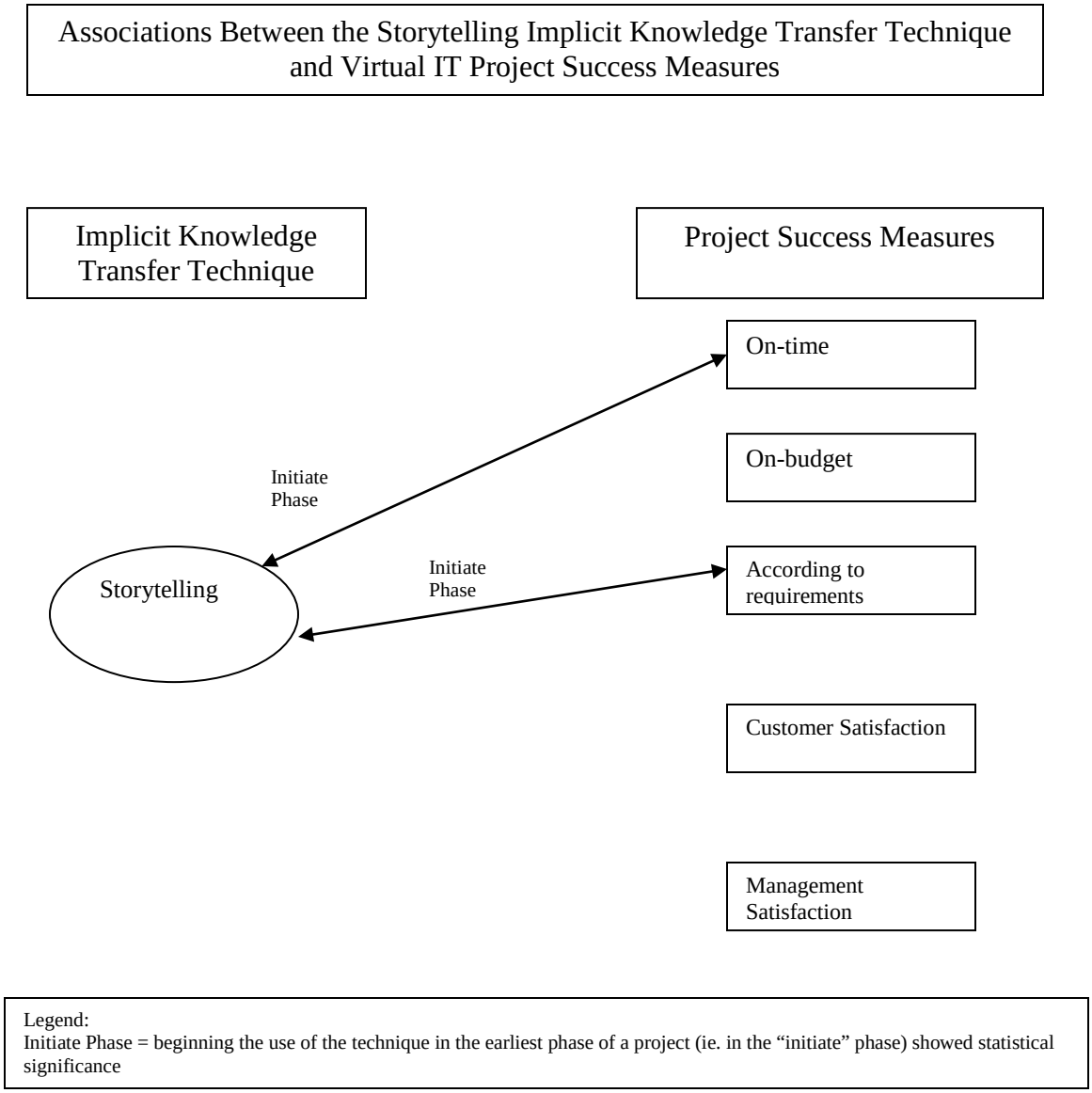


Figure 11: Associations Between the Storytelling Implicit Knowledge Transfer Technique and Virtual IT Project Success Measures (Author's image)

Significance of these results

There are no known studies linking project success to knowledge management techniques, therefore the contribution of this finding is to both the project management and the knowledge management fields. While this study cannot claim that storytelling will improve project success, there is a significant association between the use of the storytelling technique and positive outcomes in both enterprise and non-enterprise projects. The use of the storytelling technique may be particularly important when completing a project within a specific timeframe and/or when requirements for the project are firm. The contribution of this finding to the knowledge management literature is to demonstrate how this technique is being used in healthcare. Significantly, this research is the first known of its kind to study the use of implicit knowledge transfer techniques and their association with project success.

Communities of Practice (CoP) and Project Success

Summary of results

The study found that the use of CoP was associated with project success in the enterprise and non-enterprise project types and that its use showed the greatest odds of success in non-enterprise projects. Also, CoP was associated with both "requirements" and "customer satisfaction" (as previously stated) in the use of implicit knowledge transfer techniques in project phases, and associated with "on-time", "requirements", "customer satisfaction" and "management satisfaction" success measures in the use of implicit knowledge transfer techniques by

participant type. The study also found that there was an association between the use of CoP and mentoring and the use of consultants on project teams.

Non-enterprise projects

The study found that CoP was associated with greatest odds of success when used in non-enterprise projects.

Relating results to the literature

S. L. Pan and Leidner (2003) offer the perspective that the importance of CoP stems from the fact that knowledge cannot be separated from its context and that knowledge contributors as well as seekers require a common community to share general conversation, experimentation, and experiences with other people who do what they do. For the study being reported upon here, perhaps the context of the projects accounted for this finding as many projects in the field are specialized by unique service lines with smaller numbers of experts in those service lines within in the hospital setting—a facility type where the largest percentage of this study's participants were a part. Thus it is possible that the experts from the CoP on non-enterprise projects contributed to the success given the perspectives brought to the projects by CoP members. The literature offers nothing on the use of CoP and its relationship to team size so there is no external evidence suggesting that CoP might be effective with smaller groups to explain this finding. This is an area that warrants future study and may have implications beyond the healthcare field.

Significance of the results

The finding that CoP was associated with greatest odds of success when

used in non-enterprise projects may be because non-enterprise projects tend to be smaller in scope, with fewer participants of varying expertise. Thus, when CoP was used on such a project CoP afforded the project the ability to capitalize on the broad expertise of a community.

Participants on project teams

CoP's use on project teams helps to bring together like-minded people with a shared goal through innovation and collaboration (O'Dell, Grayson, & Essaides, 1998). Keys to success of virtual teams include ensuring that activities include member participation in 1) formulating mission and goals, 2) building shared commitment to team success and each other, 3) ensuring team members feel their work is important and valued, 4) building communication channels between team members, and 5) providing appropriate training for team members (Nemiro, Beyerlein, Bradley, & Beherlein, 2008).

Significance of the results

As mentioned previously in the interconnected storytelling theme CoPs, like storytelling, correlate positively with project success. This research is the first known of its kind to examine this relationship.

Mentoring and the use of consultants on teams

Summary of results

There was not enough data in this study of respondents who had used no implicit knowledge transfer technique to analyze how those who used the

technique compared to those who did not. This is an indication that these techniques are being widely used in the healthcare field. We therefore drilled down further into CoP and mentoring, comparing these two techniques as a single group to the remaining types of implicit knowledge transfer techniques to determine if there were any statistically significant differences between the two groups. The analysis showed there is an association between the use of mentoring and CoP and the use of consultants on teams.

Relating results to the literature

Various articles discuss the use of mentoring on IT project teams. Suchan and Hayzak (2001) describe mentoring's role on a project team as an activity that can enable dissatisfied project team members to receive individual attention, particularly if they are "lost in the project's flat, heavily matrixed organizational structure" or if they are uncertain of who their "boss" is on a project. Suchan and Hayzak further state that mentoring provided "emotional nurture" that enabled protégés on project teams to feel less isolated and connected to the organization. Iles and Hayers (1997) report that project team learning through mentoring needs explicit recognition with the intention of meeting both future organizational needs as well as immediate project needs. Eskerod and Blichfeldt (2005) recommend the appointment of a formal mentor to assist new project team members to become acquainted with the project and to participate in knowledge transfer to the extent that the individual project member needs it. Other articles discuss the use of consultants in IT project teams. King (2005) explains the expectation one company has of consultants to use knowledge banks on projects expressly for

embedding knowledge in their ever-changing technological environment. Sumner (2000) recommends that organizations acquire external expertise through consultants when needed for enterprise-wide projects. Schwalbe (2011) explains the use of outside consultants for leading quality improvement in teams working on enterprise-wide projects. Rarely, however, has the literature discussed the relationship between the use of consultants and mentoring. Armour and Gupta (1999) discuss the role of consultants in mentoring on project teams and have stated that in the case where a technology is being used for the first time or is being applied in a new context, an outside consultant may be used to provide new expertise as needed and to fulfill a mentoring role on the team. For many EMR implementations, external consultants are used to assist with various aspects of project management and it is possible that the novelty and complexity of this type of technology in the hospital, physician office practices and clinic environments, influenced by the presence of a consultant, may have a link to the finding in the study being reported upon here of mentoring and the use of consultants of project teams.

The literature is scant on the role of consultants in the use of projects opting for the CoP knowledge transfer technique. Perhaps the association of CoP use to consultants in the study being reported upon here mirrors the same possible explanation as for the use of mentoring previously stated above—the complexity of these technologies and the nature of the expertise needed to implement them came from outside agents to the project team whose knowledge have influenced the choice of using this technique. The contribution of this finding is to the

healthcare IT project management literature, offering a link between the use of CoP and mentoring to consultant use. Future research of complex and novel implementation projects beyond the healthcare field may offer additional insights into the link between consultants and the use of CoP and mentoring.

Another interesting finding for CoP and storytelling is that the qualitative and quantitative findings of the study being reported upon here supported each other in the area of CoP. Some study participants used the techniques in some combination daily although greatest percentages were on a weekly basis. Also, consistent with the quantitative results, the qualitative study revealed that storytelling and CoP were used more frequently than "after action reviews". What is surprising, however, is that the "after action review" technique for those in the focus group was used *during* the project after key phases rather than after the entire project was completed. This is a different application of the technique than that described by the technique's originators (Academy of Program/Project and Engineering Leadership (APPEL), 2006).

Significance of these results

The CoP implicit knowledge transfer technique showed association with successful outcomes in each of the areas where it was studied in the research being reported upon here and is one of the most important contributions of this study to the fields of project management and knowledge management. Significantly, CoP is clearly a technique which is not only worthy of strong consideration by healthcare project managers on their virtual IT project teams, but is also one worthy of further study by the knowledge management field.

Figure 12 depicts the associations between CoP and project success measures.

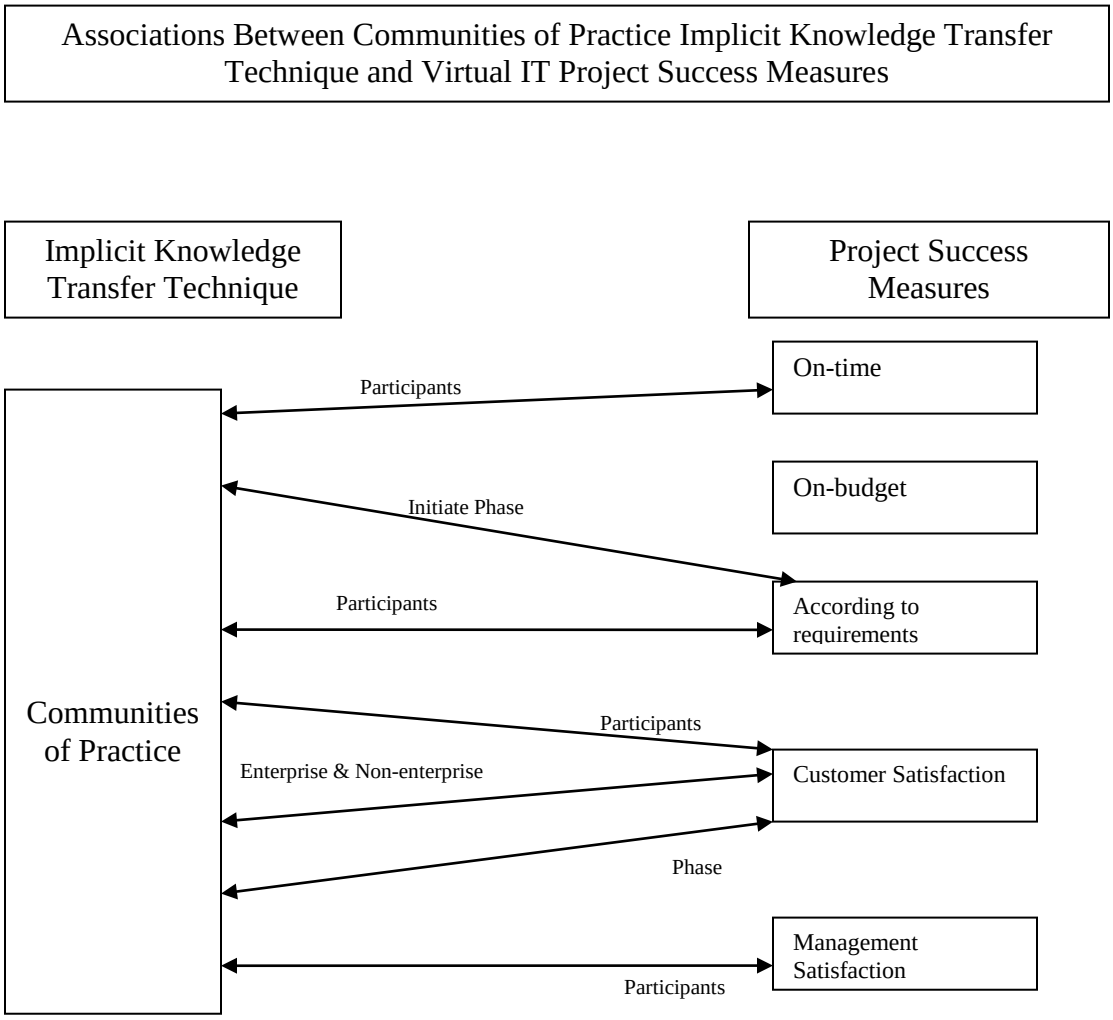


Figure 12: Associations Between the Communities of Practice Implicit Knowledge Transfer Technique and Virtual IT Project Success Measures (Author's image)

THEMES RELATED TO IMPLICIT KNOWLEDGE TRANSFER USE, FREQUENCY AND EXPERIENCE

The study led to insights related to how teams used implicit knowledge transfer techniques which are explored here. First, the study found that engagement of team members in knowledge sharing is important for the choice and use of knowledge sharing in virtual teams as 28.5% expressed that high motivation of team members' participation in knowledge sharing led to the selection of a specific technique. Though the literature does not offer specific support for this finding, there is evidence that encouraging participation by team members in the various functions of teams can be beneficial. Edmonson and Nembhard (2009) state that the limited participation of any members of the team means that valuable information and inquiry is lost, to the detriment of the project. Likewise, Kimball and Eunice (1999) encourage team participation as a strategy to optimize performance. Second, this study led to an interesting discovery in the frequency of use of knowledge transfer techniques. For the techniques of "storytelling", "mentoring" and "communities of practice" there was a notable difference between the frequency of technique use in the "weekly" and "monthly" categories. However, there was no notable difference in these frequencies for the "after action review" (AAR) technique. It is possible that for the projects in which this study's participants were involved, there was a desire for the formal reflection afforded by the AAR at both the "weekly" and "monthly" intervals. Further research into this area is necessary to understand the

nature of those desires and how the AAR technique played a role. Furthermore, AAR is the most frequently used "monthly" technique of all the techniques in this study suggesting that AAR is not as frequently used as other techniques. The literature does not offer any insights into how frequently AAR is used in comparison to other techniques, but in this case it makes sense that AAR is the most frequently used technique on a monthly basis. Project managers often create monthly reports on the status of their projects and the frequency of these reports offer a good opportunity for using AAR on a project team. Third, those using knowledge transfer techniques in this study tended not to have extensive experiences with the use of the techniques and this may account for the earlier finding on the frequency of AAR use. Those with more experience may have opted to use the technique less frequently (ie. twice per year or once per year). Fourth, this study showed that the largest percentages of respondents began their knowledge transfer techniques in the "Execute" phase of the project. Mentoring, communities of practice (CoP) and AAR began in the highest percentages in the Execute phase, while storytelling most often began in the Initiate phase. It is understandable that CoP and AAR began in the Execute phase because those techniques are most relevant to a project "in flight", but it is interesting that the mentoring technique did not begin in the Initiate phase as this might have offered even more opportunity for success in using the technique later. Again, the finding that those using the techniques in this study did not have extensive experiences with the knowledge transfer techniques might explain this finding.

LIMITATIONS OF THE STUDY

We cannot generalize to all types of virtual information systems project teams with the resulting data from this study. Our primary focus was on virtual healthcare project teams comprised of clinical and technical members. Expanding studies to other types of project teams is a topic for future research.

Another limitation is that respondents were drawn largely from those with memberships in the American Health Information Management Association (AHIMA), the Healthcare Information and Management Systems Society (HIMSS), and the Project Management Institute (PMI). Members in these professional organizations are expected to be from larger, hospital-based systems and as a result, the responses reflected by these members may differ from the experiences and responses of those who do not belong to these associations.

Also, implicit knowledge transfer uses and influences were evaluated from the perspectives of the project managers, team leads and team members of virtual information systems project teams. They did not include the perspectives of executives or others who may be a part of a traditional project governance structure.

Finally, a focus group was used as one of the data collection methodologies. The results of the focus group are not generalizable although they added insight to the survey findings. Participants in this focus group largely represented academic medical centers, so the voices of this type of practitioner were most prevalent in the discussion and the reported findings from the focus group may have been influenced by the biases of those respondents.

FUTURE RESEARCH

This is one of the very few studies of knowledge management in the healthcare IT industry. Thus, opportunities exist for future research into how knowledge management is used in the field. For example, there is the potential to explore in greater depth the use of implicit knowledge transfer techniques on virtual IT project teams using observational studies to better understand why storytelling was not associated with success in "on budget", "customer satisfaction" and "management satisfaction" success measures.

There is also the potential to gain more insight into the role of consultants in selecting and applying a knowledge transfer technique. This study identified a relationship between the presence of consultants on the project team and the use of the CoP and mentoring techniques. Additional study on the nature and role of consultants in the selection of these knowledge transfer techniques on healthcare IT project teams is a subject for future work.

It may also be worthwhile to study an expanded set of implicit knowledge transfer types such as interviewing and training as they may be associated with virtual IT project outcomes in ways that the ones from this study do not. Also, study of the combined effects from the use of various knowledge transfer techniques warrants further study. As this study showed, multiple techniques may be used simultaneously in a given organization. Thus, the combination of techniques may influence success in ways not studied here.

Almost 40% of the respondents in the survey were from the hospital environment. Only about 3% of this study's participants were from physician office practices. Therefore, there is a need to study physician office practices in more depth as we have studied medical centers. They are eligible for incentive payments based on their "meaningful use" of electronic medical records (Centers for Medicare and Medicaid Services, 2012a) and based on their meaningful use payments as of October 2012, physicians across the United States have received payments totaling over $2.8B (Centers for Medicare and Medicaid Services, 2012b). This fact suggests that there were numerous implementations of electronic medical records in physician office practices and that experiences with these projects are worthy of study as well. There may be notable similarities and differences in the experiences of practices where the use of virtual IT project teams, implicit knowledge transfer and project success are concerned.

Finally, additional research is needed to determine the extent to which healthcare virtual IT project teams' use of implicit knowledge transfer techniques compares to that in other industries. The uniqueness of the healthcare industry in comparison to other industries may account for similarities and differences that are worthy of further exploration.

RECOMMENDATIONS

Healthcare organizations wishing to improve their performance on virtual IT projects can benefit from multiple aspects of this study. First, the implicit knowledge transfer techniques of storytelling and communities of practice are

techniques that healthcare organizations should consider using because they were shown to have statistically significant associations with success in virtual IT project teams regardless of the type of project (ie. enterprise and non-enterprise). While this study cannot claim that use of these techniques will improve project outcomes, there is a significant association with positive project outcomes, and implementing the use of such knowledge transfer techniques would generally not require substantial resources.

Second, project team compositions were shown to have significant associations with specific success measures. The data showed that "clinical and technical" teams were positively associated with "on-time" success. This study cannot claim that this team composition will improve "on-time" success. However, projects with inflexible timelines may wish to consider this team configuration. Similarly, the data showed positive association between "other" team members and "on-budget" success. (These "other" team members are those that are not clinical, management or technical types of roles. These include service line personnel who support the functioning of operational areas (ex. coordinators, billers, registrars and various ancillary support personnel including lab and radiology technicians, etc)). While this study cannot claim a causal relationship between the use of "other teams" and "on-budget" success, the data show a significant association between these areas, thus this team configuration may be an important consideration for projects that have inflexible budgets. Also, the data showed positive association with teams comprised largely of clinical members and "according to requirements" success. This study cannot claim that

the use of clinical members will lead to “according to requirements” project success, however the data shows a link between the two areas and suggests that healthcare project teams may wish to consider the inclusion of clinical members since the association in this study with “according to requirements” success was significant.

Third, beginning the use of storytelling and CoP in the “initiate” phase of healthcare projects was associated with successful outcomes in this study. Both of these implicit knowledge transfer techniques were associated with the “according to requirements” success measure. Additionally, storytelling was associated with “on-time” success and CoP was associated with “customer satisfaction” success. CoP also was associated with several success measures, including “on-time”, “according to requirements”, “customer satisfaction” and “management satisfaction”, when used with the full project team. Therefore, CoP is a technique worthy of consideration on healthcare IT project teams.

CONCLUSION

The Health Information Technology for Economic and Clinical Health (HITECH) Act of 2009 has infused considerable capital into healthcare organizations, allowing them to embark on projects to implement technologies in unprecedented numbers in domains such as EMR/EHRs, PACS, CPOEs, speech dictation and transcription systems. We demonstrated in this study the widespread use of virtual IT project teams in healthcare and that these teams regularly use knowledge transfer techniques in project implementations.

This is the first study to examine four interrelated dimensions of projects: 1) *project success* (on-time, on-budget, according to requirements, customer satisfaction and management satisfaction), 2) *project type* (enterprise, non-enterprise), 3) *project phases* (initiate, plan, execute, monitor, close), and 4) *project participant types* (project manager, distributed team members, project lead and vendors). The associations that have resulted from the analysis of data in this study and the recommendations from these provide healthcare IT project managers with insights into the following areas:

a) the concept that there may be a *role* for implicit knowledge transfer techniques in their projects, and that some techniques are associated with successful outcomes;

b) the *phases* in which specific implicit knowledge transfer techniques might be most useful and the types of success measures with which the use of these techniques are associated, and;

c) the concept that using *CoP* on the full team is associated with success in four of the five success measures studied.

While much of the literature reports studies focused on *project failures* (A. D. Brown & Jones, 1998; Campbell, Sittig, Ash, Guappone, & Dykstra, 2006; Linberg, 1999; Nelson, 2007), far fewer studies focus on *success*. We instead have focused on success, identifying and evaluating implicit knowledge transfer techniques used in healthcare's virtual information systems project teams to determine which forms were most often associated with successful projects. Not only was this goal achieved, but we also uncovered positive associations between

the enterprise project type and knowledge transfer techniques, project team types and specific success measures, the start of a knowledge transfer technique in the early phase of a project methodology and success, the use of a knowledge transfer technique with all participants on the team and project success, and the association between the use of some knowledge transfer techniques with consultant participation on project teams. These findings open the possibility for additional areas of future research in healthcare IT project management, IT project management in general, and knowledge transfer.

References/Bibliography

Academy of Program/Project and Engineering Leadership (APPEL). (2006). Knowledge in Brief: Learning from Projects. *Academy Sharing Knowledge Magazine, Fall 2006,* 52.

Agresti, A., & Finlay, B. (2008). *Statistical Methods for the Social Sciences* (4th Ed). International Edition: Pearson Education Ltd.

AHANewsNow. (2009). Hospital margins sink with economy Retrieved June 1, 2010, from http://www.ahanews.com/ahanews_app/jsp/display.jsp?dcrpath=AHANEWS/AHANewsArticle/data/AHA_News_090316_Report_hospital&domain=AHANEWS

AHIMA. (2010). AHIMA Facts Retrieved June 28, 2010, from http://www.ahima.org/about/facts.aspx

AHIMA Body of Knowledge. Practice Brief-Retention of Health Information (updated). *Table 4: State Laws or Regulations Pertaining to Retention of Health Information* Retrieved August 3, 2010, from http://library.ahima.org/xpedio/groups/public/documents/ahima/bok1_012547.pdf

Al-Hawamdeh, S. (2002). Knowledge management: re-thinking information management and facing the challenge of managing tacit knowledge. *Information Research, 8*(1).

Alavi, M., & Leidner, D. E. (2001). Knowledge Management and Knowledge Management Systems: Conceptual Foundations and Research Issues. *MIS Quarterly, 25*(1), 107-136.

Allen, T. D., Russell, J. E. A., & Maetzke, S. B. (1997). Formal Peer Mentoring: Factors Related to Proteges Satisfaction and Willingness to Mentor Others. *Group & Organization Management, 22*(4), 488-507.

Amtoft, M. (1994). Storytelling as a support tool for project management. *International Journal of Project Management, 12*(4), 230-233.

Anderson, J. R. (1983). *The architecture of cognition*. Cambridge, MA: Harvard University Press.

Arlotto, P. (2009). ARRA Readiness Assessments, from http://www.healthcare-informatics.com/ME2/dirmod.asp?sid=349DF6BB879446A1886B65F332AC487F&nm=&type=Blog&mod=View+Topic&mid=67D6564029914AD3B204AD35D8F5F780&tier=7&id=EFAC783D58864E50B3F8BCC554466D48

Armour, F. J., & Gupta, M. (1999). Mentoring for Success. *IT Pro*(May/June), 64-66.

Badaracco, J. L. (1991). *The Knowledge Link: How Firms Compete through Strategic Alliance*. Boston: Harvard Business School Press.

Bader-Kowalski, C., & Jakubetzki, A. (2002). *Retaining Valuable Knowledge at Siemens AG--A Case Study*. Houston, TX: American Productivity & Quality Center.

Barker, T., & Frolick, M. N. (2003). ERP Implementation Failure: A Case Study. *Information Systems Management, 20*(4), 43-49.
Barney, J. B. (1991). Firm Resources and Sustained Competitive Advantage. *Journal of Management, 17*, 33-46.
Beise, C., Carte, T. A., Vician, C., & Chidambaram, L. (2010). A case study of project management practices in virtual settings: lessons from working in and managing virtual teams. *SIGMIS Database, 41*(4), 75-97. doi: 10.1145/1899639.1899644
Beise, C. M. (2004). *IT Project Management and Virtual Teams*. Paper presented at the Proceedings of the 2004 SIGMIS conference on Computer personnel research: Careers, culture, and ethics in a networked environment, Tuscon, AZ.
Bellinger, G. (2004). Knowledge Management--Emerging Perspectives Retrieved May 31, 2010, from http://www.systems-thinking.org/kmgmt/kmgmt.htm#bel97a
Berg, M. (2001). Implementing information systems in health care organizations: myths and challenges. *International Journal of Medical Informatics, 64*, 143-156.
Berthoin Anthal, A. (2000). Types of knowledge gained by expatriate managers. *Journal of General Management, 26*(2), 32-51.
Bikson, T. K. (1991). *A Response to Attewell and Rule* (Vol. 3). Boston, MA: Harvard Business School Press.
Boyce, M. E. (1996). Organization Story and storytelling: A Critical Review. *Journal of Organizational Change Management, 9*(5), 5.
Brown, A. D., & Jones, M. R. (1998). Doomed to Failure: Narratives of Inevitability and Conspiracy in a Failed IS Project. *Organization Studies, 19*(1), 73-88.
Brown, J. S., & Duguid, P. (1991). Organizational Learning and Communities of Practice: Toward a Unified View of Working, Learning and Innovation. *Organization Science, 2*(1), 40-57.
Burgess, J. (1996). Focusing on fear. *Area, 28*(2), 130-136.
BusinessWire. (2008). Healthcare IT Outsourcing Is Projected to Be One of the Fastest Growing Segments of Outsourcing Growth in 2008-2009 Retrieved May 16, 2010, from http://findarticles.com/p/articles/mi_m0EIN/is_2008_Feb_21/ai_n24318735/
Calder, B. J. (1977). Focus groups and the nature of qualitative marketing research. *Journal of Marketing Research, 14*(3), 353-364.
Campbell, E. M., Sittig, D. F., Ash, J. S., Guappone, K. P., & Dykstra, R. H. (2006). Types of Unintended Consequences Related to Computerized Provider Order Entry. *Journal of the American Medical Informatics Association, 13*, 547-556.
Canney Davison, S., & Ward, K. (1999). *Leading International Teams*. Berkshire, England: McGraw-Hill International.
Carey, M. A. (1995). Comment: Concerns in the Analysis of Focus Group Data. *Qualitative Health Research, 5*(4), 487-495.

Centers for Medicare & Medicaid Services. (2007). National Health Expenditures--Summary, 1960 to 2007, and Projections, 2008-2018 Retrieved June 1, 2010, from http://www.census.gov/compendia/statab/2010/tables/10s0127.pdf

Centers for Medicare & Medicaid Services. (2010, 01/05/2010). National Health Expenditure Data Retrieved June 1, 2010, from http://www.cms.gov/NationalHealthExpendData/02_NationalHealthAccountsHistorical.asp#TopOfPage

Centers for Medicare and Medicaid Services. (2012a). *April 2012 EHR Incentive Program* (Vol. 2012): Department of Health and Human Services Centers for Medicare & Medicaid Services.

Centers for Medicare and Medicaid Services. (2012b). EHR Incentive Programs Data and Program Reports Retrieved December 11, 2012, 2012, from http://www.cms.gov/Regulations-and-Guidance/Legislation/EHRIncentivePrograms/DataAndReports.html

Choo, C. W. (2000). Working With Knowledge: How Information Professionals Help Organizations Manage What They Know. *Library Management, 21*(8).

Chua, A. Y. K. (2009). Exhuming IT Projects from their Graves: An Analysis of Eight Failure Cases and their Risk Factors. *Journal of Computer Information Systems, 49*(3), 31-39.

Clements, D., & Helmer, J. (2006). CHSRF Knowledge Transfer: Teamwork in Healthcare: Pulling It All Together. *Healthcare Quarterly, 9*(4), 16-17.

Cohen, D., & Prusak, L. (2000). *In Good Company: The Role of Social Capital in Organizations*. Boston, MA: Harvard Business School Press.

Coleman, D. (Ed.). (1999). *Groupware: Collaboration and Knowledge Sharing*. Boca Raton, FL: CRC Press.

Coleman, S. (1998). *Knowledge Management: Linchpin of Change*. London: ASLIB.

Congdon, K. (2009). How much will an EHR system cost you? Retrieved June 1, 2010, from http://www.healthcaretechnologyonline.com/article.mvc/How-Much-Will-An-EHR-System-Cost-You-0001?VNETCOOKIE=NO

Connelly, C. (2010). [Number of members in project management SIG].

Consortium Benchmarking Study. (2002). *Retaining Valuable Knowledge at Best Buy Co, Inc.--A Case Study*. Houston, TX: American Productivity & Quality Center.

Cramton, C. (2001). The mutual knowledge problem and its consequences for dispersed collaboration. *Organization Science, 12*, 346-371.

Cross, R., & Sproull, L. (2004). More Than an Answer: Information Relationships for Actionable Knowledge. *Organization Science, 15*(4 (Jul-Aug, 2004)), 446-462.

Danziger, J. N., & Kraemer, K. L. (1991). *Survey Research and Multiple Operationism: The URBIS Project Methodology* (Vol. 3). Boston, MA: Harvard Business School Press.

Davenport, T., DeLong, D., & Beers, M. (Eds.). (1999). *The Knowledge Management Yearbook, 1999-2000*: Butterworth-Heinemann.

Davidson, M. (1996). *The Transformation of Management*: Butterworth-Heinemann.
DeLong, D. (2004). *Lost Knowledge: Confronting the Threat of an Aging Workforce*: Oxford University Press.
DeSanctis, G., & Monge, P. (1998). Communication Processes for Virtual Organizations. *Journal of Computer-Mediated Communication, 3*(4), 0.
Desouza, K. C., & Evaristo, J. R. (2004). Managing Knowledge in Distributed Projects. *Communications of the ACM, 47*(4), 87-91.
Ding, Q., & Akoorie, M. E. M. (2009). A Critical Review of Three Theoretical Approaches on Knowledge Transfer in Cooperative Alliances. *International Journal of Business Management, 4*(1), 47-55.
Dixon, N. (2000). *Common Knowledge: How Companies Thrive by Sharing What They Know*. Boston: Harvard Business School Press.
Doz, Y., Santos, J., & Williamson, P. (2001). *From global to metanational: How companies win in the knowledge economy*. Boston, MA: Harvard Business School Press.
Dyer, J. H., & Nobeoka, K. (2000). Creating and Managing a high-performance knowledge-sharing network: The Toyota case. *Strategic Management Journal, 21*(3), 345-367.
Edmonson, A. C., & Nembhard, I. M. (2009). Product Development and Learning in Project Teams: The Challenges Are the Benefits. *Journal of Product Innovation Management, 26*(2), 123-138.
Eskerod, P., & Blichfeldt, B. S. (2005). Managing team entrees and withdrawals during the project life cycle. *International Journal of Project Management, 23*, 495-503.
Eskerod, P., & Skriver, H. J. (2007). Organizational Culture Restraining In-House Knowledge Transfer Between Project Managers-A Case Study. *Project Management Journal, 38*(1), 110-122.
Evaristo, J. R., Scudder, R., Desouza, K. C., & Sato, O. (2004). A dimensional analysis of geographically distributed project teams: a case study. *Journal of Engineering and Technology Management, 21*(3), 175-189.
Evaristo, R., & van Fenema, P. C. (1999). A typology of project management: emergence and evolution of new forms. *International Journal of Project Management, 17*(5), 275-281.
Falbo, R. A., Atantes, D. O., & Natali, A. C. C. (2004). *Integrating Knowledge Management and Groupware in a Software Development Environment*: ZDNet.
Fern, E. (1982). The Use of Focus Groups for Idea Generation: The Effects of Group Size, Acquaintanceship, and Moderator on Response Quantity and Quality. *Journal of Marketing Research, 19, Feb 1982*(1), 1-13.
Fernandes, K. J., Raja, V., & Austin, S. (2005). Portals as a knowledge repository and transfer tool—VIZCon case study. *Technovation, 25*(11), 1281-1289.
Fernie, S., Green, S. D., Weller, S. J., & Newcombe, R. (2003). Knowledge sharing: context, confusion and controversy. *International Journal of Project Management, 21*(3), 177-187.

Fleig-Palmer, M. M., & Schoorman, F. D. (2011). Trust as a Moderator of the Relationship Between Mentoring and Knowledge Transfer. *Journal of Leadership & Organizational Studies, 18*(3), 334-343. doi: 10.1177/1548051811408615

Folch-Lyon, E., & Trost, J. (1981). Conducting Focus Group Sessions. *Studies in Family Planning, 12*(12), 443-449.

Gable, G. G. (1994). Integrating case study and survey research methods: an example in information systems. *European Journal of Information Systems, 3*(2), 112-126.

Garvin, D. A., Edmonson, A. C., & Gino, F. (2008). Is Yours a Learning Organization? *Harvard Business Review, March*, 1-11.

Garza, G. (2009). Microsoft Exchange vs Lotus Notes: A Comparison Retrieved August 5, 2010, from http://www.brighthub.com/computing/windows-platform/articles/59098.aspx

Geber, B. (1995). Virtual Teams. *Training, 32*(4), 36-42.

Gibbs, A. (1997). Focus Groups. *Social Research Update*, from http://isites.harvard.edu/fs/docs/icb.topic549650.files/Focus_Groups.pdf

Ginzberg, M. J. (1981). Early Diagnosis of MIS Implementation Failure: Promising Results and Unanswered Questions. *Management Science, 27*(4), 459-478.

Glaser, B., & Strauss, A. (1967). *The discovery of grounded theory*. Hawthorne, NY: Aldine.

Grabowski, M., & Roberts, K. H. (1998). Risk Mitigation in Virtual Organizations. *Journal of Computer-Mediated Communication, 3*(4), 0.

Griffith, T. L., Sawyer, J. E., & Neale, M. A. (2003). Virtualness and Knowledge in Teams: Managing the Love Triangle of Organizations, Individuals and Information Technology. *MIS Quarterly, 27*(2), 265-287.

Gupta, B., Iyer, L. S., & Aronson, J. E. (2000). Knowledge management: practices and challenges. *Industrial Management & Data Systems, 100*(1), 17-21.

Haas, M. R., & Hansen, M. T. (2005). When using knowledge can hurt performance: the value of organizational capabilities in a management consulting company. *Strategic Management Journal, 26*(1), 1-24.

Haldin-Herrgard, T. (2000). Difficulties in diffusion of tacit knowledge in organizations. *Journal of Intellectual Capital, 1*(4), 357-365.

Halonen, R. (2010, July 1). [Number of GCC-HIMSS Members].

Haubner, D. (2007). Program Management--Overcoming Obstacles to Success (article). Retrieved January 10, 2009, from Project Management Institute www.pmi.org

He, J., & King, W. R. (2008). The Role of User Participation in Information Systems Development: Implications from a Meta-Analysis. *Journal of Management Information Systems, 25*(1), 301-331.

Heathfield, H., Pitty, D., & Hanka, R. (1998). Evaluating Information Technology in Health Care: Barriers and Challenges. *British Medical Journal, 318*(7184), 647-649.

Heathfield, H., & Wyatt, J. (1993). Philosophies for the design and development of clinical decision support systems. *Methods Inf Med, 31*(1).
Hedlund, G. (1994). A model of knowledge management and the N-form corporation. *Strategic Management Journal, 15*(0), 73-90.
Heeks, R. (2002). Information Systems and Developing Countries: Failure, Success and Local Improvisations. *Information Society: An International Journal, 18*(2), 101-112.
HIMSS. (2010). About HIMSS Retrieved June 7, 2010, from www.himss.org/ASP/aboutHIMSSHome.asp
HIMSS Analytics. (2008). 2008 HIMSS/HIMSS Analytics Ambulatory Healthcare IT Survey. In HIMSS (Ed.). Chicago, IL: Healthcare Information and Systems Society.
HIMSS Project Management Task Force. (2008). Why Have a Project Management Methodology in Healthcare and How to Deliver Successful Projects. In Himss (Ed.). Chicago, IL.
HIPAA-Encryption.com. (2010). Government Encryption Standard | Advanced Encryption Standard (AES). *HIPAA PHI Compliance* Retrieved August 3, 2010, from http://hipaa-encryption.com/HIPAA-Compliance/phi-encryption/government-encryption-standard-advanced-encryption-standard-aes/
HITECH Answers. (2010). About the HITECH Act of 2009 Retrieved June 1, 2010, from http://hitechanswers.net/about
Ho, V. (2005). Choosing healthcare IT vendors--the inside story. *IT World Canada*. Retrieved from http://www.itworldcanada.com/news/choosing-healthcare-it-vendors-the-inside-story/112511
Holbrook, B., & Jackson, P. (1996). Shopping around: focus group research in North London. *Area, 28*(2), 136-142.
Holden, N. (2002). *Cross-cultural management: A knowledge management perspective*. London: Prentice-Hall Financial Times.
Iles, P., & Hayers, P. K. (1997). Managing diversity in transnational project teams: A tentative model and case study. *Journal of Managerial Psychology, 12*(2), 95-117.
ITCortex. Failure Causes: Statistics Retrieved May 12, 2010, from http://www.it-cortex.com/Stat_Failure_Cause.htm
Ives, B., & Olson, M. (1984). User Involvement in MIS Success: A Review of Research. *Management Science, 30*(5), 586-603.
Jennex, M. E. (Ed.). (2005). *Case Studies in Knowledge Management*. Hershey, PA: IGI Global.
Jeon, S., Young-Gul, K., & Koh, J. (2011). An integrative model for knowledge sharing in communities-of-practice. *Journal of Knowledge Management, 15*(2), 251-269.
Kamara, J. M., Anumba, C. J., & Carrillo, P. M. (2002). A CLEVER approach to selecting a knowledge management strategy. *International Journal of Project Management, 20*(3), 205-211.
Kanawattanachai, P., & Yoo, Y. (2002). Dynamic nature of trust in virtual teams. *Journal of Strategic Information Systems, 11*(3-4), 187-213.

Kaplan, B., & Duchon, D. (1988). Combining Qualitative and Quantitative Methods in Information Systems Research: A Case Study. *MIS Quarterly, 12*(4), 571-586.

Keil, M., Cule, P. E., Lyytinen, K., & Schmidt, R. C. (1998). A Framework for Identifying Software Project Risks. *Communications of the ACM, 41*(11), 76-83.

Kerzner, H. (2006). *Project Management: A Systems Approach to Planning, Scheduling and Controlling* (9th ed.). Hoboken, NJ: John Wiley & Sons.

Kimball, L., & Eunice, A. (1999). The virtual team: Strategies to optimize performance. *Health Forum Journal, 42 May/Jun 1999*(3), 58-62.

King, W. R. (2005). Ensuring ERP Implementation Success. *Information Systems Management, 22*(3), 83-84.

Kitzinger, J. (1995). Qualitative Research: Introducing Focus Groups. *British Medical Journal, 311*(29 July), 299-302.

Kloppenborg, T. J., Manolis, C., & Tesch, D. (2009). Successful project sponsor behaviors during project initiation: an empirical investigation. *Journal of Managerial Issues, 21*(1), 140-159.

Kotabe, M., Dunlap-Hinkler, D., Parente, R., & Mishra, H. A. (2007). Determinants of cross-national knowledge transfer and its effect on firm innovation. *Journal of International Business Studies, 38*, 259-282.

Kraemer, K. L. (1991). *The Information Systems Research Challenge: Survey Research Methods* (Vol. 3). Boston, MA: Harvard Business School Press.

Kram, K. E., & Isabella, L. (1985). Mentoring alternatives: the role of peer relationships in career development. *Academy of Management Journal, 28*(10), 110-132.

Krippendorf, K. (1980). *Content analysis: an introduction to its methodology* (4th ed.). Beverly Hills, CA: Sage.

Kristof, A. L., Brown, K. G., Sims, H. P., & Smith, A. (1995). *The virtual team: A case study and inductive model* (Vol. 2). Greenwich, CT: JAI Press.

Kull, M. D. (2005). Scaling the water cooler: digital storytelling for knowledge continuity. In E. G. Carayannis, Y. H. Kwak & F. T. Anbari (Eds.), *The Story of Managing Projects: A Global, Cross-Disciplinary Collection of Perspectives* (pp. 106-117). Westport, CT: Praeger.

Lawrence, P. R., & Lorsch, J. W. (1967). *Organization and Environment*. Boston: Harvard Business School Press.

Lee-Kelley, L., & Sankey, T. (2008). Global virtual teams for value creation and project success: A case study. *International Journal of Project Management, 26*, 51-62.

Lee, Z., & Lee, J. (2000). An ERP implementation case study from a knowledge transfer perspective. *Journal of Information Technology, 15*(4), 281-288.

Leibowitz, J. (Ed.). (1999). *Knowledge Management Handbook*: CRC Press LLC.

Leonard, D., & Sensiper, S. (1998). The Role of Tacit Knowledge in Group Innovation. *California Management Review, 40*(3), 112-132.

Liao, L., Chen, M., Rodrigues, J., Lai, X., & Vuong, S. (2010). A Novel Web-enabled Healthcare Solution on HealthVault System. *Journal of Medical Systems*, 1-11. doi: 10.1007/s10916-010-9572-2

Linberg, K. R. (1999). Software developer perceptions about software project failure: a case study. *Journal of Systems and Software, 49*(2-3), 177-192.
Lipnack, J., & Stamps, J. (1997). *Virtual Teams--Reaching Across Space, Time and Organizations with Technology*. New York: John Wiley & Sons.
Mannix, E., Griffith, T., & Neale, M. (2002). *The phenomenology of conflict in distributed work teams*. Cambridge, MA: The MIT Press.
Massey, A. P., Montoya-Weiss, M., & Hung, Y.-T. (2003). Because Time Matters: Temporal Coordination in Global Virtual Project Teams. *Journal of Management Information Systems, 19*(4), 129-155.
Maznevski, M. L., & Chudova, K. M. (2000). Bridging Space Over Time: Global Virtual Team Dynamics and Effectiveness. *Organization Science, 11 September-October*(5), 473-492.
McCampbell, A. S., Clare, L. M., & Gitters, S. H. (1999). Knowledge management: the new challenge for the 21st century. *Journal of Knowledge Management, 3*(3), 172-179.
McLaughlin, S., & Paton, R. A. (2008). Defining a Knowledge Strategy Framework for Process Aligned Organizations: An IBM Case. *Knowledge and Process Management, 15*(2), 126-139.
Melymuka, K. (1997). Virtual Realities. *Computerworld, 31*, 70-72.
Meredith, J. R., & Mantel, S. J. (2011). *Project Management: A Managerial Approach* (8 ed.): John Wiley & Sons.
Microsoft. (2011). *Featured Case Studies* (Vol. 2011).
Minbaeva, D. B. (2005). HRM practices and MNC knowledge transfer. *Personnel Review, 34*(1), 125-144.
Mitchell, V. L. (2006). Knowledge Integration and Information Technology Project Performance. *MIS Quarterly, 30*(4), 919-939.
Morgan, D. L. (1993). Qualitative Content Analysis: A Guide to Paths Not Taken. *Qualitative Health Research, 3*(1), 112-121. doi: 10.1177/104973239300300107
Morgan, D. L., & Spanish, M. T. (1984). Focus Groups: A New Tool for Qualitative Research. *Qualitative Sociology, 7*(3), 253-270.
Morgan, L. J., Doyle, M. E., & Albers, J. A. (2005). Knowledge Continuity Management in Healthcare. *Journal of Knowledge Management Practice, 6*.
NASA. (2010). Academy of Program/Project & Engineering Leadership. *APPEL* Retrieved May 25, 2010, from http://www.nasa.gov/offices/oce/appel/knowledge/forums/conferences_forums.html
Nelson, R. R. (2007). IT proect management: Infamous failures, classic mistakes and best practices. *MIS Quarterly, 6*(2), 67-78.
Nemiro, J., Beyerlein, M., Bradley, L., & Beherlein, S. (Eds.). (2008). *The Handbook of High Performance Virtual Teams: A Toolkit for Collaborating Across Boundaries*: Jossey-Bass.
Nonaka, I. (1994). A Dynamic Theory of Organizational Knowledge Creation. *Organization Science, 5*(1), 14-37.

Nonaka, I., & Konno, N. (1998). The Concept of "Ba": Building a Foundation for Knowledge Creation. *California Management Review, 40*(3), 40-54.
Nonaka, I., & Takeuchi, H. (1995). *The knowledge-creating company: How Japanese Companies Create the Dynamics of Innovation*. New York: Oxford University Press.
O'Dell, C., Grayson, C. J., & Essaides, N. (1998). *If Only We Knew What We Know*: Simon and Schuster.
OnLine Consultant Software. (2000-2007). Healthcare Software Vendors Retrieved May 14, 2010, from http://www.health-infosys-dir.com/vendors.htm
Osterloh, M., & Frey, B. S. (2000). Motivation, Knowledge Transfer and Organizational Forms. *Organization Science, 11*(5 (Sep-Oct, 2000)), 538-550.
Pan, G., Hackney, R., & Pan, S. L. (2008). Information Systems Implementation Failure: Insights from prism. *International Journal of Information Management, 28*(4), 259-269.
Pan, S. L., & Leidner, D. E. (2003). Bridging communities of practice with information technology in pursuit of global knowledge sharing. *Journal of Strategic Information Systems, 12*, 71-88.
Paris, S. G., Lipson, M. Y., & Wixson, K. K. (1983). Becoming a strategic reader. *Contemporary Education Psychology, 8*(3), 293-316.
Pauleen, D. J., & Yoong, P. (2001). Facilitating virtual team relationships via Internet and conventional communication channels. *Internet Research, 11*(3), 190-202.
Pawar, K., Horton, A., Gupta, A., Wunram, M., Barson, R., & Weber, F. (2002). *Inter-organizational knowledge management: Focus on human barriers in the telecommunications industry.* Paper presented at the 8th ISPE International Conference on Concurrent Engineering: Research and Applications.
Pinsonneault, A., & Kraemer, K. L. (1993). Survey Research Methodology in Management Information Systems: An Assessment. *Journal of Management Information Systems, 10*(2), 75-105.
PMI. (2008). *A Guide to the Project Management Body of Knowledge (PMBOK Guide)* (4 ed.).
Polyani, M. (1958). *Personal Knowledge: Towards a Post-Critical Philosophy*: The University of Chicago Press.
Polyani, M. (1966). *The tacit dimension*. London: Routledge.
Powell, A., Piccoli, G., & Ives, B. (2004). Virtual teams: a review of current literature and directions for future research. *ACM SIGMIS, 35*(1), 6-36.
Project Management Institute. (2004). *Organizational project management maturity model (OPM3)*. Newtown Square, PA: Project Management Institute.
Project Management Institute. (2010a). About PMI Retrieved July 25, 2010, from http://www.pmi.org/AboutUs/Pages/About-PMI.aspx
Project Management Institute. (2010b). Project Management Institute Retrieved August 4, 2010, from http://www.pmi.org/Pages/default.aspx

Project Management Institute Healthcare Specific Interest Group. (2010). Healthcare Specific Interest Group Retrieved July 25, 2010, from http://www.pmihealthcare.org/Events.htm

Reed, A. H., & Knight, L. V. (2009). Effect of a virtual project team environment on communication-related project risk. *International Journal of Project Management*.

Reed, A. H., & Knight, L. V. (2010). *Project Risk Differences Between Virtual and Co-Located Teams*. Tentatively accepted journal article.

Reissman, C. (1993). *Narrative Analysis*. Newbury Park, CA: Sage.

Roberts, J. (2000). From know-how to show-how? Questioning the role of information and communication technologies in knowledge transfer. *Technology Analysis & Strategic Management, 12*(4), 429-443.

Robey, D., Khoo, H. M., & Powers, C. (2000). Situated Learning in Cross-functional Virtual Teams. *IEEE Transactions on Professional Communication, 43*(1), 51-66.

Ruggles, R. (1998). The State of the Notion: Knowledge Management in Practice. *California Management Review, 40*(3), 80-89.

Saarinen, T., & Vepsalainen, P. J. (1994). Procurement Strategies for Information Systems. *Journal of Management Information Systems, 11*(2), 187-208.

Sachs, P. (1995). Transforming work: collaboration, learning and design. *Communications of the ACM, 38*(9), 36-45.

Sackmann, S. A. (1992). Culture and subcultures: An analysis of organizational knowledge. *Administrative Science Quarterly, 37*(1), 140-161.

SAIC. (2010). KM and British Petroleum Retrieved June 2, 2010, from http://www.saic.com/km/who.html

Saint-Onge, H., & Wallace, D. (2003). *Leveraging Communities of Practice for Strategic Advantage*. Boston: Butterworth-Heinemann.

Saiu, K., Long, Y., & Ling, M. (2010). Toward a Unified Model of Information Systems Development Success. *Journal of Database Management, 21*(1), 80-101.

Schank, R. C. (1990). *Tell Me a Story: Narrative and Intelligence*. Evanston, IL: Northwestern University Press.

Schindler, M., & Eppler, M. J. (2003). Harvesting project knowledge: a review of project learning methods and success factors. *International Journal of Project Management, 21*, 219-228.

Schmidt, R. C., Lyytinen, K., Keil, M., & Cule, P. E. (2001). Identifying Software Project Risks: An International Delphi Study. *Journal of Management Information Systems, 17*(4), 5-36.

Schwalbe, K. (2009). *Information Technology in Project Management* (6th ed.). Boston, MA: Cengage Learning.

Schwalbe, K. (2011). *Information Technology Project Management* (6th - REVISED ed.). Boston, MA: CENGAGE Learning.

Sedgwick County Division of Information & Operations. (2004). *Project Management Methodology*. Kansas.

Sense, A. J. (2011). The project workplace for organizational learning development. *International Journal of Project Management, 29*, 986-993.

Shachaf, P. (2008). Cultural diversity and information and communication technology impacts on global virtual teams: An exploratory study. *Information and Management, 45*(2), 131-142.
Simonin, B. L. (1999). Transfer of marketing know-how in international strategic alliances: An empirical investigation of the role and antecedents of knowledge ambiguity. *Journal of International Business Studies, 30*(4), 463-490.
Smith, E. A. (2001). The role of tacit and explicit knowledge in the workplace. *Journal of Knowledge Management, 5*(4), 311-321.
Snyder, B. (2003). *Teams That Span Time Zones Face New Work Rules* (Vol. 2010): Standord University Graduate School of Business.
Solomon, C. M. (1995). Global teams: the ultimate collaboration. *Personnel Journal, 74*(9), 49-58.
Stagg Elliott, V. (2009). Practices lose financial ground as recession outpaces productivity Retrieved June 1, 2010, from http://www.ama-assn.org/amednews/2009/10/26/bil21026.htm
Suchan, J., & Hayzak, G. (2001). The communication characteristics of virtual teams: a case study. *IEEE Transactions on Professional Communication, 44*(3), 174-186.
Sumner, M. (2000). *Risk Factors in Enterprise Wide Information Management Systems Projects.* Paper presented at the Special Interest Group on Computer Personnel Research Annual Conference.
Swap, W., Leonard, D., Shields, M., & Abrams, L. (2001). Using Mentoring and Storytelling to Transfer Knowledge in the Workplace. *Journal of Management Information Systems, 18*(1), 95-114.
Teece, D. J. (1998). Research directions for knowledge management. *California Management Review, 40*(3), 289-292.
Terry, K. (2003). EMRs: What you need to know Retrieved June 1, 2010, from http://www.modernmedicine.com/modernmedicine/article/articleDetail.jsp?id=111372
Townsend, A. M., DeMarie, S. M., & Hendrickson, A. R. (1998). Virtual teams: Technology and the workplace of the future. *Academy of Management Executive, 12*(3), 17-29.
van Manen, M. (1990). *Researching the lived experience*. London, Ontario: Althouse.
Vitalari, N. P. (1985). Knowledge as a Basis for Expertise in Systems Analysis: An Empirical Study. *MIS Quarterly, 9*(3), 221-240.
Weick, K. E., & Westley, F. (1996). Organizational Learning: Affirming an Oxymoron. In C. H. S. R. Clegg, W. R. Nord (Ed.), *Handbook of Organization Studies* London: Sage.
Wenger, E. C., McDermott, R., & Snyder, W. C. (2002). *Cultivating Communities of Practice: A Guide to Managing Knowledge*. Boston: Harvard Business School Press.
Williams, T. (2007). Chapter 2-Literature Survey *Post-Project Reviews to Gain Effective Lessons Learned*. Newtown Square, PA: Project Management Institute.

Wyatt, J. C. (2001). Management of explicit and tacit knowledge. *Journal of the Royal Society of Medicine, 94*, 6-9.
Xue, Y., Sankar, C. S., & Mbarika, V. W. A. (2004/2005). Information Technology Outsourcing and Virtual Team. *The Journal of Computer Information Systems, 45*(2 (Winter)), 9-16.
Young, R. (1998). The wide-awake club. *People Management, 4*(3), 46-49.
Zachary, L. J. (2000). *The Mentor's Guide: Facilitating Effective Learning Relationships*. San Francisco: Jossey-Bass.
Zander, U., & Kogut, B. (1995). Knowledge and the Speed of the Transfer and Imitation of Organizational Capabilities: An Empirical Test. *Organization Science, 6*(1), 76-92.

APPENDIX 1: LOGISTIC REGRESSION

The formula for logit is:

$$\text{Logit } (p) = \log (p/(1-p))$$

where p in this analysis represents the probability of success. Success represents "on-time", "on-budget", "according to requirements", "customer satisfaction", or "management satisfaction".

The logit procedure is useful for modeling categorical responses and finding predictor variables (if any exist) in the model. The general model is:

$$\textbf{Logit (p)} = B_0 + B_1X_1 + B_2X_2 + B_3X_3 + \ldots + B_KX_K$$

where logit(p) is a measure of the total contribution of all the independent variables used in the model; B_0 is the intercept; $B_1, B_2, B_3 \ldots B_K$ represent regression coefficients of X_1, X_2, $X_3 .. X_K$

For any variable X, the B (beta) represents the change in the log odds of success for any unit-increase in X. A positive B_i indicates an increase in the log odds. $\exp(B_i)$ represents the rate of change in the odds of success for a unit increase in Xi.

In the analyses of all H1 and H2 success performance measures, logistic regression analysis was applied, and significant features were selected using backward selection procedure. Variables with the highest p-value larger than 0.10 were removed and the analysis re-run until a final model was produced. Significance for this analysis was evaluated based on a threshold of p-values <0.1

Logistic regression is described in more detail in Agresti and Finlay (2008) .

APPENDIX II: QUESTIONNAIRE

1. INFORMATION FOR PARTICIPATION IN RESEARCH STUDY

IMPLICIT KNOWLEDGE TRANSFER USE IN VIRTUAL HEALTHCARE INFORMATION SYSTEMS PROJECT TEAMS AND ITS ASSOCIATION WITH SUCCESSFUL PROJECT OUTCOMES

You are being asked to participate in a research study being conducted by Nadene Chambers at DePaul University. We are asking you because we are trying to learn more about implicit knowledge transfer techniques in healthcare virtual information systems project teams, and their association with successful projects. This study will take about 25-30 minutes of your time. If you agree to be in this study, you will be asked to complete an online questionnaire. The questionnaire will include questions about your experiences with implicit knowledge transfer techniques in healthcare virtual information systems project teams, and their association with successful projects. You can choose not to participate. There will be no negative consequences if you decide not to participate or change your mind later.

How much time will this take?
This study will take about 25-30 minutes of your time.

What will I be asked to do if I agree to participate in this study?
If you agree to be in this study, you will be asked to participate complete an online survey about your experiences in a healthcare information systems virtual team and how you have used specific knowledge transfer techniques.

What are the risks involved in participating in this study?
Being in this study does not involve any risks other than what you would encounter in daily life
.
What are the benefits of my participation in this study?
You will not personally benefit from being in this study. However, we hope that what we learn will help the field of project management, healthcare chief information technology and associated project managers as well as the field of knowledge management.

Will I receive any kind of payment for being in this study?
Survey participants will receive a $20 gift certificate for their completion of the study.

Can I decide not to participate? If so, are there other options?
Yes, you can choose not to participate. Even if you agree to be in the study now, you can change your mind later and leave the study. There will be no negative consequences if you decide not to participate or change your mind later.

How will the confidentiality of the research records be protected?
The records of this study will be kept confidential. In any report we might publish, we will not include any information that will identify you. Research records will be stored securely and only the researchers will have access to the records that identify you by name. Some people might review our records in order to make sure we are doing what we are supposed to. For example, the DePaul University Institutional Review Board, and/or the Data and Safety Monitoring Board may review your information. If they look at our records, they will keep your information confidential.

If you have questions about this study, please contact Nadene Chambers, 312.914.3885, nchambe2@cdm.depaul.edu. Alternatively, you may contact this study's faculty sponsor, Linda Knight, PhD, 312.362.5165, lknight@cdm.depaul.edu. If you have questions about your rights as a research subject, you may contact Susan Loess-Perez, DePaul University's Director of Research Protections at 312-362-7593 or by email at sloesspe@depaul.edu.

You may print this information for your records.

2. Opening Statement

Thank you for your willingness to participate in this study. Your responses will be useful in helping us to understand how knowledge is shared in distributed project teams in healthcare information technology. This survey will take approximately 25-30 minutes to complete. Your participation in this survey is completely voluntary, and your responses will be kept confidential.

3. Demographics

Definition of distributed information systems team

For purposes of this study, a distributed information systems team is defined on a continuum where, at a minimum, at least one member of the team consistently (>50% of the time) works in a different geographic location than the rest of the core team, and at a maximum, all members of the team are geographically dispersed with no defined “core”.

*** 1. DE1: Have you ever worked on a distributed information systems team as per the definition above?**

- ◯ yes
- ◯ no

4.

*** 2. DE2: Are you currently working on a distributed information system team?**

- ◯ yes
- ◯ no

5.

*** 3. DE3: Have you had a distributed information system team experience that has already ended?**

- ◯ yes
- ◯ no

6. Distributed Teams Experience Continued

*** 4. DE4: Thinking of your LAST distributed information systems team experience that you completed, please state approximately when that experience ended?**

- ◯ <1 year ago
- ◯ 1-2 years ago
- ◯ 3-5 years ago
- ◯ >5 years ago

*** 5. DE5: How may total years of experience do you have working on distributed information systems teams?**

- ◯ <2 years total experience
- ◯ 2-4 years total experience
- ◯ 4-6 years total experience
- ◯ >6 years total experience

*** 6. DE6: Do you have experience working on distributed information systems teams that involved enterprise-wide clinical projects?**

(Enterprise-wide projects are large-scaled projects that typically involve multiple departments and the outcomes of these projects usually have an impact on multiple departments. Examples of enterprise-wide projects include, but are not limited to, electronic medical record (EMR) implementation, picture archiving and communication system (PACS) implementation, computerized physician order entry (CPOE), e-Prescribing, personal health records (PHR), practice management systems (PMs), etc.)

- ◯ yes
- ◯ no

7. DE7: In what type of organization do you presently work?

- [ ] Academic/Educational Institution
- [ ] Ancillary Clinical Services Provider
- [ ] Ambulatory clinic—hospital owned
- [ ] Ambulatory Clinic—independent
- [ ] Academic Medical Center
- [ ] Community Health Center
- [ ] Consulting firm (healthcare)
- [ ] Federal, State, Local government office
- [ ] Home healthcare organization
- [ ] Hospital/multi-hospital system/integrated delivery system
- [ ] Long-term care facility
- [ ] Payer/Insurer/Managed Care organization
- [ ] Physician office
- [ ] Professional society
- [ ] Public Health organization
- [ ] Vendor

Other (please specify)

8. DE8: In what state do you presently work? (If you work in multiple states, choose the state where you spend MOST of your time).

- ◯ Alabama
- ◯ Alaska
- ◯ American Samoa
- ◯ Arizona
- ◯ Arkansas
- ◯ California
- ◯ Colorado
- ◯ Connecticut
- ◯ Delaware
- ◯ District of Columbia
- ◯ Florida
- ◯ Georgia
- ◯ Guam
- ◯ Hawaii
- ◯ Idaho
- ◯ Illinois
- ◯ Indiana
- ◯ Iowa
- ◯ Kansas
- ◯ Kentucky
- ◯ Louisiana
- ◯ Maine
- ◯ Maryland
- ◯ Massachusetts
- ◯ Michigan
- ◯ Minnesota
- ◯ Mississippi
- ◯ Missouri
- ◯ Montana
- ◯ Nebraska
- ◯ Nevada
- ◯ New Hampshire
- ◯ New Jersey
- ◯ New Mexico
- ◯ New York
- ◯ North Carolina
- ◯ North Dakota
- ◯ Northern Marianas Islands
- ◯ Ohio
- ◯ Oklahoma
- ◯ Oregon
- ◯ Pennsylvania
- ◯ Puerto Rico
- ◯ Rhode Island
- ◯ South Carolina
- ◯ South Dakota
- ◯ Tennessee
- ◯ Texas
- ◯ Utah
- ◯ Vermont
- ◯ Virginia
- ◯ Virgin Islands
- ◯ Washington
- ◯ West Virginia
- ◯ Wisconsin
- ◯ Wyoming

Other (please state "unemployed" if not currently working)

9. DE9: In what state is your organization headquartered?

- ◯ Alabama
- ◯ Alaska
- ◯ American Samoa
- ◯ Arizona
- ◯ Arkansas
- ◯ California
- ◯ Colorado
- ◯ Connecticut
- ◯ Delaware
- ◯ District of Columbia
- ◯ Florida
- ◯ Georgia
- ◯ Guam
- ◯ Hawaii
- ◯ Idaho
- ◯ Illinois
- ◯ Indiana
- ◯ Iowa
- ◯ Kansas
- ◯ Kentucky
- ◯ Louisiana
- ◯ Maine
- ◯ Maryland
- ◯ Massachusetts
- ◯ Michigan
- ◯ Minnesota
- ◯ Mississippi
- ◯ Missouri
- ◯ Montana
- ◯ Nebraska
- ◯ Nevada
- ◯ New Hampshire
- ◯ New Jersey
- ◯ New Mexico
- ◯ New York
- ◯ North Carolina
- ◯ North Dakota
- ◯ Northern Marianas Islands
- ◯ Ohio
- ◯ Oklahoma
- ◯ Oregon
- ◯ Pennsylvania
- ◯ Puerto Rico
- ◯ Rhode Island
- ◯ South Carolina
- ◯ South Dakota
- ◯ Tennessee
- ◯ Texas
- ◯ Utah
- ◯ Vermont
- ◯ Virginia
- ◯ Virgin Islands
- ◯ Washington
- ◯ West Virginia
- ◯ Wisconsin
- ◯ Wyoming

Other (please state "unemployed" if not currently working)

10. DE10: Do you belong to any of these professional organizations? (Choose as many as apply)

- ☐ Health Information and Management Systems Society (HIMSS)
- ☐ Project Management Institute (PMI)
- ☐ American Health Information Management Association (AHIMA)
- ☐ Not applicable

Other (please specify)

7. Distributed Information Systems Teams

For purposes of this study, a distributed team is defined on a continuum where, at a minimum, at least one member of the team consistently (>50% of the time) works in a different geographic location than the rest of the core team, and at a maximum, all members of the team are geographically dispersed with no defined “core”.

In this section you will be addressing your last completed distributed team experience (CDTE). The CDTE describes a distributed team experience that has already ended.

11. The name of the project you worked on for your last completed distributed team experience (CDTE) is: (ex. EHR implementation; e-Prescribing implementation; Practice Management System implementation; etc)

* 12. DT1: Which comes closest to describing your last completed distributed team experience (CDTE)?

- ◯ IRD: Intra-departmental (ie. a project that included only members within your department)
- ◯ ITD: Inter-departmental (ie. a project involving 2 or more departments that would primarily benefit the departments involved in the project)
- ◯ ORG: Organizational (ie. a project involving 2 or more departments that would have application/benefit to multiple other departments in the organization beyond the departments working on the project; an enterprise-wide project)
- ◯ GLO: Global (ie. a project involving 2 or more departments, that would have application/benefit to multiple other departments in the organization, involving international components of the organization).

* 13. DT2: What type of project was your completed distributed team experience (CDTE)?

- ☐ Electronic Medical/Health Record (EMR)/(EHR) implementation
- ☐ Computerized Physician Order Entry (CPOE) implementation
- ☐ Picture Archiving and Communication System (PACS) implementation
- ☐ e-Prescribing
- ☐ application upgrade
- ☐ new software development
- ☐ system migration

Other (please specify)

* 14. DT3: What was the composition of the members of this completed distributed team experience (CDTE)?

Please specify percents to total 100%.

Clinical (ie. MDs, nurses, therapists, etc.)	
Technical (ie. developers, database administrators, project managers, programmers, etc.)	
Administrative (ie. managers, directors, vice presidents, etc.)	
Other	

15. DT4: Which of the following best describes your role in this last completed distributed team experience (CDTE) project team?

◯ Team Member--(one who is responsible for executing tasks and producing deliverables as outlined in the Project Plan and directed by the Project Manager, at whatever level of effort or participation has been defined for them)

◯ Team Lead--(one who provides task and technical leadership by facilitating problem solving and focusing the team on the tasks at hand and customer requirements)

◯ Project Manager--(one who is responsible for ensuring that the Project Team completes the project; develops the Project Plan with the team and manages the team's performance of project tasks; secures acceptance and approval of deliverables from the Project Sponsor and Stakeholders; is responsible for communication, including status reporting, risk management, escalation of issues that cannot be resolved in the team, and, in general, making sure the project is delivered in budget, on schedule, and within scope)

Other (please specify)

16. DT5: How long did your last completed distributed team experience (CDTE) project last?

◯ <3 months
◯ 3-6 months
◯ 7-12 months
◯ 13-18 months
◯ 19-24 months
◯ >24 months
◯ don't know

17. DT6: How long did YOU PARTICIPATE on the last completed distributed team experience (CDTE) project team?

◯ <6 months
◯ 6 months to 1 year
◯ 1 to 2 years
◯ >2 years

18. DT7: What was the maximum size of the last completed distributed team experience (CDTE) project team?

- ◯ <5 people
- ◯ 5-10 people
- ◯ 11-15 people
- ◯ 16-30 people
- ◯ 31-60 people
- ◯ 61-100 people
- ◯ 101-150 people
- ◯ 151-200 people
- ◯ 201-250 people
- ◯ >250 people
- ◯ don't know

19. DT8: What type of organization was the last completed distributed team experience (CDTE) project team a part of?

- ◯ Academic/Educational Institution
- ◯ Ancillary Clinical Services Provider
- ◯ Ambulatory clinic—hospital owned
- ◯ Ambulatory Clinic—independent
- ◯ Academic Medical Center
- ◯ Community Health Center
- ◯ Consulting firm (healthcare)
- ◯ Federal, State, Local government office
- ◯ Home healthcare organization
- ◯ Hospital/multi-hospital system/integrated delivery system
- ◯ Long-term care facility
- ◯ Payer/Insurer/Managed Care organization
- ◯ Physician office
- ◯ Professional society
- ◯ Public Health organization
- ◯ Vendor

Other (please specify)

* 20. DT9: What was the size of the IT organization in which you had your last completed distributed team experience (CDTE)?

Total IT staff (including consultants)

- ◯ None
- ◯ One person less than full-time
- ◯ About one person full-time
- ◯ About two people full-time
- ◯ About 3-5 people full-time
- ◯ About 6-10 people full-time
- ◯ About 11-20 people full-time
- ◯ About 21-40 people full-time
- ◯ About 41-80 people full-time
- ◯ About 80-100 people full-time
- ◯ About 101-150 people full-time
- ◯ About 151-200 people full-time
- ◯ About 201-250 people full-time
- ◯ Greater than 250 people full-time

Don't know. Please provide a guess of the number of IT staff (including consultants) you believe were in the IT organization:

* 21. DT10: Where were the last completed distributed team experience (CDTE) members located?

- [ ] Across a campus
- [ ] Throughout a city/metropolitan area
- [ ] Throughout a single state
- [ ] Among 2-3 states
- [ ] Across the country (>4 states)
- [ ] Around the world

Please specify the states (if applicable) or countries (if applicable)

22. DT11: When did the last completed distributed team experience (CDTE) end?

- ◯ <6 months ago
- ◯ 6 months to 1 year ago
- ◯ 1-2 years ago
- ◯ >2 years ago

23. DT12: Did an external vendor representative/consultant serve as project manager, team lead or team member on your last completed distributed team experience (CDTE) project?

- ◯ yes
- ◯ no

* 24. DT12-2: In what role was the vendor representative/consultant? (check all that apply)

- [ ] Project Manager
- [ ] Team Lead
- [ ] Team Member

* 25. DT13: Which of the following comes closest to describing your last completed distributed team experience (CDTE)?

- ◯ Enterprise-wide project (such as Electronic Medical Records (EMR), computerized physician order entry (CPOE), picture archiving and communication system (PACS), software upgrade, etc.)
- ◯ Non-enterprise project (such as New software development, Package Installation, system migration)

26. DT14: With respect to your completed distributed team experience (CDTE), is there anything specific with respect to the team composition, project type, your role, the team's distribution or the project scope that you would like to share?

8. Knowledge Sharing

* 27. KT1. On some teams, specific types of techniques are used to share knowledge. Did any of the following types of knowledge sharing occur on your last completed distributed team experience (CDTE)? (Check all that apply)

☐ Type A: In this type of knowledge sharing, team members, team leaders or project managers share stories with other members of the team to pass on knowledge, motivate a specific action or communicate cultural values of the organization.

☐ Type B: In this type of knowledge sharing, one member of the team acts as a mentor to another member to share technical, operational or managerial skills to another. The mentor and protégé also share experiences with each other.

☐ Type C: In this type of knowledge sharing a community is comprised of beginners, intermediate specialists and experts in a given subject matter who regularly share their experiences and collaborate, converse and connect about problems faced in their duties. These communities can be of any size and may extend beyond the distributed team.

☐ Type D: In this type of knowledge sharing, teams reflect on their work by asking "what was supposed to happen in the project?", "what actually did happen in the project?", "why were there differences?" and "what can we learn from this and do differently next time?" This is a different exercise from the casual, ad hoc or informal conversations that may occur in passing among different combinations of team members. Instead, this refers to a formal meeting (or set of meetings) comprised of distributed team members (ie. project managers, team leads, team members) who convene after the project has ended for the purpose of discussing the specifics of the project to learn from the experience.

☐ None of the above knowledge sharing techniques (types A-D) were used

☐ No knowledge sharing technique was used at all

* 28. KT2: If your last completed distributed team experience (CDTE) involved the use of knowledge sharing techniques, please specify who participated in these activities and with what frequency

	Participants in the knowledge sharing activities	Frequency that the type of knowledge sharing was used (Select the closest frequency)	If you were responsible for using the technique, how much experience did you have with it?	What was the earliest phase of the project in which the technique was used?
Type A: sharing stories				
Type B: mentoring				
Type C: community of distributed team members				
Type D: formal reflection of what happened in the project				

29. KT3: Were any other techniques used to share knowledge related to the project on your last completed distributed team experience (CDTE) besides Types A, B, C or D above?

◯ no

◯ yes

If "yes", please specify

* 30. KT4: For what percentage of the total project time was the knowledge sharing technique in your last completed distributed team experience (CDTE) project used?

Technique was used for this percentage of the project length:

31. KT5: How was knowledge about your last completed distributed team experience (CDTE) project shared with other groups beyond the distributed team?

- [ ] face to face workshops/forums
- [ ] online/electronic workshops/forums
- [ ] posting on internal organizational site
- [ ] physical posting of information in community locations
- [ ] posting on enterprise project management website (ex. Microsoft Project Web Access)
- [ ] not shared outside of distributed team
- [ ] unsure if dissemination occurred

Other (please specify)

32. KT6: What types of technology, if any, were used to facilitate the knowledge sharing in your completed distributed team experience (CDTE) project?

- [ ] Share Point
- [ ] Shared Drive(s)
- [ ] Google Docs
- [ ] WebEx
- [ ] Microsoft Word
- [ ] Clarity
- [ ] Lotus Notes

Other (please specify)

*** 33. KT7: What factor do you believe is the primary contributor to the use of knowledge sharing techniques on your completed distributed team experience (CDTE)? (Select only one)**

- ◯ reputation of, and trust in, the team member initiating the knowledge sharing
- ◯ high motivation by the team members to participate in knowledge sharing
- ◯ a credible expert in knowledge sharing was on the team and encouraged its use by the team
- ◯ there was support for knowledge sharing by the team's project manager
- ◯ there was a credible technical expert on the team who others sought out for the sharing of knowledge
- ◯ there was technology available to the team to support the sharing of knowledge
- ◯ the frequency of team meetings facilitated the ability to share knowledge
- ◯ people on the team generally got along well so it was easy to share knowledge

Other (please specify)

9. Completion of Knowledge Transfer section

34. KT8: If there is anything else you wish to comment on with respect to your experience with knowledge sharing that was particularly effective, the use of technology to share knowledge, or techniques used to share knowledge on your last completed distributed team experience (CDTE) project that would clarify any of your responses above, please include those comments here

10. Risk

35. R1: Is information system project risk regularly assessed and monitored in your organization?

- ◯ yes
- ◯ no

* 36. R2: How would you assess the performance of the last completed distributed team experience (CDTE)?

	did not meet	somewhat unmet	neutral	somewhat met	fully met	N/A
on time	◯	◯	◯	◯	◯	◯
on budget	◯	◯	◯	◯	◯	◯
meets requirements/user specifications	◯	◯	◯	◯	◯	◯
user/customer satisfaction	◯	◯	◯	◯	◯	◯
management satisfaction	◯	◯	◯	◯	◯	◯

Other (please specify)

11. Management Risks

37. R3-1: Which of the following MANAGEMENT risks played the most significant roles in the lack of/minimal success of your CDTE project? (Check all that apply. You may also skip a risk if it was not present in your CDTE).

	on time project completion	within budget	according to requirements/user specifications	business owner satisfaction (user or management)	IT management satisfaction
Company politics and/or lack of integrity	☐	☐	☐	☐	☐
Excessive wait for funding approval, no funding or loss of funding	☐	☐	☐	☐	☐
Geopolitical issues (ie. political power changes in a geographical area)	☐	☐	☐	☐	☐
Inadequate project management and/or inexperienced project manager	☐	☐	☐	☐	☐
Lack of commitment from management	☐	☐	☐	☐	☐
Poor decision making process	☐	☐	☐	☐	☐
Project critical to the organization	☐	☐	☐	☐	☐
Project manager replaced during project	☐	☐	☐	☐	☐

Other (please specify)

12. Project Risks

38. R3-2: Which of the following PROJECT risks played the most significant roles in the lack of/minimal success of your CDTE project? (Check all that apply. You may also skip a risk if it was not present in your CDTE).

	on time project completion	within budget	according to requirements/user specifications	business owner satisfaction (user or management)	IT management satisfaction
Cost overruns	☐	☐	☐	☐	☐
Creation of meaningless intermediate deliverables to give the impression deadlines are being met	☐	☐	☐	☐	☐
Developed application or product unacceptable to end-user	☐	☐	☐	☐	☐
Hidden agendas impact the project	☐	☐	☐	☐	☐
No contingency planning	☐	☐	☐	☐	☐
No sponsors or wrong sponsors	☐	☐	☐	☐	☐
Poor quality deliverables	☐	☐	☐	☐	☐
Unrealistic Estimate/Budget expectations	☐	☐	☐	☐	☐
Unrealistic time estimate	☐	☐	☐	☐	☐

Other (please specify)

13. Requirements Risks

39. R3-3: Which of the following REQUIREMENTS risks played the most significant roles in the lack of/minimal success of your CDTE project? (Check all that apply. You may also skip a risk if it was not present in your CDTE).

	on time project completion	within budget	according to requirements/user specifications	business owner satisfaction (user or management)	IT management satisfaction
Developed application or product doesn't satisfy requirements	☐	☐	☐	☐	☐
Poorly written, unclear or vague project requirements	☐	☐	☐	☐	☐
Project scope too limited or vague	☐	☐	☐	☐	☐
Project scope was scaled back from original scope	☐	☐	☐	☐	☐
Too many scope changes/scope creep	☐	☐	☐	☐	☐
Unclear project objectives	☐	☐	☐	☐	☐

Other (please specify)

14. Team Risks

40. R3-4: Which of the following TEAM risks played the most significant roles in the lack of/minimal success of your CDTE project? (Check all that apply. You may also skip a risk if it was not present in your CDTE).

	on time project completion	within budget	according to requirements/user specifications	business owner satisfaction (user or management)	IT management satisfaction
Conflict among team members	☐	☐	☐	☐	☐
Cultural or language differences	☐	☐	☐	☐	☐
Idle people resources, for example due to early staffing or project windup	☐	☐	☐	☐	☐
Insufficient knowledge transfer	☐	☐	☐	☐	☐
Lack of appropriately skilled resources	☐	☐	☐	☐	☐
Lack of balance or diversity on the project team	☐	☐	☐	☐	☐
Lack of needed training	☐	☐	☐	☐	☐

41. R3-5: Which of the following TEAM risks played the most significant roles in the lack of/minimal success of your CDTE project? (Check all that apply. You may also skip a risk if it was not present in your CDTE).

	on time project completion	within budget	according to requirements/user specifications	business owner satisfaction (user or management)	IT management satisfaction
Lack of or inadequate communication	☐	☐	☐	☐	☐
Lack of project team cohesion	☐	☐	☐	☐	☐
Loading up project with excess resources to resolve issues	☐	☐	☐	☐	☐
Loss of key resource(s) that impact the project	☐	☐	☐	☐	☐
Personnel turnover	☐	☐	☐	☐	☐
Project team members resist change	☐	☐	☐	☐	☐
Resource inexperience with company and its' processes	☐	☐	☐	☐	☐
Team members are not accountable for bad or poor decisions	☐	☐	☐	☐	☐
Too many meetings	☐	☐	☐	☐	☐

Other (please specify)

15. Technical Risks

42. R3-5: Which of the following TECHNICAL risks played the most significant roles in the lack of/minimal success of your CDTE project? (Check all that apply. You may also skip a risk if it was not present in your CDTE).

	on time project completion	within budget	according to requirements/user specifications	business owner satisfaction (user or management)	IT management satisfaction
Forced to work within dictated constraints	☐	☐	☐	☐	☐
Integration of project components is complex	☐	☐	☐	☐	☐
Lack of knowledge needed for successful integration of project components	☐	☐	☐	☐	☐
Technical connectivity issues hinder communication	☐	☐	☐	☐	☐
Unidentified technical constraints	☐	☐	☐	☐	☐
Inadequate technical resources, i.e. hardware, processing availability	☐	☐	☐	☐	☐
Technology hardware new to the organization	☐	☐	☐	☐	☐
Technology software new to the organization	☐	☐	☐	☐	☐

Other (please specify)

16. User/Stakeholder Risks

43. R3-6: Which of the following USER/STAKEHOLDER risks played the most significant roles in the lack of/minimal success of your CDTE project? (Check all that apply. You may also skip a risk if it was not present in your CDTE).

	on time project completion	within budget	according to requirements/user specifications	business owner satisfaction (user or management)	IT management satisfaction
Catering to desires and wants of a few stakeholders	☐	☐	☐	☐	☐
Inexperienced end users	☐	☐	☐	☐	☐
Lack of end user buy-in	☐	☐	☐	☐	☐
Lack of stakeholder or end-user involvement in project	☐	☐	☐	☐	☐
Misidentification of stakeholders	☐	☐	☐	☐	☐

Other (please specify)

17. Vendor Risks

44. R3-7: Which of the following VENDOR risks played the most significant roles in the lack of/minimal success of your CDTE project? (Check all that apply. You may also skip a risk if it was not present in your CDTE).

	on time project completion	within budget	according to requirements/user specifications	business owner satisfaction (user or management)	IT management satisfaction
Lack of coordination among vendors	☐	☐	☐	☐	☐
Poor vendor performance	☐	☐	☐	☐	☐
Poor vendor relationship	☐	☐	☐	☐	☐

Other (please specify)

18. Completion of Risk Section

45. R4: If there is anything else you wish to comment on with respect to your experience with project risks on your completed distributed team experience (CDTE) project that would clarify any of your responses above, or that was particularly effective, please include those comments here

19. General Experiences

Up to this point we have focused on your last completed distributed team experience. Now we would like you to think more broadly about any distributed team experience you've been a part of. Thinking in general terms about your experiences with distributed information systems project teams, please answer the following questions.

46. GE1: Have you ever had a vendor representative/consultant on any of your distributed information systems teams (not including your completed distributed team experience (CDTE))?

- ◯ yes
- ◯ no

47. GE2: What roles have you seen on distributed information systems project teams of vendor representative/consultant? (check all that apply)

- ☐ project manager
- ☐ team lead
- ☐ team member

Other (please specify)

Previously we referenced 4 types of knowledge sharing techniques:
Type A: In this type of knowledge sharing, team members, team leaders or project managers share stories with other members of the team to pass on knowledge, motivate a specific action or communicate cultural values of the organization.
Type B: In this type of knowledge sharing, one member of the team acts as a mentor to another member to share technical, operational or managerial skills to another. The mentor and protégé also share experiences with each other.
Type C: In this type of knowledge sharing a community is formed containing members beyond the distributed team and is comprised of beginners, intermediate specialists and experts in a given subject matter who regularly share their experiences and collaborate, converse and connect about problems faced in their duties. These communities can be of any size.
Type D: In this type of knowledge sharing, teams reflect on their work by asking "what was supposed to happen in the project?", "what actually did happen in the project?", "why were there differences?" and "what can we learn from this and do differently next time?" This is a different exercise than casual, ad hoc conversations that may occur among different combinations of team members. Instead, this refers to a formal meeting comprised of distributed team members who convene after the project has ended for the purpose of discussing the specifics of the project to learn from the experience.

48. GE3: Were any other techniques used to share knowledge related to any of your prior distributed team project experiences besides Types A, B, C or D above?

- ◯ no
- ◯ yes

If "yes", please specify

49. GE4: In what other industries have you done IT-related work? (Select all that apply)

- [ ] Agriculture
- [ ] Accounting
- [ ] Advertising
- [ ] Aerospace
- [ ] Airline
- [ ] Apparel
- [ ] Automotive
- [ ] Banking
- [ ] Broadcasting
- [ ] Brokerage
- [ ] Biotechnology
- [ ] Chemical
- [ ] Computing
- [ ] Defense
- [ ] Education
- [ ] Energy
- [ ] Finance
- [ ] Legal
- [ ] Manufacturing
- [ ] Motion Picture
- [ ] Music
- [ ] Pharmaceuticals
- [ ] Publishing
- [ ] Real Estate
- [ ] Retail and Wholesale
- [ ] Securities & Commodities
- [ ] Sports
- [ ] Television
- [ ] Transportation
- [ ] Only worked in HEALTHCARE industry

Other (please specify)

20. Thank you

Thank you for completing this questionnaire.

You are eligible for a $20 gift certificate for completion of the survey. In order to separate your responses to the virtual teams questionnaire from any personal identifiers for the gift certificate you will be asked to go to another website to supply an email address. We will then send you an email with information on how to access your $20 Amazon gift certificate.

PLEASE VISIT THIS SITE TO REQUEST YOUR GIFT CERTIFICATE:
http://www.surveymonkey.com/s/DePaul_GiftCertificate