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**AN INVESTIGATION OF KNOWLEDGE TRANSFER AND RETENTION
IN A GOVERNMENT PROCURMENT OFFICE**

THESIS

Garland T, Mobley, Captain, USAF

AFIT/GSS/ENV/09-M01

**DEPARTMENT OF THE AIR FORCE
AIR UNIVERSITY**

AIR FORCE INSTITUTE OF TECHNOLOGY

Wright-Patterson Air Force Base, Ohio

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AFIT/GSS/ENV/09-M01

AN INVESTIGATION OF KNOWLEDGE TRANSFER AND RETENTION
IN A GOVERNMENT PROCURMENT OFFICE

THESIS

Presented to the Faculty

Department of Systems and Engineering Management

Graduate School of Engineering and Management

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In Partial Fulfillment of the Requirements for the
Degree of Master of Science in Information Resource Management

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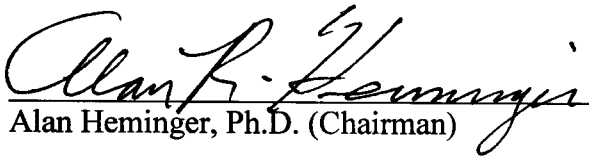
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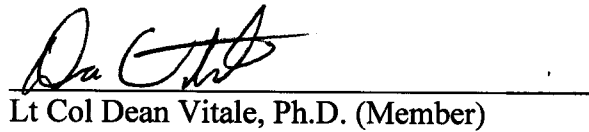
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Abstract

There is no measure for the loss of corporate memory. Organizations build a reservoir of knowledge in its employees, and this knowledge becomes a critical ingredient in an organization's ability to carry out its mission. Knowledgeable people are extremely valuable and once they leave, their organizationally-applied knowledge leaves with them. This study introduces specific knowledge attributes that significantly impact effective tacit and explicit knowledge transfer and retention. Under this construct the proposed investigation explores a government program office to see if replacing experienced government employees with outsourced personnel impacts corporate knowledge retention.

The study concludes that a loss of corporate knowledge can occur within U.S. government procurement program offices when government personnel are replaced with contractors who do not transfer their knowledge. When the organization does not have a useful knowledge management system outsourced employees have a lack of trust in the system, a lack of transferred knowledge can be expected. For this reason, contractors use other means to store and transfer their knowledge in systems not available or accessible to the organization.

Dedication

This work is dedicated to my God and Lord Savior Jesus the Christ from which ALL Blessings flow. With Him all things are possible.

Acknowledgements

I pay the warmest homage to all of my peers, mentors, and role models for their long coveted encouragement, inspiration, and vision. I give a special thank you to all instructors who have instilled the optimal balance of knowledge and insight they have instilled in me. These keys have lit the path that has guided me to scholastic achievement and proven to be paramount to my success. I extend my great thanks to the Military Satellite (MILSATCOM) Systems Wing for their support of this study. Finally, I offer my most sincere thanks my friends and family. This work would not have possible nor as fulfilling if not for their continued love and support. I am eternally in your debt and I pray to spend a lifetime reimbursing that debt of love to you.

Garland T. Mobley

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AN INVESTIGATION OF KNOWLEDGE TRANSFER AND RETENTION IN A GOVERNMENT PROCURMENT OFFICE

I. Introduction

Organizations depend on extensive corporate knowledge to help them achieve their mission. If an organization loses its knowledge it may not be able to effectively and efficiently carry out that mission. For example, this type of knowledge loss occurs when the organization loses personnel with key corporate knowledge resulting from turnover, downsizing, or outsourcing without a plan of how to effectively replace or retain this knowledge.

The loss of such corporate knowledge can arise within United States military organizations when civilian and military personnel are replaced with contractors to achieve the corporate mission of defense. Whether contractors work through contract completion or expiration, they work for a limited time and when they leave that organization; their acquired corporate knowledge often leaves with them. This thesis will explore knowledge retention methods of transfer and sharing in response to government employee turnover. The Air Force's Space and Missile Center (SMC) will be examined to investigate its knowledge sharing practices as its personnel numbers have shifted toward a contractor-heavy work force. In addition, this study will assess how this shift may impact the ability to execute the mission of conducting effective acquisition procurement functions over time.

Background

Stressed personnel requirements can be attributed to two military manpower challenges: the U.S. War on Terror and the Air Force (AF) personnel reduction. In addition, to the events

of September 11th, there are other reasons the DoD elected to outsource. In the mid 1990's there was a substantial movement to outsource and privatize government functions in the effort to redirect fiscal resources from military personnel obligations to defense modernization programs. By the early 2000's the DoD implemented a reduction of force during the War on Terror in Iraq, which further decreased total force numbers. Ten years later the outsourced positions, initially intended to be temporary support functions, became critical. Increasingly, the number of contractors began filling critical military vacant procurement positions.

The DoD projected to cut its AF manpower numbers down to 316,000 active duty servicemen by 2009, while many military members were called to war. Secretary of Defense Robert Gates announced the last manpower reduction of another 12,000 airmen, which would have brought the AF from the current 328,000 to an expected 316,000 (approximately 12% over 4 years) by fiscal year 2009 (Nolan, 2008). In December 2006 Langley Air Force Base, VA public affairs office reported that the reduction of force was implemented to offset military spending for the procurement of "modern aircraft." (Nolan, 2008). Gates understood the costs of war had thinned out military forces to a point which is becoming hyper-extended. It is now the AF's challenge to determine the optimal redistribution of forces. Currently the top priority job requirements are for aircraft maintenance, special operations, and Air Force Cyber Command (AFCYBER) (now integrated under AFSPC) (Nolan, 2008). The war requirements coupled with the government's attempt to reduce spending resulted in the reduction of force that would later induce government outsourcing. Outsourcing is the transfer of a support function, previously performed in-house, to an outside service provider, usually given extensive flexibility regarding how it performs its outsourced function. Privatization is a type of outsourcing that occurs when

government assets (depots, data centers, etc) are transferred to the private sector. In these cases the government sheds in house expertise to perform integral core competencies (Fields, 1996).

Military and civilian workforce has been downsizing since the end of the Cold War. A lack of enthusiasm in future aspirations for government work has been regarded as a high cost of military downsizing. “Anecdotal evidence suggests recruitment is already a growing problem in the defense industrial sector, with some firms now offering bonuses of several thousand dollars to employees who bring in new recruits” (Marshall, 2000). Michael Marshall notes, the impacts of this can be observed by its adverse effects on employee loyalty, particularly for military research laboratory personnel. Marshall conducted a study to investigate corporate reductions and their effect on the DoD.

The private sector conducts “rightsizing” as a cost cutting technique, to facilitate immediate profitability and relieve monetary concerns. While this may lend itself useful as a short term solution, it has impacts for organizations and their employees. “Indeed, massive downsizing frequently generates more problems than it solves, and almost never achieves its original financial objectives” (Borque, 1995; Gosselin, 1994; Dupuis, Boucher, and Clavel, 1996). “The costs of replacing them with new employees are enormous for an organization that has lost its best people and, with them, their special knowledge and expertise.” (Borque, 1995; Gosselin, 1994; Dupuis, Boucher, and Clavel, 1996). Direct (visible) and indirect (hidden) costs of turnover can have a \$3,000 per person expenditure for a new hire (Marshall, 2000). Hiring/recruiting and product delays are examples of direct and indirect expenses, respectively. In addition, the brightest people leave insecure job environments and the companies that execute this tactic historically do not have an increased return on investment after losing such corporate

expertise and energy. “An American Management Association survey has found that fewer than 45 percent of the companies downsizing over the past 10 years have not reported profit increases” and “One layoff can ruin morale” because “organizational downsizing can have a variety of dysfunctional consequences on surviving employees” (Marshall, 2000).

Throughout conducting research for this investigation there has been no conclusive measure for the loss of corporate memory. Such knowledge is defined by Marshall as “experience in specific projects, networks with clients and contracts, familiarity with company culture, and awareness of an organization’s informal relationships and decision-making processes” (Marshall, 2000). Knowledge losses can also be attributed to outsourcing. “Companies’ intent on reducing their capital base or handing off a problem by outsourcing a function forget the importance of local knowledge, specific to the company, with serious consequences for productivity” (Marshall, 2000). Loss of corporate knowledge can be terribly expensive in time spent reinventing the wheel for common projects and having the intuitive vision to create innovative solutions for unique problems. “It is becoming clear that much of the innovation depends on informal networks in the organization, networks that until recently have been underappreciated” (Marshall, 2000).

Despite the commercial ills of outsourcing and downsizing, the DoD also practices such tactics to save fiscal resources. Marshall noted the failed practice of outsourcing to save money particularly regarding the declining expertise in DoD labs. “Just as in the private sector, most of the downsizing in the DoD’s in-house labs in recent years has been driven by the belief that decreased headcount translates into money saved. However, as much of the private sector has now realized, there are other themes in the overall equation” (Marshall, 2000). Marshall says,

“downsizing the labs under current rules is just as apt to result in the loss of valued employees as elimination of a truly redundant one.” He also states, “Ironically, the loss of key technical personnel during the reduction process in the DoD labs has led to necessity of recruiting new scientific and engineering talent even as these labs collectively continue to shed end strength” (Marshall, 2000). It is with this premise Marshall asks, “Is it realistic to expect that these labs can recruit and retain the best and brightest scientific and engineering talent in this churning environment” (Marshall, 2000). Looking through his lens, the DoD’s practice of personnel reductions and outsourcing is possibly risking the loss of its procurement corporate memory.

In 1996 the Defense Science Board Task Force (DSBTF) on outsourcing and privatization was created to conduct a study on how the “DoD could use outsourcing as an important tool to free up substantial funds to support defense modernization needs” (Fields, 1996). The report findings supported “more aggressive outsourcing effort is needed” and reported the savings potential of \$10 billion or more annually by 2002, if the DoD used outsourcing. Phillip A. Odeen, chairman of the Defense Science Board stated, “The Task Force believes that all support functions should be contracted out to private vendors except those functions which are (inherently governmental), directly involved in warfighting, or for which no adequate private sector capability exists or can be expected to be established” and adds, “Many support functions performed primarily by military personnel (e.g., individual training and support services in military hospitals) are also ripe for outsourcing” (Fields, 1996). Fields suggests in order for such an outsourcing and privatization effort to be successful three requirements must be met:

- Changes in defense policies and procedures to facilitate outsourcing

- Relief from legislative impediments and regulatory constraints
- Improvements in defense contracting procedures and incentives to encourage greater reliance on outsourcing

By the end of the Cold War, procurement funding was reduced by 69 percent from \$196 billion in 1985 to \$39 billion in 1996 and during that time, procurement was approximately 18% of the Secretary of Defense and Chairman of the Joint Chiefs of Staff budget for sustainment. The DSBTF suggested that a cost savings of 30 to 40 percent of function costs from outsourcing would amount to \$7 to \$12 billion annually (Fields, 1996). In order to accomplish this endeavor, incentives to encourage DoD to move toward outsourcing were recommended. For example, “Local commanders that achieve outsourcing objectives should be rewarded with promotions and desirable assignments. Senior DoD officials should take full advantage of their authority to waive A-76 requirements and aggressively seek to eliminate legal restrictions that discourage outsourcing” (Fields, 1996). Contract terms were suggested to have a particular service length with the appropriate management controls and oversight to properly ensure job performance.

The DSBTF’s report also mentions “attrition and relocation should be the preferred strategies for downsizing the DoD workforce, reductions-in-force (RIFs) should be viewed as a last (but sometimes necessary) alternative” in military force reduction. The government initially offered a Voluntary Separation Pay (VSP). Many of those who accepted the option of a lack luster golden parachute were single with less than 4 years in the military. The lack of job security, in the struggling U.S. economy, awaiting AF members and their families influenced their reluctance to leave the military. Furthermore, the Task Force suggests hiring contractors to

perform a substantial range of government functions. In the absence of an organic workforce, it is usually more difficult to give those jobs back to government employees later. “DoD should reverse the current presumption in favor of organic support, vendors should provide all support unless there are compelling reasons for the workload to remain in-house” (Fields, 1996).

Although the intention of outsourcing major support functions is to employ large numbers of trained and capable workers in a short period, the vendor usually reemploys workforce that worked for the outsourcing firm at contract completion. Usually, at least 50 percent of these employees are retained for full-time employment. “On many occasions, the outsourcing firms may require that service provider grant the “right to first refusal” to displaced workers as a condition of the service contract. However, some workers will not be re-hired, as vendors usually perform the support function with significantly less manpower than previously utilized” (Fields, 1996). For example, the DoD outsourced 25 percent of the 850,000 positions conducting *commercial activities* including procurement functions like RDT&E support, manufacturing/fabrication, and other non-manufacturing roles (Fields, 1996). “Although 10 USC 2465 prohibits DoD from contracting out civilian guards and firefighters at most military bases” (Fields, 1996), contracting modifications were made to accommodate manpower challenges for installation support functions just as system program offices. “Arbitrary exemptions from outsourcing of some prime candidate functions (e.g., fire safety, physical security)” (Fields, 1996).

This contracting philosophy is paralleled in for DoD procurement. “To date, the Department’s acquisition reform efforts have focused primarily on streamlining the process associated with the acquisition of military systems and the procurement of *commercial-type*

products” (Fields, 1996). The study also states, “To date, acquisition reform has not addressed the unique problems and requirements associated with service contracts. In order to implement an aggressive outsourcing strategy, the DoD must significantly improve its capability to develop, structure, and manage large, complex contracts. For example, DoD contracting officers frequently lack adequate expertise in the service being procured (Fields, 1996). While DoD contracting officers who purchase hardware typically develop expertise in a particular system or commodity area, service contracting is often viewed from a monolithic perspective” (Fields, 1996). The DoD procurement process can foster formalized, distinct, and sometimes adversarial relationships between vendors and DoD contract oversight personnel. This is why holding contracted personnel responsible for specific procurement functions can be often frowned upon due to its potential conflict of interest. In the system program offices, there are specific duties contracted personnel can occupy. “The Secretary of Defense should stress that all non-combat support services must be considered for outsourcing except those functions that are not inherently governmental or which no adequate and competitive private sector capability exists or can be expected to be established” (Fields, 1996). Given the emphasis to outsource vacant procurement functions with contractor support personnel, what happens to corporate knowledge when these employees leave the organization due to corporate turnover?

Organizations develop knowledge over time

All long standing organizations build up a reservoir of knowledge among their employees, and this knowledge becomes a critical ingredient in each organization’s ability to carry out its mission. This knowledge was built from individuals gaining personal experience as

they did their jobs, and it is often well beyond the specific written guidelines that appear in a corporate set of procedures. As time progresses, some of this valuable knowledge is shared in informal dialogue between workers or codified and transferred to new employees. Mentoring and special shadowing programs for protégés are techniques used to support an environment conducive for transferring such tacit knowledge exchange. Explicit knowledge can be documented and recorded but tacit knowledge is not as easily captured (Davenport, DeLong, & Beers, 1998). Collecting corporate lessons learned across an organization and storing the knowledge in information systems (IS) can be an effective method of capturing explicit knowledge for continuity. However, since tacit knowledge is built on experience and is stored in the mind of the knower, it requires dialog between individuals concerning a specific matter (Davenport & Prusack, 2000). This knowledge can be collected and shared in an IT based knowledge repository, but, more often, it is shared across the organization among departments (Lubit, 2001).

Organizational knowledge application

Experience-based knowledge can be written into instructions or passed from person to person, but much of it is kept in the mind and memory of the individual(s) that learned it through on-the-job experience. If job conditions evolve to a point where specific situations would not warrant the current knowledge, it has then become obsolete and will be replaced by other experience-based knowledge (Lubit, 2001).

The knowledge that helps an organization do its job is the combination of written knowledge, and the knowledge that is presently in the mind of the knower(s) (Lubit, 2001). This knowledge is most valuable because its application renders experience-based solutions to particular situational problems. The combination of written and experienced-based knowledge is critical to achieving organizational missions. As mentioned earlier, knowledge that can be explicitly recorded or documented for collection is known as explicit knowledge and, knowledge that exists in the mind for the individual possessing it is known as tacit knowledge. Since tacit knowledge is acquired through an individual's experience, its application cannot be easily mimicked or taught. "Tacit knowledge can be the basis for sustainable competitive advantage, because it can be spread within the firm, but it is very difficult for other firms to imitate" (Lubit, 2001). An organization reaches its fullest potential when this type of corporate knowledge is shared among other key knowledge workers within that organization. Such a meeting of the minds is some of the best breeding grounds for creative thought for the birth of corporate innovation. "First, companies can act to internally spread knowledge other companies will find almost impossible to copy, that is, tacit knowledge. Second, companies can create superior knowledge management capabilities and thereby foster on-going innovation" (Lubit, 2001). Knowledge maps assist in locating such individuals while communities of practice provide the environment for such dialogue (Lubit, 2001).

Knowledgeable people are extremely valuable to an organization; once they leave, organizationally-applied knowledge leaves with them. Turnover is inevitable. Voluntarily turnover can be taking another job, or accepting a new position at another location. Non-voluntarily turnover can be contract termination, enterprise downsizing, personnel "right-sizing",

or death (Lubit, 2001). For this reason, valuable corporate knowledge should be captured, retained, and maintained by the organization until it is no longer needed (Davenport & Prusack, 2000). However, it is also important to filter out obsolete, incorrect, or biased knowledge based on tainted experience knowledge from the valuable tacit corporate knowledge to potentially reduce the impact of its loss.

Impacts of knowledge loss

If corporate knowledge is lost, the organization may not operate as efficiently. The organization may fail to make effective decisions, fail to reach its fullest potential, or lose focus of core business practices if knowledge is not retained. Without any form of corporate knowledge or lessons learned, an organization is destined to repeat mistakes or take a reactive posture of reinventing solutions to recurring problems. Knowledge is known to be a factor in sustaining a competitive advantage (Lubit, 2001). Failing to capture and manage knowledge is corporate value lost.

Government outsourcing

As a result of the events on September 11th, a surge of military members were called to extended deployment duty. This created the need for contractor support across all specialty coded areas requiring professional expertise, including procurement functions. These procurement functions were outsourced to contractors because they can be quickly hired to fulfill the requirement of skilled expertise in the acquisition procurement field. Contractors who

initially filled government personnel positions as a temporary alternative support evolved into long term manpower solutions. Thus the ratio of contractors to government employees became largely skewed from an influx of outsourcing.

A Defense Acquisition University (DAU) (Gilbreth, 2005) study on outsourcing procurement functions identified the most problematic area of a contractor-majority workforce as, “difficulty in having enough qualified contracting specialists to staff the needed requirements for contracting officers.” It seems as though the majority of contractors are former government employees so if the government outsources too many procurement functions, it may deplete its own pool of trained personnel needed for the future. “No government organization wants to outsource procurement services to the extent where the core procurement capability would be dissolved” (Gilbreth, 2005). Furthermore, the graying workforce will eventually retire leaving a huge gap in knowledgeable workers. In the “graying” workforce, it is expected that many workers will either retire or die. Without preserving corporate knowledge before these experienced workers retire, many new hires will have to use valuable resources re-inventing the wheel on some processes when the knowledge from a “greybeard” would have significantly reduced the time and effort to reach a solution. At a minimum, codifying their lessons learned should be exercised to ensure some knowledge is retained. Mentorship is highly encouraged as should be informal group meetings and communities of practice.

Problem Statement

Manpower constraints have forced the Space and Missiles Center (SMC) at Los Angeles, CA, to heavily outsource its procurement functions. Like many other government organizations, SMC has hired a large proportion of contract employees to help it achieve its mission and is steadily migrating toward a predominately contractor-based workforce to meet manpower shortfalls. Corporate turnover of those outsourced human resources threatens knowledge retention required for positive long term impacts on competent acquisition program execution. Upon contract completion or expiration, government- contracted employees leave the organization. Is their corporate knowledge being captured before their contract ends? In respect to the current trend for hiring contractor personnel to replace government (civilian and military) workers, is SMC at risk for losing knowledge resulting from such turnover? It is important to understand the impact of this loss on corporate knowledge. This thesis will identify if SMC's current measures for knowledge retention of corporate knowledge. If required, prescribe actions based on sound knowledge management practices to minimize knowledge loss. When the employees complete their work obligation and leave, they take their tacit and/or explicit corporate knowledge with them. Under this premise, the following research questions are posed:

Research Question 1: Is SMC at risk for losing corporate knowledge by hiring contractors?

Research Question 2: Are SMC's knowledge retention methods useful for its employees?

Research Question 3: What forms of knowledge transfer do contractors support?

Significance of Study

The AF acquisition workforce has been reduced in an AF-wide “rightsizing” and has forced former acquisition officers to leave the DoD. Many of these personnel have been replaced by defense contractors. The Space and Missiles Center (SMC) has moved to a contractor-heavy workforce within the past few years. Since Secretary Gates announced a stop to AF manpower reductions, SMC has been instructed to reduce its contractor support by some 20% (Nolan, 2008). This means many government contractor personnel will leave, and without proper explicit and tacit knowledge codification, their corporate knowledge will leave with them.

Thesis Structure

This research investigates the impact of replacing SMC long-term employees with short term contractors on the retention and use of corporate tacit knowledge. The next chapter provides literary background on the studies that have been done in this area, and suggests ways to pursue this study. Chapter three presents the methodology that will be used in this study. Chapter four presents the results and analysis of the investigation of the hypothesis. Chapter five will discuss recommendations following the study, including implications for practice, as well as address limitations of the research and suggest for further research in this area.

II. Literature Review

Overview

The literature review investigates work and analysis surrounding knowledge retention and sharing. This was done by researching published articles, case studies, and journal articles investigating those knowledge management aspects and reviewing such techniques in corporate or government organizations. Finally, make a method selection to address the research questions.

This chapter investigates knowledge transfer, knowledge sharing, and capturing and retaining knowledge practices used to address knowledge loss in commercial and government workforce environments. The commercial sector finds knowledge management practices are vital for maintaining corporate knowledge to sustain their competitive advantage and profit margins (Lubit, 2001). The DoD elected to use the business practice of contractor outsourcing to buffer the manpower impacts of force reduction (Fields, 1996). DoD wide manpower challenges have matriculated into the government procurement offices. The government underestimated the costs of military downsizing and over utilized outsourcing for its cost reduction benefits. These corporate business decisions have resulted in the potential loss of corporate knowledge that may damage the government's ability to successfully execute the defense programs in the future. Therefore, an analysis of the DoD's response for outsourcing contractors to address manpower challenges in government institutions particularly acquisition management is mentioned (Gilbreth, 2005). A selective amount of work has been done in this particular topic so there was not much material in respect to the topic, but there was much material for knowledge management in sustaining competitive advantage, corporate and government contractor turnover.

Types of knowledge

As stated in the previous chapter, there are distinct differences between explicit and tacit knowledge. Explicit knowledge can be captured and codified in the form of documentation (Davenport & Prusack, 2000). The most common method to transfer explicit knowledge is by recording and collecting this documentation and storing it in a database for retrieval. However, tacit knowledge is experienced-based existing in the mind of the knower as corporate wisdom (only if the individual accesses it) (Lubit, 2001). It is not easily codified, thus it is not feasible for organizations to record it in a database. Since tacit knowledge is experience-based it often requires interpersonal methods to transfer it to individuals. Explicit knowledge can be transferred using an interface of information systems to find common solutions in daily operations, while tacit knowledge transfer uses person to person interface to find particular solutions for specific situations. Corporations often define knowledge in general with the explicit definition consequently overlooking the benefits of tacit knowledge. The result is companies mistakenly seeking the use information technology systems as a key basis for implementing knowledge management. Although tacit knowledge exchange occurs in formal and informal means in corporate venues throughout a corporation, it is less emphasized at the lower echelons of a business community.

Knowledge Sharing in Organizations

In the 2003 Desouza wrote, “Facilitating tacit knowledge exchange”. The article outlines a case study that outlines explicit and tacit knowledge and provides techniques for creating a

work environment for effective formal and informal knowledge sharing. Desouza speaks to two specific perspectives of knowledge: explicit as well as tacit. Explicit knowledge can be described as knowledge which can be easily transmitted into electronic format such as a manual or email. This speaks to knowledge which has been presented in a way that is straightforward, easy to communicate, and accessible, when compared to the perspective of its counterpart. Tacit knowledge is said to be highly personal and hard to formalize, thus making it difficult to communicate or share with others (Desouza, 2003).

Facilitating tacit knowledge is vital to the success of the contractor work environment as knowledge originates in the minds of individuals. Without it, there will be aspects of knowledge which will continue to remain untapped. Through the use of tacit knowledge, people are able to share their experiences, hunches, and insights in a humanistic manner allowing them to transition as well as gain ground in the work environment. Implementing an IT solution using explicit knowledge alone can result in a system which lacks goals, ideals, values, and experiences. The subjective and intuitive nature of tacit knowledge makes it difficult to process or transmit the acquired knowledge in any systematic or logical manner (Desouza, 2003). By utilizing an approach which is geared more towards the humanistic aspect of sharing knowledge, people maybe more susceptible to sharing information.

In a study presented by Desouza, [2003] he discusses the pros and cons of acquiring knowledge using the tacit perspective; incorporating a humanistic and entertainment approach through the use of games rooms in corporate America. Initially upon inauguration of the game rooms, observations concluded that the usage rate was extremely low. Due to this outcome, management within the selected beta site initiated multiple positive reinforcements to encourage

the usage of the rooms. It was later found by way of conducting an employee survey, these positive reinforcements helped to increase the usage of the onsite games rooms. Lessons learned as well as highlights from the study concluded that top management support is crucial in the success of effectively leveraging knowledge. Their presence as well as their voice is strongly needed as management sets the tone for effective knowledge management practices. “Success stems from a management team which acts as a catalyst or enabler through setting examples, engendering trust, instilling cohesive and creative culture, and establishing a vision” (Desouza, 2003). In the presented study, management failed to do this by taking a more relaxed approach. Another barrier experienced by this beta site was employee resistance coupled with fear. Failure to convey clear objectives as well as a purpose for the game rooms resulted in negative perspectives as well as a state of confusion for employees. To remedy this management educated middle managers, provided structured presentations, incorporated a logo, as well as an intranet discussion board to allow employees to post questions anonymously. These changes made a positive impact on the usage of the game rooms. After continued use of the game rooms an electronic database was implemented which allowed employees to freely share any kind of knowledge as well as schedule playing time on the various games and equipment. Management took into account that knowledge management cannot be fostered in an environment where employees feel micromanaged (Desouza, 2003). Without imposing strict guidelines, tacit knowledge exchanged increased by 32% in a 20 week timeframe. In the presented case study, Desouza was able to demonstrate informal as well as emergent structures as a positive means to foster tacit knowledge exchange.

Why Knowledge is important for business

Tacit knowledge is a vital key to business. The article entitled, “Knowledge Management: The Keys to Sustainable Competitive Advantage” provides insight of the corporate perspective of knowledge management. Lubit tells how tacit knowledge is the true source of sustaining a competitive advantage and features rationale for the importance to overcome barriers inhibiting knowledge sharing. The author also tells how to build solid in-house expertise starting with hiring competent employees possessing sound expertise and transferring their knowledge to junior managers and young employees. Competitive advantage comes from “knowing how to do things, rather than in having special access to resources and markets, knowledge and intellectual capital have become both the primary basis of core competencies and the key to superior performance.” Growing knowledge resources create not only competitive advantage, but “sustainable competitive advantage” (Lubit, 2001). Two ways of doing this is by distributing corporate tacit knowledge internally throughout a company so a competitor would not be able to duplicate or recreate it, and using group tacit knowledge to bolster corporate innovation.

In order for knowledge based core competencies to be the basis for a sustainable competitive advantage, the tacit knowledge must be open to the entire company (Lubit, 2001). Often times the problem with this is knowledge not shared throughout the company then belongs to only to a select group of people, thus has “limited impact on the firm’s ability to create value.” However if knowledge crosses the boundary lines of the company and into other firms, it then begins to take the title known as industry best practices instead of the foundation for a sustainable competitive advantage. This is why it is imperative for corporate tacit knowledge to

combine with skills and resources that define core competencies and be widely disseminated throughout the organization. This ensures that the knowledge and its use is not only the life blood within the organization, but imbedded into its structure for how the firm does business. This is why the firm's core competencies would be so difficult to duplicate without adopting a knowledge management system thereby forming its own distinct corporate entity.

“Tacit knowledge entails information that is difficult to express, formalize, or share. It stands in contrast to explicit knowledge, which is conscious and can be put into words” (Lubit, 2001). “Tacit knowledge is knowing how while explicit knowledge is knowing what” (Lubit, 2001). Specific skills that build tacit knowledge require more than observation, it is unconsciously learned from experiences learned while exposed in an environment. Examples of this phenomenon are shooting a basketball or swinging a baseball bat. Learning such skills cannot be fully explained verbally, it takes a degree of practice by the individual in order for them to learn. Intelligent application and acquisition of tacit knowledge requires having personal experience in an activity, if possible while working with experts. Tacit knowledge comes from personal experience more so than observation of how experts address common and uncommon problems.

The key to turning tacit knowledge into core competencies requires the capture and transfer of such knowledge (Lubit, 2001). The critical observation for those who use tacit knowledge is to see how their actions affect the outcome. The trial and error of learning required to develop and transfer corporate tacit knowledge can be slow and costly at times, but a necessary evil to create innovative solution often stifled by biased expert opinion. It is important for turning tacit knowledge into core competencies. Expert supervisors must balance mentorship

with critiquing protégés work without limiting their ingenuity. Hospital residencies of the medical field and paralegal assistance in the judicial system are not only common but more over expected if an individual seeks to acquire expert status in these professional areas. However, in business realm mentorship is uncommon. For this reason, “managers are taught how to coach, then make efforts to train subordinates, and provide “one-on-one mentoring”. (Lubit, 2001) Turning tacit knowledge into core competencies also requires recording such knowledge and disseminating it via networks and work groups.

The article entitled, “Knowledge Worker: Human Resource Strategy to Achieve a Competitive Advantage” (Alvesson, 2000). Alvesson investigates a corporate knowledge management approach of retaining knowledge by retaining the knowledge worker and a key source for sustaining competitive advantage. Concepts of the article emphasize on tacit and explicit knowledge exchange and dissemination via socialization. The loyalty of knowledge workers and the ways to minimize turnover are critical management problems (Alvesson, 2000). As corporate employees become more knowledge based, organizations will need to implement strategic human resource practices to retain its corporate knowledge base by retaining the knowledge worker thus retaining a critical source of competitive advantage. The performance of knowledge based industries depends on organizations attracting, holding, and motivating knowledge workers (Drucker, 2003). New knowledge is created through the ongoing interaction between tacit knowledge of the individual and the explicit contextual knowledge possessed by the organization (Spender, 1996). Human resource practice of socialization is a vital connection between the knowledge worker’s tacit knowledge and the organization’s ability to create and sustain a competitive advantage (Spender, 1996). Socialization among an organization’s

employees play a critical role in creating new tacit knowledge that can lead to creating a competitive advantage. Knowledge is becoming a firm's primary resource and because knowledge is stored in the minds of the individuals who possess it, employee turnover can decrease a firm's tacit knowledge stores (Droege & Hoobler, 2003). Socialization amongst knowledge workers with various backgrounds and specialties produce new innovative tacit knowledge that would be unachievable without an interdependent work environment (Droege & Hoobler, 2003). The proper organizational structure is equally important for proper dissemination of this knowledge. Social interaction allows the diffusion of tacit knowledge via the organization's social structure; it can significantly decrease the loss of most tacit knowledge resulting from turnover. (Droege & Hoobler, 2003) recommend three types of ways tacit knowledge can be transferred: interaction, collaboration, and access to specific tacit knowledge. Some firms have taken a more proactive approach to the inevitable occurrence of corporate turnover.

Knowledge and Corporate Turnover

In the article entitled, "Human resource planning in knowledge-intensive operations: A model for learning with stochastic turnover, Matsuo tells of a company's attempt to measure tacit knowledge transfer. It takes a scientific approach to assessing the risk of turnover and creating a surplus of knowledge workers referred to a "knowledge stock" comprised of new hires and senior employees (Bordoloi & Matsuo, 2001). Placing this mix of workers in a common environment allows the author to create a model for steady state conditions to induce tacit

knowledge transfer using a non-linear production tool. Its purpose is to determine the proper mix of new hires to seniors depending on the desired production output.

Employees take advantage of the knowledge they acquire when they leave their current employer for better opportunities, thus creating significant turnover (Matsuo, 2001). For this reason, manufacturing and service industries are working to build a “knowledge stock” comprising of corporate knowledge collected from a mix of workers having experience from various knowledge levels. The research was done of a semiconductor production plant. However, the plant requires multi-stage knowledge development of each employee in the steady state, particularly tacit knowledge for variations and uncertainties from low volume production of customized orders, and frequent technology product changes. The study developed a model for human resource planning to reduce the risk of losing valuable knowledge resources resulting from corporate turnover. It focused on the number of workers maintained in the knowledge mix pool while balancing an expected number of resources lost due to the uncertainty of turnover rates. The model used a discrete-time model that identified three knowledge levels of workers and two production stages designating. It details where new hires with low production knowledge begin thru high knowledge workers functioning in corresponding senior production areas. The objective was to “minimize the total worker related costs for which we aim to meet demand by employing the optimal number of workers at different levels at different production stages are such that the demand is met with desired level of reliability.” The scope of methodology was focused for manufacturing system periodically subjected to random production yields. The methodology solution supports a large investment in the development of human resource workflow. Non-linear programming tool with a desired output, historical data, and a

restoration factor to adjust for turnover uncertainty was used to calculate a series of non-linear equations to “determine the number of workers to hire at the beginning of each period and develop an appropriate training schedule for higher productivity and flexibility” at various of knowledge levels. Results of the study indicate the company underestimated the optimal number of high level knowledge workers given the steady state manufacturing requirements. Although advantageous, given the cognitive construct of knowledge management this scientific approach to dealing with turnover is not the most practical.

In the world business most strategic decisions are fiscally based. In the article, “Assessing Employee Turnover Costs: A Revised Approach”, Tziner outlines a corporate practice of analyzing financial impacts of knowledge loss in terms of indirect and direct costs resulting from corporate turnover. It also assesses costs for turnover in respect to lost productivity from employee behavioral stimuli and analyzes the financial value of knowledge sharing via socialization. As firms encounter increasing competition from global markets cutting costs becomes increasingly imperative to reduce the cost for employee turnover. Just as reducing operational and operational costs while increasing profits and cash flow are vital to a firm’s survival, such a cost benefits analysis can be conducted to evaluate human resources. In an investigation of corporate turnover, (Tziner & Birati, 1996) developed a mathematical model based on the expenses associated with corporate loss in regards to functional vs. dysfunctional corporate turnover. Their investigation covered the quality of job performance to distinguish functional vs. dysfunctional personnel, but did not analyze the quality of knowledge of these employees nor determine the impacts of knowledge lost as a result of corporate turnover. The analysis also did not provide an analysis of corporate knowledge lost as a result of a catastrophic

event or over a distinct period of time.

The analysis defined a series of costs associated with turnover. Separation costs included time associated with exit interviews from both the interviewer and interviewee, administrative costs from employee payroll removal, and severance pay to the departing employee. It also included replacement costs incurred from job advertising, time screening interviews, medical examinations, and orientation courses for candidate applications. Training costs cover formal training, organizational relations, and on-the-job training. Finally, costs in lost productivity attributed to the new employee's learning curve. "Functional" turnover was defined as "poor performers encouraged to leave voluntarily or laid off", and "dysfunctional" turnover was defined as those who "choose to quit or are terminated due to downsizing" (Tziner, 1996). According to this investigation, these four categories outline the costs for turnover. All of which were considered for calculations for the methodology. The analysis describes socialization referring to "the process of acquiring the relevant information those employees must know in order to adequately perform their jobs" (Tziner, 1996). However, in the interest to reduce coworker and supervisor expenditures "socialization and mentoring of newcomers takes time away from management's more productive efforts" and noted as a necessary evil (Tziner, 1996). Forsaking the socialization of newcomers in the interest to save time and money would be a huge folly according to knowledge management practices.

The methodology used direct costs, indirect costs, and financial values as the construct to group the costs associated with turnover. Direct costs include all the costs incurred by "recruiting, hiring, training, and socializing new employees" (Tziner, 1996). Indirect costs

include “interruptions in production, sales, and the delivery of goods and services” (Tziner, 1996). Financial value costs result from a “drop in morale of the remaining work force following on dysfunctional turnover.” (Tziner, 1996) The formula was based on a cost/benefit analysis and applied to both direct and indirect costs of dysfunctional and functional turnover to assess the firm’s monetary penalties including its accounting for a corresponding area of employee behavior.

In anticipation of the graying workforce, it seems logical to implement a strategic plan to address the impact of losing knowledge from a catastrophic sized turnover boom. In “Employee Turnover: Do You Have a Strategic Transition Plan”? Krumrie suggests knowledge management solutions to a graying workforce by knowledge sharing and retention techniques in response to such turnover. Techniques mentioned are mentoring, the use of information technology (IT) systems, knowledge maps, and flexible work programs for with high compensation packages for valued retirees. This article states the inevitable occurrence of employee turnover. It mentions the main reasons for turnover. Some move on for career opportunities that accommodate personal goals, others for the sake of something new. Diane Domeyer, executive director of Office Team says, “Planning for turnover is critical because it affects the company’s bottom line. The departure of valuable, tenured employees can lead to loss of company knowledge and important industry contacts” (Krumrie & Lynch, 2006). The authors offer an employee transition plan to reduce the disruption from turnover by maintaining continuity.

Krumrie further insists that documentation be a vital component of an effective transition plan. Organization charts, automated computer systems documentation, work products, and internal/external business contacts are some items that should be recorded for continuity.

Employee job rotation is a type of turnover that occurs within the organization as a way of grooming specific fast burning employees for advancement. Interdepartmental personnel exchange allows employees broaden their perspective of the organization and expand their corporate knowledge. If quality performers are not prepared for advancement, they get passed over for promotion and begin to consider leaving the organization. Mentorship and sponsorship are vital social tools used to thwart the main problem of turnover which is losing well functioning employees. These methods assist positive workflow and foster employee loyalty as some employees transition or retire. Krumrie suggests the use of an exit checklist for those who do leave the organization. It should include contacts and data management activities with instructions on how to perform the job, and provide adequate time to pass the torch from the former employee as they rotate out to the new employee as they to transition in. The main purpose of adequate transition time is to significantly reduce the risk of having a failed reach back knowledge capability if the former employee cannot be reached. “Don’t rely on the departing employee to be available after departure. It is likely they will become completely preoccupied by their new endeavor and have little time to spend keeping you afloat, even if you offer compensation” (Krumrie & Lynch, 2006). An IT form of continuity was recommended to assist for documentation and data recovery. Finally, adopting flexible policies for retired employees allows older workers to “bring knowledge, passion, and good work ethic” by serving as consultants, mentors and trainers for new employees (Krumrie & Lynch, 2006). Offering generous salaries for part-time or flexible hours or covering health care expenses were also suggested for optional knowledge retention programs for retirees.

Which procurement functions are outsourced?

The Air Force Deputy Assistant Secretary of Contracting (SAF/AQC) and Defense Acquisition University (DAU) conducted a study of Air Force Material Command (AFMC), U.S. Central Command (CENTCOM), the Defense Logistics Agency (DLA) among 15 other DoD and six non-DoD agencies to investigate whether contractors were working in procurement functions that are to held solely by government personnel (Gentil, 2007). The study investigated:

- What is reasonable to contract out in the procurement area?
- What are the other federal agencies doing and what can we learn from them?
- How widely is procurement functions contracted out?
- If we contract out procurement functions, how can we grow contracting officers?
- Are we violating some law if we contract out procurement functions?
- Have we gone too far in some areas?
- Where do we cross the inherently governmental line?

A team of researchers conducted surveys as their method of analysis to verify the current practice of which vacant government procurement positions are currently filled by contractors (Gilbreth, 2005). The study also investigated the DoD agencies and other military services for reasons they do not outsource. These procurement services outsource activities they deem as inherently governmental.

Knowledge Management in the DoD

“Over the last decade, the DoD has sought increasingly to transform its basic approach to warfighting and the methods it uses to support warfighters” (Camm, 2003). As part of this effort, leaders and influential observers of DoD have repeatedly encouraged DoD to emulate “best commercial practices” (BCPs). These are the practices of commercial firms that have been recognized by their peers as being the best among firms engaged in similar activities. Over the past 20 years, many successful firms have found that BCPs offer an important new source of information for improving their competitive position” (Camm, 2003). However, some believe the DoD and government organizations should not employ methods practiced in commercial firms for various reasons. “By contrast, skeptics argue that the institutional setting of DoD (and, more broadly, the federal government) is so different from the settings of commercial firms that BCPs have little to teach DoD. Differences in basic values, incentives, constraints, and operating environments, as well as DoD’s profoundly political setting, limit the applicability of BCPs observed in commercial firms.” (Camm, 2003) Knowledge management techniques are not considered best practices from the commercial sector. Best practices can be applied to any firm and work for that corporation producing various results. However, knowledge management to be a truly effective it must be applied with an emphasis on corporate culture (Desouza, 2003). There are fundamental differences between commercial firms and the DoD. “Large commercial firms typically identify their shareholders, customers, employees, suppliers, and the outside community as the stakeholders relevant to their success. DoD serves taxpayers, warfighters, and military families rather than stakeholders and customers. Its employees are organized differently and have different rights” (Camm, 2003).

Knowledge management techniques that should be implemented across the DoD include creating knowledge networks, a culture for knowledge sharing, as well as capturing and storing knowledge via information systems (IS). The fundamental differences between corporate America and large government organizations is one profit driven while the other is politically charged, but their formats for the implementation of knowledge management practices to buffer employee turnover bare close similarities. “With rapid employee turnover due to retirements, there is a corresponding need to capture knowledge of the employees before they leave the organization” (Liebowitz, 2002). Liebowitz recommends U.S. government institutions to implement knowledge management activities in the following areas. They are of the following:

- “Capturing and storing, the fullest extent possible, employee knowledge that is critical to the organization’s operations and other key decisions” (Liebowitz, 2002)
- “Increase employee access to knowledge needed to perform efficiently, effectively and, as appropriate, consistently” (Liebowitz, 2002).
- “Instilling a culture of knowledge sharing and reuse within the organization” (Liebowitz, 2002).

The majority of knowledge sharing within government organizations occurs informally from interpersonal means, but employees should be encouraged to use a formal means of codifying such tacit knowledge. Reinventing the wheel, repeated mistakes, and duplication of effort occur all too often in government organizations due to a “lack of sharing good ideas, and slower introduction of new solutions” (Liebowitz, Knowledge Management in a Large Government Organization, 2002). A government knowledge sharing portal should include three primary knowledge applications containing “People Connection, Knowledge Base, and Lessons

Learned” sections (Liebowitz, 2002). First, the section designed for people interaction has a personal contacts section to contact individuals with specific knowledge for their job, mentoring, and communities of practice. Second, is a knowledge library section that contains a multimedia source to retrieve knowledge from past projects, a project directory, webcasts and tutorials. Finally, a lessons learned repository for holding significant historical knowledge of successful and unsuccessful projects in the form of easy to read case studies.

Reaching out to retirees by creating Alumni Associations as effective knowledge retention for executive mentoring, middle managers fulfills the role of personal mentorship was recommended for general employees. In addition to exercising such tacit knowledge practices, the value of using information technology (IT) for retaining explicit knowledge is also important (Liebowitz, 2002). Using IT for a knowledge sharing portal featuring communities of practice, and storing lessons learned are two ways for doing this (Liebowitz, 2002). Two management controls senior executives can use to assist the implementation and adoption of knowledge management are enforcing corporate policy to record lessons learned as standard practice and incentivize its use with rewards. These practices are successful knowledge management techniques to stifle ill effects of corporate turnover in government organizations (Liebowitz, 2002).

Knowing where the knowledge is in a firm is half the battle, but also a vital step in locating what is arguable it’s most valuable resource. In “Where the knowledge is”, Smith outlines a government solution to the graying workforce by using a creating an IT system containing volunteer knowledge map of those retiring. The database would have their contact information (email and phone number) for a knowledge reach back capability. Post career jobs

as part-time consultants are also mentioned. “The federal workforce is undergoing tremendous change at a time when baby boomer retirements threaten to pull the plug on expertise at many agencies. Congress and the executive branch should encourage programs that preserve the knowledge of experienced federal workers, not only to minimize their losses but to increase efficiency” (Smith, 2003).

According to Smith, approximately one third of all federal employees will retire by the end of this year (2008) and their knowledge will leave with them. Pete Smith a government executive recommends “tapping the expertise of federal retirees” in the form of “using knowledge networks, having them on call for emergencies, and offering them part-or-full-time jobs” (Smith, 2003). He also recommends using IT systems to connect employees with the right people who have the knowledge, “not just information in a database” (Smith, 2003). He mentions some degree of screening of applicants. Although “most retired workers would participate voluntarily” (Smith, 2003) not all retirees are supportive of innovative solutions. Furthermore, others may not have usable knowledge applicable for unique situations. Therefore, having retirees available “on call for critical operations or with critical skills” (Smith, 2003) is suggested. In addition, offering post-career jobs on a part-time or full time basis is also recommended.

Model Development Research

Knowledge retention is defined as the application of tacit or explicit knowledge.

“Knowledge transfer involves two actions: transmission (sending or presenting knowledge to a

potential recipient) and absorption by that person or group” (Davenport & Prusack, 2000). The following equation is the premise for Davenport’s definition for knowledge transfer:

$$\textit{Transfer} = \textit{Transmission} + \textit{Absorption} \text{ (and Use)}$$

Equation 1. Knowledge Transfer Equation

In order to apply knowledge it must first be understood in a cognitive tacit sense before it can be applied or recorded using explicit means. Therefore, in order to reach the fullest potential for knowledge transfer and sharing they must come together at a culmination point. This synergistic effect produces new knowledge that gets circulated back into its initial constructs but serves as retained knowledge for future application.

“Tacit knowledge transfer generally requires extensive personal contact. The “transfer relationship” may be a partnership, mentoring, or an apprenticeship, but some kind of working relationship is usually essential.” (Davenport & Prusack, 2000). The illustration reflects knowledge retention as it relates to knowledge sharing and transfer.

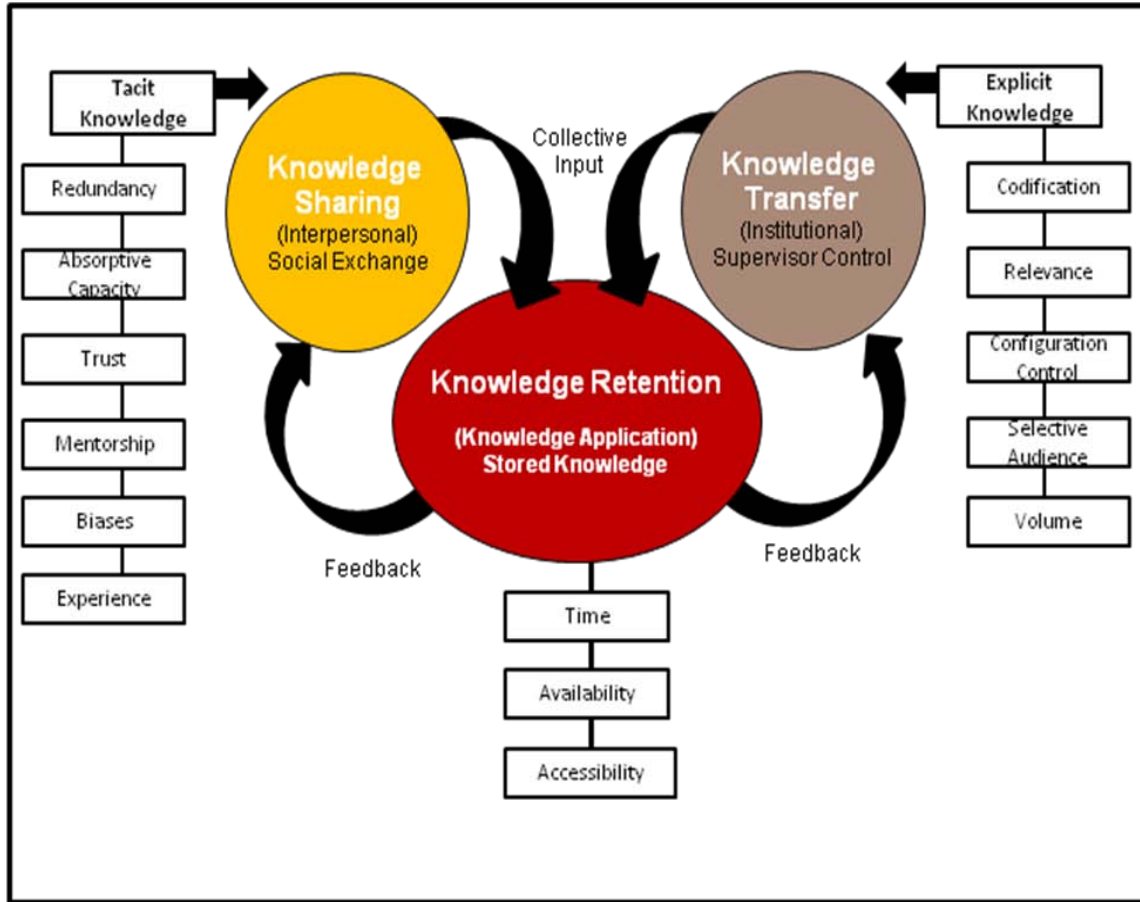


Figure 1. Research Model

Model Attributes and Themes

Knowledge sharing and knowledge transfer are often treated as synonymous in knowledge management. However, for the purpose of this investigation, they will be defined differently. Knowledge sharing will be defined as the transferring of tacit knowledge by *interpersonal* communication in “social exchange” (King & Marks, 2005). Knowledge transfer is the gaining of explicit knowledge via *institutional* constructs provided by “supervisory controls” (King & Marks, 2005). “This is the key distinction between “knowledge sharing” and “knowledge transfer”; in the latter, the person who is to be the recipient is usually unknown to

the source” (King & Marks, 2005). These Knowledge attributes have relevance in the primary knowledge themes. Due to the variable nature of the attributes, they are interchangeable under their assigned primary knowledge themes (sharing or transfer) depending on the context in which they are used. For example, the trust or time attributes can be used under knowledge sharing, transfer, or retention those themes impact the three themes differently.

Knowledge Retention Attributes

The definition of *Time* as it relates to this study is defined as a “lack of time and meeting places” (Davenport & Prusack, 2000). “The main purpose of adequate transition time is to significantly reduce the risk of having a failed reach back knowledge capability if the former employee cannot be reached after turnover” (Krumrie & Lynch, 2006). *Availability* can be described as the ability to retrieve knowledge for use at ones discretion; on demand. An example of this is creating a surplus of knowledge workers referred to a “knowledge stock” comprised of new hires and senior employees to induce tacit knowledge transfer (Matsuo, 2001). *Accessibility* can be defined as the right to retrieve or use specific knowledge. “In information use, as elsewhere, expediency prevails. Accessibility predominates over quality of information as a criterion for use” (Catherine E Connelly, 2003).

Knowledge Sharing Attributes

Redundancy is characterized as some degree of pre conditional knowledge initially acquired prior to mentorship. “Research shows time and time again that a shared language is

essential to productive knowledge transfer. Without it, individuals will neither understand nor trust one another. It is defined by Nonaka and Takeuchi as overlapping areas of expertise ...” (Davenport & Prusack, 2000). It dictates a basic level of comprehension from experience to provide a common basis of understanding for mentors and mentees to communicate. *Absorptive capacity* can be defined as the ability to value, assimilate, and apply new knowledge or as sited by Dong-Gil Ko as the “ability of a recipient to recognize the importance and value of externally sourced knowledge, assimilate it, and apply it” (Ko, Kirsch, & King, 2005). *Trust* has a variety of definitions depending on the context in which it is used (Cohen & Levinthal, 1990). It can be defined as the degree of vulnerability or amount of trust in an individual for knowledge sharing or system for knowledge transfer. “Interpersonal trust has been defined as employees maintaining reciprocal faith in each other in terms of intention and behaviors” (Lin, 2006). “Information-based trust” (Hsu, Ju, Yen, & Chang, 2007) is achieved when one relies on information from another without fear of punishment or rewards from being trustworthy, it is synonymous with “knowledge-based trust” (Hsu, Ju, Yen, & Chang, 2007). Finally, “integrity-based trust has an important role to play in motivating knowledge-sharing. One is not likely to be motivated to share one’s knowledge with another individual or a community if one perceives them to be dishonest or unreliable” (Sharratt & Usoro, 2003). *Mentorship* can be described as personal training from a senior to a junior individual via interpersonal communication. It can be observed by working with experts and coaches are another tool to induce mentorship. For this reason “managers are taught how to coach, make efforts to train subordinates, and provide “one-on-one mentoring” (Lubit, 2001). *Biases* are opinions of a topic or situation based on personal experience that can be skewed because of their “frame of reference” (Davenport & Prusack,

2000) concerning that topic. *Experience* is defined as common ground knowledge through “education, discussion, publications, teaming, and job rotation” (Davenport & Prusack, 2000)

Knowledge Transfer Attributes

Codification is the most common method to transfer explicit knowledge by recording and collecting documentation. It can be stored in a database for transferring that knowledge to an individual. Government organizations should also “create a more unified knowledge network, formalize and systematize knowledge capture, and strengthen incentives to reuse knowledge” (Liebowitz, 2003). *Relevance* speaks to the degree of applicability of an item of knowledge (Connelly, 2003). *Configuration Control* can be described as a standardized approach to structured knowledge. Database management to ensure relevant material is properly cataloged and kept current within the knowledge repository. *Selective Audience* can be regarded as having knowledge sources that directly related to a specific group or individual. This term and definition came from the participants in this study. For example, an email from the base Med Group reminding a member to schedule their annual medical appointment can be a type of selective audience tool. *Volume* can be defined as the amount of space occupied. It can be characterized as, “volume of knowledge content and usage (that is, the number of documents or accesses for repositories or participants for discussion-oriented projects” (Davenport, DeLong, & Beers, 1998).

Just as explicit knowledge is specific to each individual, a collection of people (firm) has a particular organizational knowledge unique from other firms. Inhibitors to knowledge transfer can be analyzed to determine the appropriate knowledge management solution (Davenport & Prusack, 2000). Of these listed below trust, biases are depicted as (different cultures, vocabularies, frames of reference), lack of time, and absorptive capacity have been selected as attributes for this study.

Summary

The previously mentioned literary works outline commercial and government methods for knowledge retention. However, they have not covered knowledge sharing or retention as it specifically relates to contractors in a government organization. This study investigates knowledge retention at SMC/MCSW. It will be based on knowledge retention methods and practices supported by IT systems and knowledge sharing techniques for government organizations mentioned in the articles and case studies covered in this section.

III. Methodology

Overview

This chapter outlines the design aspects of the methodology for this study.

It will provide the rationale for its case study method selection, determine relevant data to be collected, and explain how that collected data will be processed. The research methodology will utilize a mixed methods research design consisting of group interviews for and historical information.

Case Selection

The Military Satellite Communications Systems Wing (MCSW) is located at the Space and Missiles Center at Los Angeles Air Force Base, CA. Its mission is to develop, acquire, and sustain space-enabled, global communications capabilities to support National Objectives. The MILSATCOM Systems Wing conducts planning, acquisition and sustainment of space-enabled global communications in support of the President, Secretary of Defense, and combat forces. Wing systems consist of satellites, terminals, and control stations, worth over \$40 billion providing communication for 16,000 aircraft, ships, mobile and fixed sites. It interfaces with MAJCOMs, HQ USAF, and DoD Agencies.

MCSW has five Groups and one squadron that deliver three primary Satellite Communications (SATCOM) product lines. The Protected Communications Group provides the DoD with survivable, global, secure, protected, jam-resistant communications for high priority

military ground, sea, and air assets. The group provides operations and sustainment support to on-orbit Milstar constellation. In addition, the group executes the \$6.7B Advanced Extremely High Frequency (AEHF) and \$1.2B Enhanced Polar SATCOM (EPS) programs. The user equipment or terminals for the DoD protected communication systems in the currently operational Milstar Command Post Terminal (CPT) and \$3.2B Family of Advanced Beyond-Line-of-Sight Terminals (FAB-T) development program (Martin, 2008).

Review Problem Statement

Manpower constraints have forced the Space and Missiles Center (SMC) at Los Angeles, CA to heavily outsource its procurement functions. SMC, like many other government organizations, has hired a larger proportion of contract employees to help it achieve its mission. When the employees complete their work obligation and leave, they take their tacit and/or explicit corporate knowledge with them. In addition, the study will assess the potential loss of DoD procurement knowledge resulting from corporate turnover. This is reflected in the following research questions:

Research Question 1: Is SMC at risk for losing corporate knowledge by hiring contractors?

Research Question 2: Are SMC's knowledge retention methods useful for its employees?

Research Question 3: What forms of knowledge transfer do contractors support?

The organizations for this study consist of MCSW procurement office branches, along with one squadron, and five groups to include the 653rd Electronic Systems Group (ELSG/KC) at the Electronic System Center at Hanscom AFB, MA. The total force is approximately 600 personnel consisting of 60 military, 120 civilians, and 120 contractors not to include 300 Federal Funded Research and Development Corporation (FFRDC) and 120 Systems Engineering Technical Assistance (SETA) support contractors (MSCW/OM office). FFRDC's were initially established during World War II to work as defense, energy, aviation, space, health and human services, and tax administration personnel. They are technical subject matter experts who usually assist the government with scientific research and analysis, systems development, and acquisition. SETA's are civilian government contractors who also assist government specifically with scientific expertise for acquisition programs, who work shoulder to shoulder with the government engineering staff as long-term support.

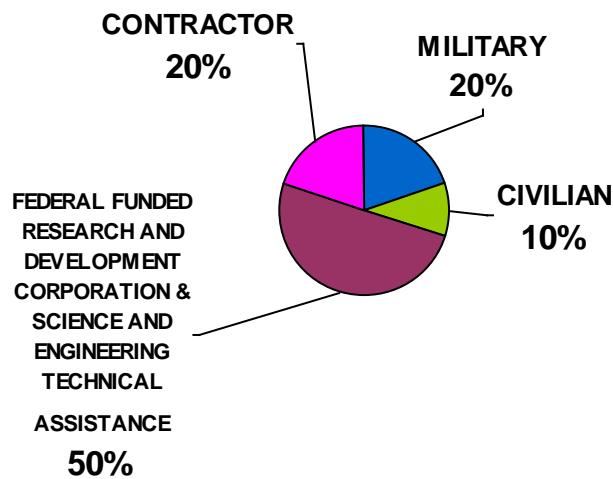


Figure 2. MCSW Workforce

Sampling

“The sample allows strong internally valid and credible, transferable/generalized conclusions to a span of desired populations” (Tashakkori & Teddlie, 2003). Both qualitative and quantitative studies have different terminology and approaches. Validity corresponds with the conceptual ideals for this study, addresses the knowledge retention in a majority contractor workforce, and provides a valid means to produce sufficient data to answer the research questions. The *accessible population* for this investigation is the Military Satellite Communications Systems Wing at the Space and Missiles Center (SMC/MCSW) at Los Angeles AFB, CA. MCSW is representative sample of the theoretical population or the population that will provide the participants for this study. The interview participants are generalizable to this population (Tashakkori & Teddlie, 2003). The mixed methods approach will be conducted on the accessible population using variations of probabilistic and nonprobabilistic sampling. The data collected will be a combination of group interviews and historical data. The sample method for this study is the nonprobabilistic analogue of stratified random sampling because it is typically used to assure that smaller groups are adequately represented. For this reason, the study will employ this mixed methods sampling method. This sampling process allows results to be accurately drawn from a body of test subjects (MCSW) to generalize results that mirror similar impacts on a larger population (SMC).

The purposive (nonprobabilistic) sampling frame is defined by the military, civilian, and contractor personnel who will participate in the group interviews. For this investigation, each subgroup (military, civilians, and contractors) will have an equal opportunity to participate. An invitation for voluntary participation to a knowledge management forum will be distributed to

the accessible population (MCSW wide) for interview solicitation. The sampling frame will be characterized as the list of attendees supporting group interviews and those data results will be used to support the qualitative analysis (Tashakkori & Teddlie, 2003). Due to the nature of government contractor employment regulations, contractors may participate on a voluntary basis at no additional cost to the government. The attendance list (sampling frame) will also specifically indicate the organization participation by each organizational branch and job category (military, civilian, and contractor) group interviews. This combination of probability (first) and purposive (second) sampling procedures is a very powerful (and fairly common) type of mixed methods sampling strategy. It is employed often in equivalent-status sequential designs (i.e., QUAN/QUAL) in which both types of methods are given equal weight, as typically seen in dissertation research conducted in educational settings (Tashakkori & Teddlie, 2003).

Selected design: Mixed Methods

Exploratory research will be used to inductively obtain a better understanding of the phenomena. Most exploratory research is conducted using qualitative rather than quantitative means. However, the data for this study will be collected using two sources one supporting the other in support of the one topic. The mixed methods design is the incorporation of various qualitative or quantitative strategies within a single project that may have either a qualitative or quantitative theoretical drive (Tashakkori & Teddlie, 2003). The Concurrent Triangulation Design format is used in this study to design the methodology for the data collection process (Tashakkori & Teddlie, 2003).

The concurrent triangulation design uses two analytic procedures to assess mixed methods data output. The first is *quantifying qualitative data* where numerical coding is done to process qualitative data. This can be done by coding. Coding is conducted by assigning a number to a theme or term then recording the number of times that code term or theme is repeated. That number is recorded as numeric data. Next, analyze the quantitative data by using *Spearman's Rank correlation coefficient* to measure the likeness or agreement of group correlated responses. The second is entitled, *comparing results* where the quantitative results are compared to the qualitative. This will be done to evaluate the qualitative data from group interviews against the historical data. This procedure will be used at the conclusion of data analysis to compare qualitative and quantitative results, then uses it to support statistical trends by qualitative themes or vice versa (Tashakkori & Teddlie, 2003). This design uses two different methods in the attempt to confirm, cross-validate, or corroborate findings within a single study (Greene, 1994). The data will then be deductively analyzed to locate patterns to highlight similarities and reinforce the validity of the claims.

Data Collection Approach

Data collection methods will be conducted to analyze MCSW personnel behaviors toward the current organizational knowledge management practices. According to the proposed methodology, this investigation will consist of historical data, group interviews, and individual interviews. Historical data will be collected by research investigation and focus groups will supply data from a series of interviews. These data will be compared for pattern recognition.

The proposed methodology model below is an illustration of the data collection process for this study.

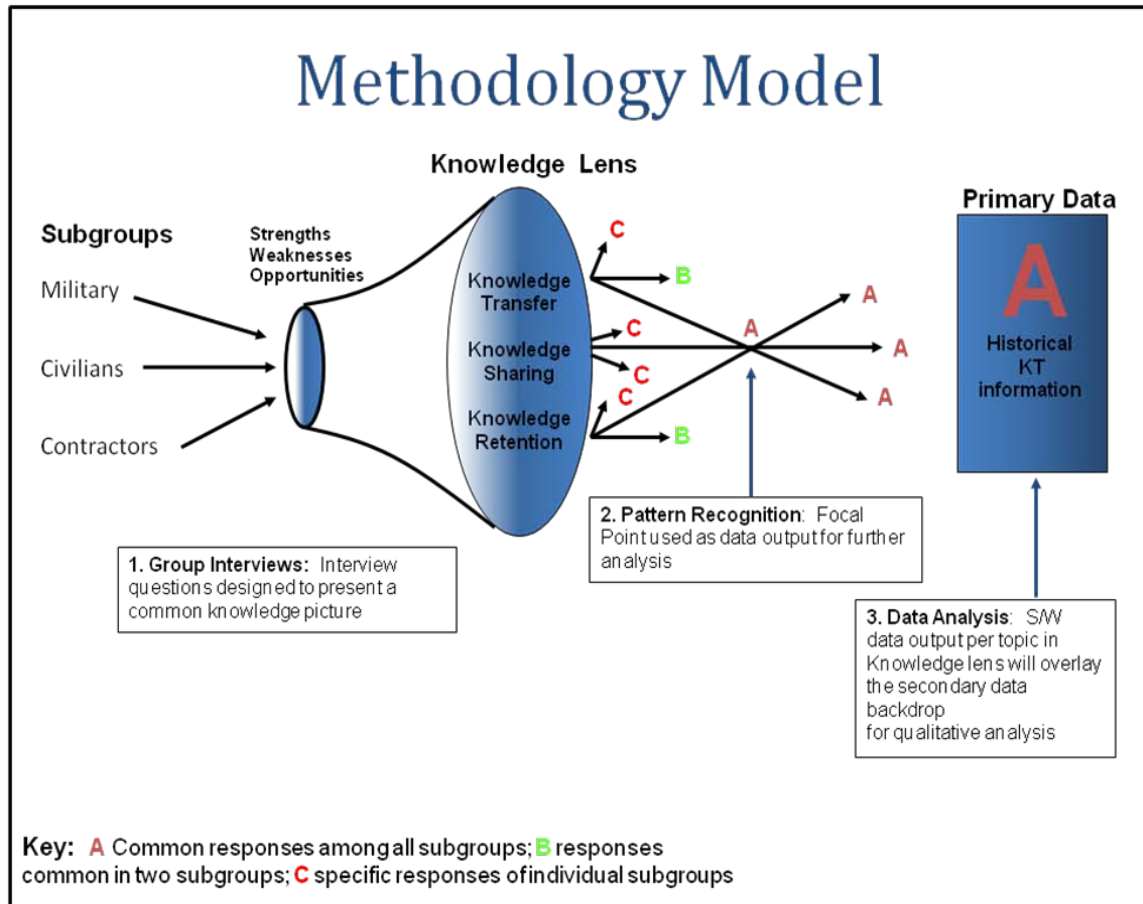


Figure 3. Methodology Model

Subgroups (Qualitative)

Subgroups are military, civilians, and contractors who will be interviewed either as individuals or groups to assess MCSW's current knowledge management health. Individuals will be interviewed using the *Nominal Group Technique (NGT)*, developed by Delbecq and Van de Ven for vital in depth data supporting this investigation (Greene, 1994). Group interviews or *focus groups* will retrieve facts, individual beliefs, feelings (desirable and undesirable), and

motives (what should and should not be done), as well as present as past behaviors concerning knowledge transfer within MCSW. In addition, NGT provides feedback of their organizational experiences with knowledge sharing and retention. Groups promote unity for group consensus on a particular subject matter. A moderator / primary researcher regulates discussion and ensures all members contribute to the end data product.

Strengths & Weaknesses

These group interviews are also designed to probe personnel for organizational culture/structural issues with respect to knowledge transfer observed as a function of strengths and weaknesses. This will allow the participants to express not only the methods used but it allows them to prioritize their preferred knowledge sharing, transfer, and retention methods. This key information will allow a multi-dimensional assessment of specific aspects, systems, and methods to be categorized, ranked, and scored in addition to frequency of use. Improving knowledge strengths reinforce sustaining a competitive advantage, because it is as distinctive as an impression or knowledge fingerprint specifically unique to that firm. Although strengths are important, under this assessment weaknesses define the primary areas of concern. Data reflecting strengths will be maintained and possibly further developed to ensure positive knowledge flow. Just as explicit knowledge is specific to each individual, a collection of people (firm) has a particular organizational knowledge unique from other firms. Weaknesses hold a higher degree of emphasis because they are regarded as a greater contributor for knowledge retention challenges.

Knowledge Lens

Participants will be asked 3 open ended questions for unbiased qualitative feedback relevant to knowledge sharing, transfer, and retention. They will be asked the following questions on the basis of strengths and weaknesses:

1. How do you *share* your knowledge?
2. What do use to *store* your knowledge?
3. What knowledge sources (reservoirs) do you *use* to do your job?

Tacit Knowledge Sharing

Interview Question 1. *How do you share your knowledge?*

This question is asked to measure people's behavior on tacit knowledge sharing by evaluating their participation in such opportunities. This question provides behavioral data to reflect organizational support of the semantic knowledge sharing among peers, supervisors, and personnel cultures (among military, civilian, and contractors). This will be done by asking the group's assessment of the organization's current knowledge sharing environment, and gauging their participation in interpersonal knowledge sharing activities. These responses will help assess the organization's climate for interpersonal knowledge sharing and possibly suggest a root cause for a lack of participation in such knowledge sharing opportunities (King & Marks, 2005). Related research questions are (RQ1 & RQ3).

Explicit Knowledge Transfer

Interview Question 2. *What do you use to store your knowledge?*

This question is asked to measure behavior for using the explicit knowledge transfer system(s) participation and gain customer feedback of current system's usability. In addition, responses to these questions may provide clarity for potential reluctance for using the system (King & Marks, 2005). The related research questions (RQ 1 & RQ 2).

Knowledge Retention

Interview Question 3. *What knowledge sources (reservoirs) do you use to do your job?*

This question is asked to measure organizational usefulness of retained knowledge. Data provided from these questions indicate SMC's ability to provide effective knowledge to contractor/personnel via a dedicated IS for formal knowledge transfer. Users may support the system, but if it does not help them do their job the knowledge system is not effective. Historical data results may indicate user support in the form of frequency of use as a measure of usefulness for the knowledge retention system. However, interview responses may reveal its organizational effectiveness. In addition, criteria for assessing culture for knowledge climate by leadership support. If leadership provides rewards or positive feedback on the use of the knowledge transfer system, it may incentivize personnel to use it more frequently (King & Marks, 2005). The related research question (RQ 2).

Subgroups will be asked subsequent questions using the same response tool to further probe their personal thoughts on the subject matter and will be recorded as qualitative data. The facilitator will collect their responses and display them on a flip chart to allow them to express

unrestrained thoughts of how they view the current knowledge management system. The responses will be prioritized by group consensus. If there are no groups, individual interviews will be used.

Historical Data (Quantitative)

Historical data is known as data that are present but must be uncovered (Tashakkori & Teddlie, 2003). Historical and archived data of MCSW's knowledge management IT system will be used in this study. There are several types of this data, such as personal documents, official documents, physical data, and archived research data (Tashakkori & Teddlie, 2003). Although historical data will support behavioral aspects of this study, interviews may reveal the rationale to strengthen or weaken the inferences that would have been made on historical data alone. The MCSW/OM office will provide an almanac of the knowledge transfer IT account represented by each research subgroup on an annual basis. This will supply background information on explicit knowledge transfer methods from information technologies supporting knowledge management, continuity, and total organization situational awareness among fellow directorate's knowledge resources. MCSW military and civilian results will be statistically analyzed and compared to the government contractor's to determine if contractors at the system program office are sharing organizational knowledge.

Step 1: Group Interviews

Group interviews will be semi-structured by using a combination of 3 open ended interview questions. The data collection method selected is the *Nominal Group Technique* on the target sample frame defined for researchers using this quantitative method for group interviews is 8-10 participants per group for 3-4 groups. There will be a rotation of new people after each session, so there will be approximately 4 interviews with time duration of roughly 90 minutes to one hour sessions per day. Interviews will begin with the facilitator stating the following welcome message:

Thank you for your time in participation of this forum. MCSW leadership desires your feedback regarding the knowledge management practices in this organization. AFIT researchers at the behest of the senior leadership of this organization will assess your organization's knowledge climate by collecting census type data of what you use to share, transfer, and retain your knowledge. Your open and honest feedback will be used to assess and modify current policies, in an effort to improve your current work environment, with respect to management practices. For this reason, please share your honest opinions and thoughts on solutions to challenges you currently face. All results will be presented in summary aggregate form to protect the privacy of those involved.

Next, the facilitator will define and contrast the differences between information and knowledge to ensure they comprehend what data is being asked of them. Participants will have 10 minutes to answer the interview questions as well as its strengths and weaknesses on individual index cards. The use of index cards assists in discouraging acquiescence or answering

in what is perceived to be socially desirable. (Leedy & Ormord, 2005) A flip chart will be used for shared discussion to help them prioritize their individual responses into a group consensus (Greene, 1994). The three knowledge themes provide 6 (approx) sets of data per subgroup. Results from the interview cards will be combined into one organization wide strengths and weaknesses chart representative of each subgroup (military, civilian, and contractor).

Step 2: Pattern Recognition

Before the data from the knowledge matrix can be decoded into knowledge charts. All participant responses retain their initial strengths/weaknesses categorization as they are recorded onto a *knowledge matrix*. Knowledge events are categories that the interviewee responses share a common context to define the participant's response. For example, an IT system name and personal computer drives can share the same knowledge event categorized as "databases". The interviewee responses will be categorized by *knowledge events*, then coded and mapped to corresponding to the (15) *Knowledge attributes*. The Knowledge attributes will be compared to the knowledge events for correlation by subgroup.

Coding & Translation

Subject's responses expressing strengths/weaknesses to the knowledge questions will be coded and analyzed in the knowledge matrix to determine the appropriate Knowledge attributes captured in the research model. The knowledge events identified by the interview facilitator will be compared against the 15 Knowledge attributes for agreement. The facilitator's rating of their

relatedness will be cross evaluated by those of another subject matter expert using *Cohen's kappa* to test agreement of two raters for inter-rater reliability (Galton, 1892).

The equation for κ is:

$$\kappa = \frac{\Pr(a) - \Pr(e)}{1 - \Pr(e)},$$

Equation 2. Cohen's Kappa

The *knowledge charts* will be converted into *knowledge reports*. Knowledge charts contain numerically scored data, based the on the quantitative data taken from the participant's responses. They capture data results for each session per subgroup as seen in the following table

KRS	Config Mentor	Capture Control	Store/Codify	Selective Avail	Audiences	Trust	Relevance	Biases	Corp Turnover	Access	Vol	Absorptive Time capacity	Exp
Mil Gr													
Mil Ind													
Civ Gr													
Civ Ind													
Cont													
Mil Avg													
Civ Avg													

Table 1. Knowledge Chart

They represent the numerical form of the strengths and weaknesses as they relate to knowledge events and attributes. Top strengths and weaknesses from the knowledge charts will be used to create *knowledge reports*:

Knowledge Transfer - Strengths					
	Military		Civilian		Contractor
Score		Score		Score	

Table 2. MCSW Knowledge Report

Knowledge reports are lists of scored and prioritized Knowledge attributes and prioritized by subgroup. They will be compared by using *Spearman's Rank correlation coefficient* to test the strengths and weaknesses relatedness of the subgroup's Knowledge attributes to determine patterns of similarities or discontinuities in their respective results. ρ is stated as:

$$\rho = 1 - \frac{6 \sum d_i^2}{n(n^2 - 1)}$$

Equation 3. Spearman's Rank

Spearman's rank evaluates two sets of data at a time and there are three subgroups, so they will be evaluated in the following order (military vs. contractor, contractor vs. civilian, and civilian vs. military). The three sets of knowledge charts will be analyzed for patterns in the strengths and weaknesses. This will show which subgroups believe what Knowledge attributes are the organization's greatest strength and weakness as it pertains to knowledge transfer, sharing, and retention. The trends will be tallied using Spearman's Rank correlation coefficient then recorded into a collective site picture. Final organizational site picture results will be adjusted to quota percentages. Results for this investigation will be categorized using a nonprobability purposive sampling technique called the *proportional quota sampling* method

(Tashakkori & Teddlie, 2003). The quota sampling method is a nonrandom selection of participants according to a fixed quota. MCSW has a ratio of military, civilians, and contractors proportional to its manpower profile of 15%, 15%, and 70% respectively. It will be applied to the results found from the sample size for both the group interview and secondary data for this study. This will best simulate the organization manpower numbers for feasible recommendations. This will serve as the final output of the pattern recognition portion of this process. The results from this step will be used in the data analysis step.

Step 3: Data Analysis

In the data analysis step all qualitative and quantitative data results will be compared. All knowledge charts and the organizational knowledge site picture will be compared against the historical data to measure their correlation. The data results from this stage will be contrasted to and supply rationale for their results. Data collection begins with research of the MCSW knowledge database personnel. Its purpose is to prepare a backdrop reflecting current behaviors toward using the designated knowledge management IT system. Specific data inquiries include the number of users and their *frequency* of use among military, civilians, and contractors over time. This presents a fundamental linkage between the data and one of the two knowledge themes for this investigation. The quantitative data provide rationale and support for the qualitative rationale manifested the group interview results. The results from explicit knowledge transfer will be compared with the historical data independently, and then balanced with the tacit knowledge sharing and knowledge retention data results for recommendation.

The final output result will assist in answering the research questions. They will reveal if subgroups have conflicting views of the current organizational knowledge management system and what it should be. The results will also disclose if organizational knowledge management aspects require resolution and if so specifically identify a set of principles to remedy this disconnect. MCSW military and civilian results will be statistically analyzed and compared to the government contractor's to determine if SMC is at risk for losing valuable knowledge by having a contractors heavy work environment.

Validity

Many of the validity concerns were addressed in the mixed methods selection. For a study to be generalizable with proper validity and repeatability, its results can be logically applied to similar such cases (Tashakkori & Teddlie, 2003).

Quantitative Validity

The archived data is based on frequency of behavioral patterns. The value of using the mixed methods approach is that it can involve an extensive collection of data from various observations from group interviews and historical documents (Tashakkori & Teddlie, 2003). The historical information is based on quantifiable data on the current knowledge management system. It will serve as background material for the group interviews and will be compared to the qualitative data results from group interviews. Consistent patterns or repeatable trends from

interview dialog may warrant a degree of evidence towards a claim for validity (Tashakkori & Teddlie, 2003).

Qualitative Validity

The pattern recognition step for data collection will use the *data transformation* validity check. According to Onwuebuozie (2001), the manner in which the emergent themes cluster within each factor (i.e., meta-theme) facilitates identification of the interrelationships among the themes. Once the meta-themes have been determined, an interrespondent meta-theme matrix (i.e., Participant x Meta-theme matrix) and an intrarespondent thematic matrix (i.e., Unit x Meta-theme matrix) can be constructed comprising a combination of 0's and 1's. These matrices can then be used to determine frequency (manifest) effect sizes and intensity (manifest) effect sized for the meta-themes (Tashakkori & Teddlie, 2003). In addition, the *data correlation validity* check will be used. If only one type of data is collected, then the data transformation leads to the data integration stage in which all data are integrated into a coherent whole. However, if both types of data are collected, the next step might be the data correlation stage to correlate the quantitative data with the qualitative data. The ability to undertake a correlation exists if both data types are collected for each sample member (Tashakkori & Teddlie, 2003). A different accessible population or sample size was used for the qualitative data, but the same sample members were used to collect both qualitative and quantitative data.

The *data comparison* validity check will apply for the data analysis step. In using the data comparison stage, the researcher might not be able (or might choose not) to correlate or consolidate the two types of data. Instead, the analyst might decide to compare these data. This comparison stage involves comparing data from different data sources. This step may be used if the purpose of the mixed methods research is either triangulation, initiation, or complementarily (Tashakkori & Teddlie, 2003).

External Validity and Transferability

External validity is a measure of how generalizable the conclusions are as they relate to a potential parallel or similar case scenario. An element of randomness assists the logical rationale supporting the argument for possible validity for generalizable requirements. Therefore using a random selection method for drawing sample populations is often recommended. In addition, a report's conclusions are intended to be used on an additional group greater than or equal to the (population) size in the study to verify the solution's repeatability. For this study, defining the accessible sample is not done randomly, but the determination of which MCSW members will participate for interviews is completely random. In addition, population sampling under the mixed methods approach addresses validity issues.

Validity Risks

Risks to the results impacting external validity are the fact that MCSW is in a specific location. One could argue that the corporate culture in California is specific to its residents and hence, unusual to the theoretical population of the Air Force.

Reliability

This investigation used *expert selection* to reinforce reliability. Expert sampling is assembling a group of persons with known specific and credible experience. (Leedy & Ormord, 2005) A second rater assessed the Knowledge attributes to the knowledge events using Cohen's kappa to test for likelihood of rater agreement. This satisfies inter rater reliability of knowledge events and the subject's responses as they relate to the Knowledge attributes. The expert selected was selected on their merits and well versed in the knowledge management subject matter. They also reviewed the feasibility of interview questions.

Confidentiality

Ethical Protection of the sample frame was also exercised. Neither the formatted attendance list will appear as an appendix, nor the actual sampling frame. The structured interview questions were reviewed by the Institutional Review Board for suitability of human experimentation and have been approved in accordance with 32 CFR 219, DoD 3216.2, and AFI 40-402 regulations to ensure ethical standards for human test subjects were practiced. In

addition, to retain confidentiality, MCSW will retain the list. It will remain as SPO property and its specifics will not be featured in this study. All sessions will be recorded unless the participants request that the recording device to be turned off. However, all data collection recording instruments without participant's names (flip charts, observer notes, and interviewee index cards) will be used as official documentation and property of the Air Force.

Summary

The case identification, methods, data collection processes, and validity have been addressed. In the next chapter, the results from data collection methods discussed in this chapter will be displayed.

IV. Results and Analysis

Overview

This chapter consists of results from the proposed methods outlined in chapter three. Historical information of MCSW's knowledge management process was collected from its information and security branch (MCSW/OM). They provided reports of their knowledge management system. In addition, a series of group and individual interviews were conducted over the course of three days. There were six military, five civilians and four contractors for a total of 15 participants from various departments within the MCSW organization who attended the interview sessions. There were two nominal group sessions. The first was a military group of three participants; the other was a civilian group of two participants. The data from the individual military sessions were aggregated into one artificial group, and then averaged with the data from the military nominal group to produce one set of scores for the military. This aggregate and average scoring process was conducted for the civilian individual interviews and nominal group data as the military's. There were no contractor nominal group sessions, so their individual interview data were aggregated into one set of scores for their artificial group. The organization was assessed and the research questions were answered using this data.

The MSCW Knowledge Management System

All historical data of the SMC/MCSW knowledge management system was provided by the MCSW/OM office. MSCW uses a commercial off the shelf (COTS) product called Livelink Enterprise Content Management (ECM) (Strong, 2008). SMC network administrators at the base

communications squadron used Livelink to design a content repository for cross-organization information sharing. It is intended to be a central source of knowledge for all base personnel by allowing them to access neighboring system program office content files. Below is an illustration of total MCSW Livelink users.

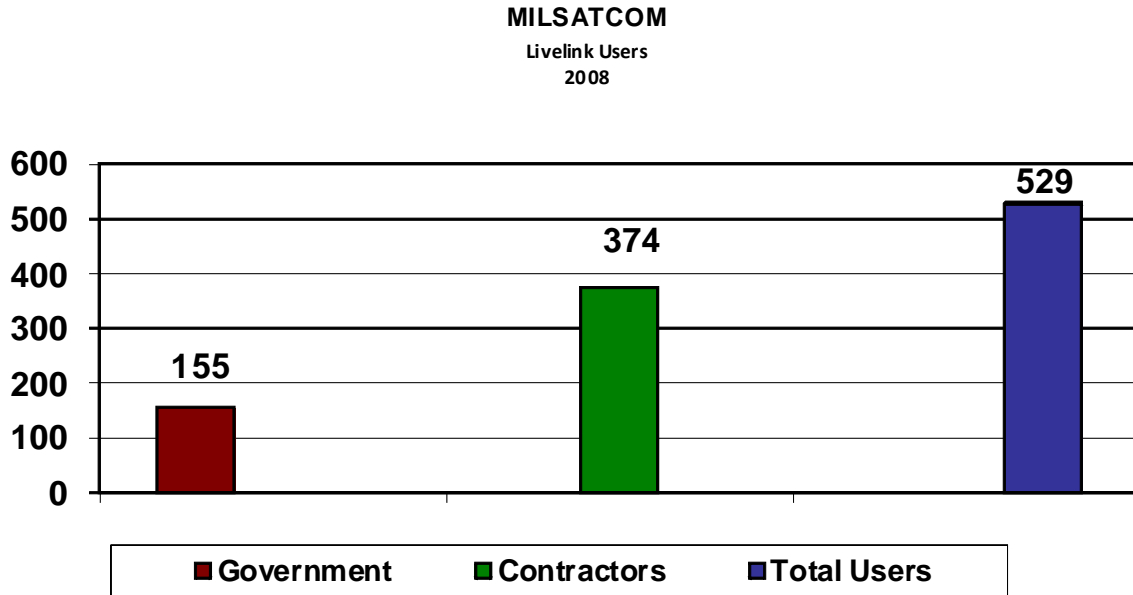


Figure 4. MCSW Livelink Users

SMC's concept of knowledge management is a collection of content files used as a central information repository (Strong, 2008). The Knowledge Management System for the MILSATCOM Wing has an organization specific sub-database within Livelink system called McKMS, which acts as MCSW's intranet portal equipped with data folders that decentralizes into departmental levels. Within McKMS there is an Electronic Records Management (ERM) section, a Livelink working area, a Task Control System (TCS), and a Personal Records Management System (PRMS). The *Electronic Records Management library* stores official, technical and contractual procurement information records. It is 10% complete and has development and security challenges (Strong, 2008). The TCS is designed to assist with

administration duties of inner-department information flow for tracking internal/external actions, such as OPR suspensions, taskers, awards, and decorations. It is 60% complete (Strong, 2008). It also has an unofficial records section that is flexible to accommodate the specific needs of that unit. It is 50% complete (Strong, 2008). The *Personnel Data Base* allows workers to create their own folders to track all personnel actions. These include manpower, awards, security, training, and readiness checklists. In addition to its intranet capabilities, Livelink features personal folders with viewing permissions to deny access. The following illustration depicts the forecasted account activity for current and new users who subscribe to the shared database. This system is 30% complete (Strong, 2008). The table below is an illustration of the current usage vs. projected growth of the KcKMS system.

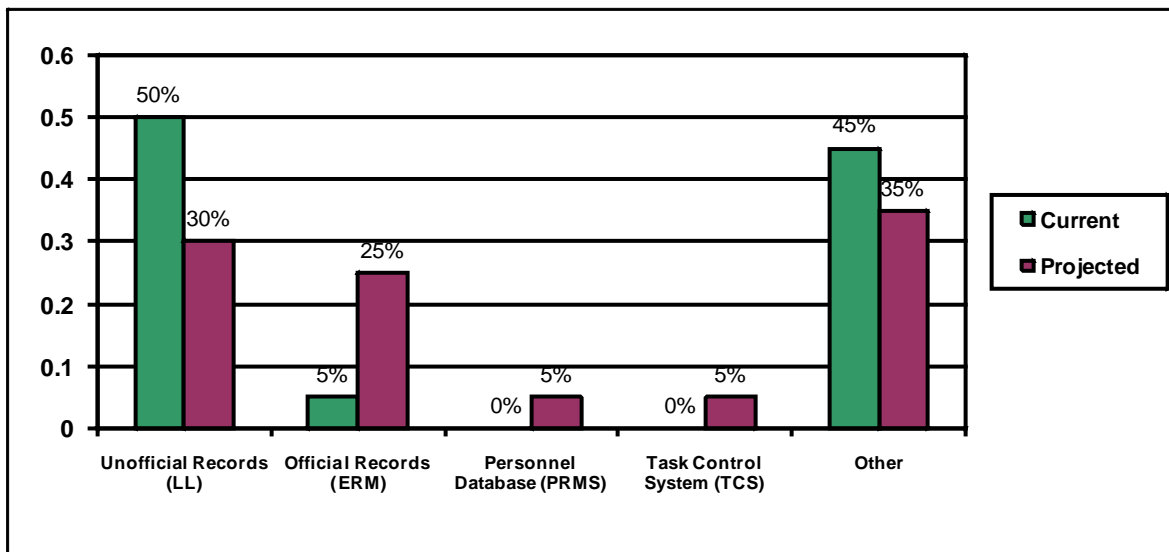


Figure 5. MckMS Projected Use

According to the MCSW/OM office, frequency of use is indicative of the system's usefulness (Strong, 2008). The number times people access the repository is measured by its number of clicks also known as its click rate (number of clicks over time). This number is tracked and tallied for account activity. From this count, the Livelink administrators at their

respective organizations report the Livelink usage to the base communications squadron, and then reported for senior management. The report reflects frequency by measuring the number of hits as a characterization of usefulness. No user feedback was available for review. The graph below illustrates a monthly account (click rate) of Livelink usage from its inception in 2004 thru 2008 for government employees and contractors at MCSW.

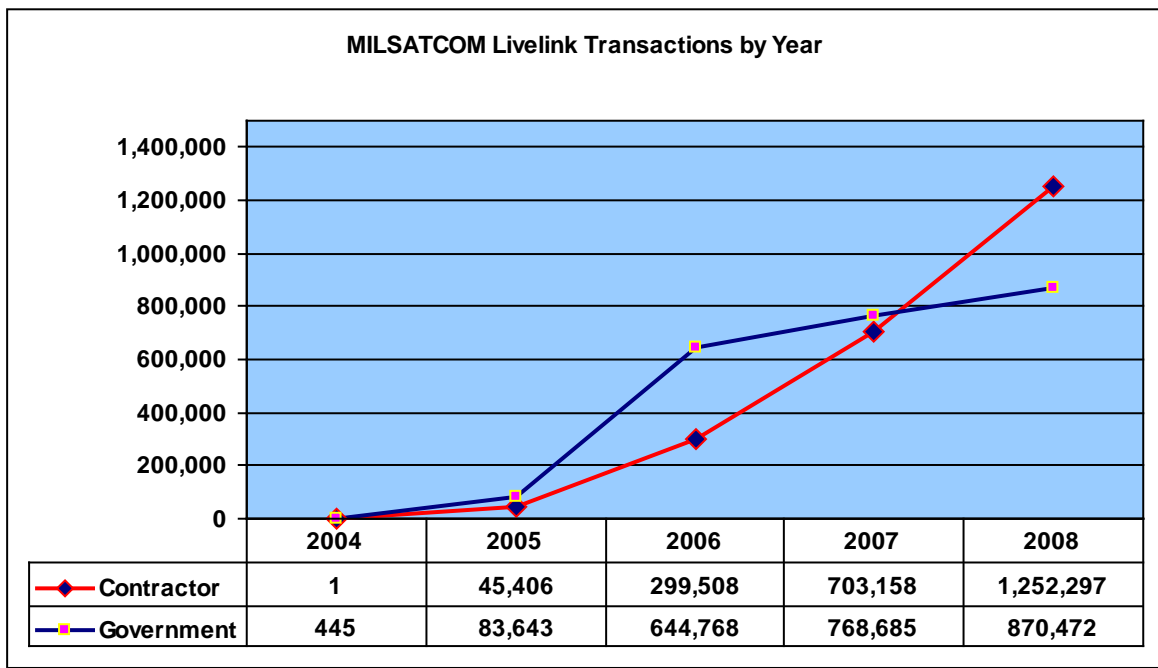


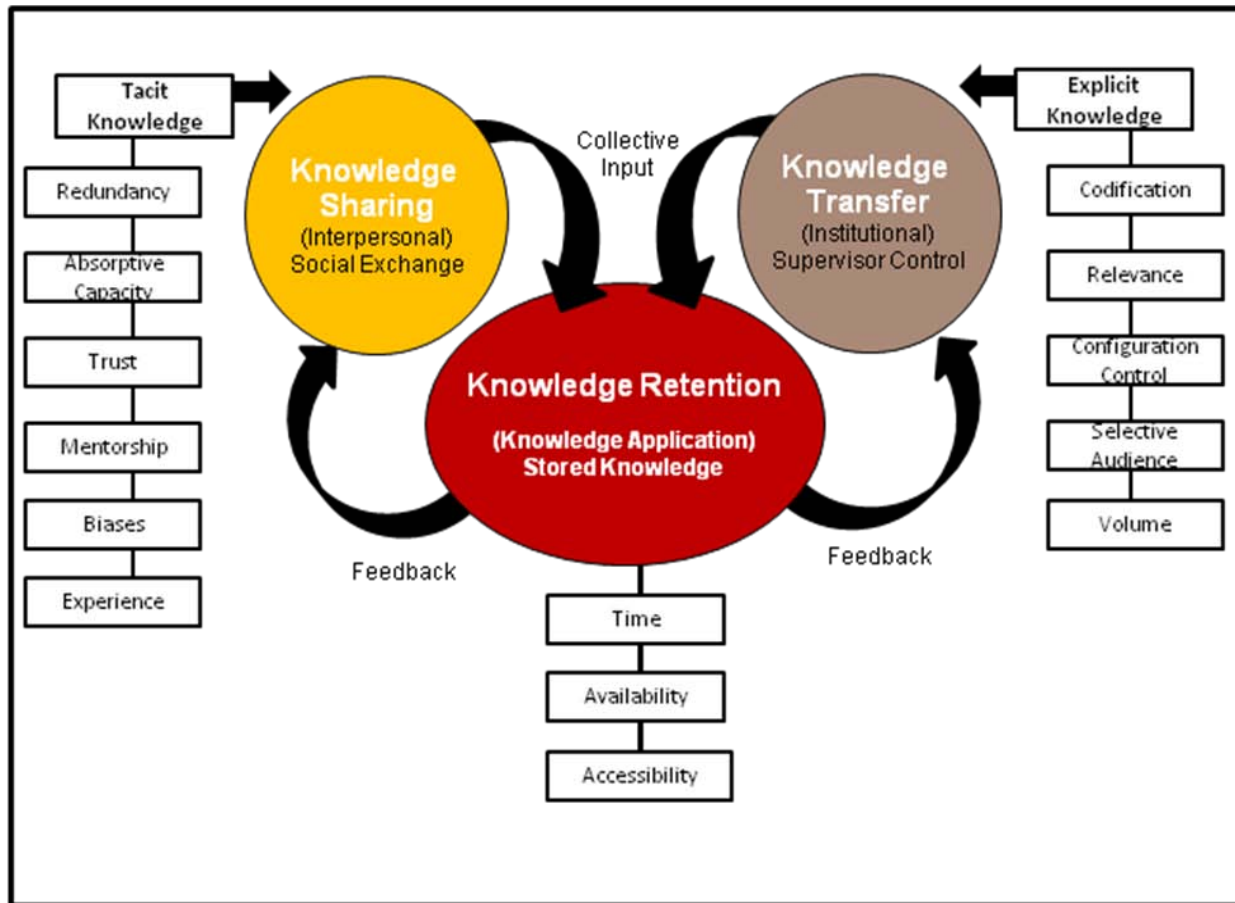
Figure 6. MCSW Livelink Transactions

Although the Livelink and McKMS systems are referred to as knowledge management systems, they differ from an IT based knowledge management system taught in academia. The content management systems used at SMC resembles information repositories. Information such as templates, processes, and program specifics can be stored on an open source network for the base to access. The purpose of such a reservoir is to share information that may be useful to neighboring departments or to display documents (procedures, templates) other departments use to execute functional work processes. What is missing from this database is not the information,

but in fact the knowledge itself. Linking the explicit knowledge is only half of what knowledge IT systems should do. Key linkages between organizations that foster open discussion, communication and rapport among functional employees are required (Liebowitz, 2003). Another is a designated area for lessons learned for quick and easy access to a “knowledge librarian” that can either assist the user or refer him or her to an employee who can (Liebowitz, 2002). According to the current system design, McKMS does not have the necessary components to be called a knowledge management system.

Group and Individual Interview Data Results

The purpose for conducting interviews is to collect data that reflect the subgroup’s behaviors toward knowledge transfer and retention. The participants were given a common lens to view knowledge transfer and retention as they are asked three specific questions to provide feedback of their organization. As stated in previous chapters, for the purpose of this investigation knowledge sharing is defined as tacit knowledge shared via interpersonal means. Transferred explicit knowledge is conveyed via institutional tools. Retention integrates the shared and transferred knowledge for the application and use of the newly acquired knowledge. This premise allows a key connection to the research model and the rationale for the interview questions. It links objectives vital for execution yielding otherwise undetected patterns of behavior.



Research Model

From this basis, the participants were given three open ended questions and asked to provide answers as well as the strengths and weaknesses associated with those answers. The questions are of the following:

1. How do you *share* your knowledge?
2. What do use to *store* your knowledge?
3. What knowledge sources (reservoirs) do you *use* to do your job?

The first question relates to knowledge sharing, the second for knowledge transfer, and the third for knowledge retention. The participants scored their responses using a *Likert Scale* of

1 thru 5 from favorable to unfavorable respectively. As the participants responded, they were unaware that they provided their experiences in regard to the 14 knowledge attributes associated with explicit and tacit knowledge, and consequently the three knowledge themes (knowledge sharing, knowledge transfer, and knowledge retention). This way, participants could channel their thoughts uninhibitedly to answer the questions without influencing the data. After the interviews, their specific responses (qualitative data) were recorded onto a matrix for coding.

Knowledge Events

The participants' responses became migrated into the knowledge events to simplify categorization of the strengths and weaknesses. The participants used similar terms to describe the same occurrence, so all responses were consolidated into categories based on their actual words. These categories were on the "job training" (OJT), "achieved email", "hard copy documents", "databases", "personal knowledge", and "web" are collectively called *knowledge events*. *OJT* encompasses knowledge transferred by interpersonal or face to face communication (e.g. Demonstration, training or mentorship from military, civilian, or contractor). *Achieved email* expresses codified knowledge via electronic communication means. *Hard copy documents* are physical forms of codified knowledge (e.g. contract files, books, reference manuals, etc.). *Databases* are defined as codified knowledge on a dedicated server intended to be available and accessible for all knowledge workers in an organization. In this case Livelink, McKMS, and TIDE were mentioned. *Personal knowledge* refers to knowledge tools that are easily accessible to an individual, but not necessarily accessible to personnel in the organization. For example hand written notes, personal laptops, and individual data warehouses were mentioned.

Web represents all web based tools or links external to what the organization provides allowing personnel access knowledge provided via the internet. For example, internet sites, SIPRNET, chat rooms, communities of practice, e-pubs were mentioned. The responses were scored by rank order and tallied into points per knowledge term. The scored knowledge events were recorded on a matrix using 1 (unbolded) to affirm the positive and a bold **1** to affirm the **negative** or **the lack of** a particular knowledge term. For example, a **bolded** number under the mentorship knowledge term does not mean the participant responded in the negative, but affirmed the lack of mentorship as a concern. Participants' index cards from the interviews are in Appendix A. The full knowledge matrix with corresponding knowledge events and attributes are featured in Appendix B.

Participants' responses to the questions appear on the knowledge matrix. The data is separated into strengths and weaknesses as they pertain to their respective knowledge sharing, transfer, and retention themes. The knowledge events and corresponding knowledge attributes were interconnected by their likeness of definition. The knowledge events were tested using Cohen's Kappa, between the facilitator and a secondary subject matter expert, to test for inter-rater reliability. The coders agreed on 131 of 135 total Knowledge attributes for an agreement rate of 97%, thus yielding a Cohen's Kappa of .75. The respective Cohen's Kappa values are listed below.

Knowledge Event	Frequency of Positive Agreement	Number of discordant Pairs
Archived Email	15	0
Culture	14	1
Databases	15	0
Documents	14	1
On the Job Training (OJT)	15	0
Personal Knowledge	14	1
Web	15	0
Hard Copy Documents	14	1
Oral Communication	15	0
Total	131	4

Figure 7. Cohen's Kappa Reliability Results

Outputs from the knowledge matrix are entered into the knowledge charts. Since there was one group of the participants per government-represented subgroup (military and civilians), data from individual interviews was averaged with the aggregated individual interview data. Subsequent individual interviews were calculated in this manner, to provide subgroup totals. Data results from this process will be observed for the pattern recognition. The following series of tables (knowledge charts) illustrate the three subgroups, per knowledge theme. They were calculated as individual and group scores then into overall scores as they relate to the knowledge attributes per subgroup.

KSS	Config Capture			Selective			Corp			Absorptive			Exp	
	Mentor	Control	Store/Codify	Avail	Audiences	Trust	Relevance	Biases	Turnover	Access	Vol	Time capacity		
Mil Gr	5	0	9	0	0	0	0	0	0	0	0	10	4	0
Mil Ind	4.66	1.33	1.33	3.33	6.33	0	0	0	0	0	0	0	0	0
Civ Gr	0	0	5	5	4	5	0	0	0	0	0	0	0	0
Civ Ind	0	0	1.66	1.66	0	0	0	0	0	1.33	0	1.66	3.33	0
Cont	1	0	2	3.5	0	0.75	1.25	0	0	2.75	1	1.25	0	0
Mil Avg	4.83	0.665	5.165	1.665	3.165	0	0	0	0	0	0	5	2	0
Civ Avg	0	0	3.33	3.33	2	2.5	0	0	0	0.665	0	0.83	1.665	0

Figure 8. Knowledge Sharing Strengths Chart

KSW	Config		Capture		Selective			Corp			Absorptive			
	Mentor	Control	Store/Codify	Avail	Audiences	Trust	Relevance	Biases	Turnover	Access	Vol	Time	capacity	Exp
Mil Gr	5	0	7	3	0	0	0	4	0	5	0	8	5	0
Mil Ind	1.66	2.33	3.33	2.33	0	1.33	4.66	2.33	1.33	4.66	0.33	1.33	0	0
Civ Gr	0	0	4	8	0	5	3	0	0	4	0	0	5	0
Civ Ind	1.66	0	1.66	3	0	1.33	0	3	0	0	0.33	4.66	4	0.66
Cont	0	0	2.5	2.25	0	1.25	3.25	1	0	2.25	1.25	2	3.75	2.25
Mil Avg	3.33	1.165	5.165	2.665	0	0.665	2.33	3.165	0.665	4.83	0.165	4.665	2.5	0
Civ Avg	0.83	0	2.83	5.5	0	3.165	1.5	1.5	0	2	0.165	2.33	4.5	0.33

Figure 9. Knowledge Sharing Weaknesses

KTS	Config		Capture		Selective			Corp			Absorptive			
	Mentor	Control	Store/Codify	Avail	Audiences	Trust	Relevance	Biases	Turnover	Access	Vol	Time	capacity	Exp
Mil Gr	0	0	5	10	0	0	0	0	0	0	0	0	0	0
Mil Ind	1.66	0	1.33	3.33	0	0	1	0	1.66	0	0	0	0	0
Civ Gr	0	2	5	5	0	4	4	0	0	3	0	3	0	0
Civ Ind	0	0	0	3.33	0	0	1.66	0	0	4.66	0	0	0	0
Cont	0	1	3	3	3.25	1	1	1	0	5.75	3	0	0	0
Mil Avg	0.83	0	3.165	6.665	0	0	0.5	0	0.83	0	0	0	0	0
Civ Avg	0	1	2.5	4.165	0	2	2.83	0	0	3.83	0	1.5	0	0

Figure 10. Knowledge Transfer Strengths

KTW	Config		Capture		Selective			Corp			Absorptive			
	Mentor	Control	Store/Codify	Avail	Audiences	Trust	Relevance	Biases	Turnover	Access	Vol	Time	capacity	Exp
Mil Gr	5	2	0	9	0	5	3	4	3	0	1	0	0	0
Mil Ind	0	2.66	0	2.66	0	3.33	0.33	1.66	0	2.66	0.66	0	0	0
Civ Gr	0	1	0	8	0	4	2	1	0	13	6	4	0	0
Civ Ind	1	2.33	0	2	0	1.33	8	0	0.66	4.33	0	2.66	0	1.66
Cont	0	2	0.75	4.5	0	3.25	0	0	0	5	0.75	0.5	0	2.5
Mil Avg	2.5	2.33	0	5.83	0	4.165	1.665	2.83	1.5	1.33	0.83	0	0	0
Civ Avg	0.5	1.665	0	5	0	2.665	5	0.5	0.33	8.665	3	3.33	0	0.83

Figure 11. Knowledge Transfer Weaknesses

KRS	Config		Capture		Selective			Corp			Absorptive			
	Mentor	Control	Store/Codify	Avail	Audiences	Trust	Relevance	Biases	Turnover	Access	Vol	Time	capacity	Exp
Mil Gr	4	0	0	10	0	0	0	0	0	0	0	0	0	0
Mil Ind	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Civ Gr	0	0	5	0	0	4	0	0	0	5	0	0	0	0
Civ Ind	0	0	0	1.66	0	0	0	0	0	0	1.66	0	0	3.33
Cont	0	0	0.25	0	0	2	2.75	0	0	4.5	0	1.25	0	1.25
Mil Avg	2	0	0	5	0	0	0	0	0	0	0	0	0	0
Civ Avg	0	0	2.5	0.83	0	2	0	0	0	2.5	0.83	0	0	1.665

Figure 12. Knowledge Retention Strengths

KRW	Config Mentor	Capture Control	Store/Codify	Selective Avail	Audiences	Trust	Relevance	Biases	Corp Turnover	Access	Vol	Time	Absorptive capacity	Exp
Mil Gr	0	0	0	5	0	8	5	0	4	0	5	0	0	0
Mil Ind	1.33	0	0	1.33	0	1.66	1.66	3.33	0	0	0	1.33	0	0
Civ Gr	0	0	0	4	0	4	0	2	5	10	3	0	0	5
Civ Ind	0	1	0	1.66	0	2.66	1.33	0	3.66	1.66	1.66	1.33	0	1.66
Cont	0	1	0	0	0	5	3.25	0.75	0	2.5	1	0	0	0
Mil Avg	0.665	0	0	3.165	0	4.83	3.33	1.665	2	0	2.5	0.665	0	0
Civ Avg	0	0.5	0	2.83	0	3.33	0.665	1	4.33	5.83	2.33	0.665	0	3.33

Figure 13. Knowledge Retention Weaknesses

Knowledge reports are generated from the knowledge charts. Knowledge reports are the ranked priority of the knowledge attributes as perceived by the subgrouped participants. Each subgroup was tested for relatedness by using *Spearman's rank constant coefficient*. Spearman's rank uses two lists of data sources to calculate their relatedness. Since there are three subgroups, they were evaluated two at a time in the following order: (Military vs. Civilian, Civilian vs. Contactor, and Contractor v. Military). No rankings provided evidence to reject the null hypothesis supporting the claim that the groups are different, except for one where contractor relatedness significantly differs from the military's, for knowledge retention weaknesses. The respective Cohen's Kappa values are listed in Appendix C.

Strengths	Military	Civilians	Contractors
Score		Score	Score
5.16	Ability to Codify	3.33	3.5
5	Time	3.33	2.75
4.83	Mentorship	2.5	2
3.16	Selective Audiences	2	1.25
2	Accessibility	1.66	1.25
1.66	Availability	.83	1
.66	Config Control	.66	1
			.75
Weaknesses	Military	Civilians	Contractors
Score		Score	Score
5.16	Ability to Capture Store/Codify	5.5	3.75

4.83	Accessibility	4.5	Absorptive capacity in recipients	3.25	Relevance
4.66	Time	3.16	Trust	2.5	Ability to Capture Store/Codify
3.33	Mentorship	2.83	Ability to Capture Store/Codify	2.25	Accessibility
3.16	Biases	2.33	Time	2.25	Availability
2.66	Availability	2	Accessibility	2.25	Experience
2.5	Absorptive capacity in recipients	1.5	Relevance	2	Trust
2.33	Relevance	1.5	Biases	1	Biases
1.16	Configuration Control	.83	Mentorship		
.66	Trust	.33	Experience		
.66	Corporate Turnover	.165	Volume		
.165	Volume				

Figure 14. Knowledge Sharing

Strengths	<i>Military</i>		<i>Civilians</i>		<i>Contractors</i>
Score		Score		Score	
6.66	Ability to Capture Store/Codify	4.65	Availability	5.75	Accessibility
3.16	Configuration Control	3.83	Accessibility	3.25	Selective Audiences to reduce waste
.83	Corporate Turnover	2.83	Relevance	3	Ability to Capture Store/Codify
.83	Mentorship	2.5	Ability to Capture Store/Codify	3	Availability
.5	Trust	2	Trust	3	Volume
		1.5	Time	1	Configuration Control
		1	Configuration Control	1	Trust
				1	Relevance
Weaknesses	<i>Military</i>		<i>Civilians</i>		<i>Contractors</i>
Score		Score		Score	
5.83	Availability	8.66	Accessibility	5	Accessibility
4.165	Trust	5	Availability	4.5	Availability
2.83	Biases	5	Relevance	3.25	Trust
2.5	Mentorship	3.33	Time	2.5	Experience
2.33	Configuration Control	3	Volume	2	Configuration Control
1.66	Relevance	2.66	Trust	.75	Ability to Capture Store/Codify
1.5	Corporate Turnover	1.66	Configuration Control	.75	Volume
1.33	Accessibility	.83	Experience	.5	Time

.83	Volume	.50	Mentorship
		.50	Biases
		.33	Corporate Turnover

Figure 15. Knowledge Transfer

Strengths		<i>Military</i>		<i>Civilians</i>		<i>Contractors</i>	
Score		Score		Score		Score	
5	Availability	2.5	Ability to Capture Store/Codify	4.5	Accessibility		
2	Mentorship	2.5	Accessibility	2.75	Relevance		
		1.66	Experience	2	Trust		
		.83	Availability	1.25	Experience		
		.83	Volume	1.25	Time		
				.25	Ability to Capture Store/Codify		
Weaknesses		<i>Military</i>		<i>Civilians</i>		<i>Contractors</i>	
Score		Score		Score		Score	
4.83	Trust	5.83	Accessibility	5	Trust		
3.33	Relevance	4.83	Corporate Turnover	3.25	Relevance		
3.16	Availability	3.33	Trust	2.5	Accessibility		
2.5	Volume	3.33	Experience	1	Volume		
2	Corporate Turnover	2.83	Availability	1	Configuration Control		
1.66	Biases	2.33	Volume	.75	Biases		
.66	Mentorship	1	Biases	.75	Trust		
.66	Time	.66	Relevance	.5	Relevance		
		.66	Time				
		.5	Configuration Control				

Figure 16. Knowledge Retention

The results from the knowledge reports provide an organizational site picture of strengths and weaknesses for the three knowledge themes, as perceived by the subgroups. The organizational site picture captures the top strengths and weaknesses, as expressed by the organization's subgroups. The participant's responses provided the necessary data to inductively reflect which knowledge attributes represent their subgroup in the organizational site picture. Below is a list of the top strengths and weaknesses identified by each subgroup according to the three knowledge themes.

	Strengths	Weaknesses
Military		
Knowledge Transfer	Ability to Store/Codify	Availability
Knowledge Sharing	Ability to Store/Codify	Ability to Capture Store/Codify
Knowledge Retention	Availability	Trust
Civilian		
Knowledge Transfer	Availability	Accessibility
Knowledge Sharing	Ability to Store/Codify	Availability
Knowledge Retention	Ability to Capture Store/Codify	Accessibility
Contractor		
Knowledge Transfer	Accessibility	Accessibility
Knowledge Sharing	Availability	Absorptive capacity
Knowledge Retention	Accessibility	Trust

Figure 17. Subgroup Top Strengths and Weaknesses

Research Question Results

The research questions are the basis for this investigation. Their objectives support the proposed methodology and create the means to accomplish research goals. Each interview question is mapped to a research question (s), so that personnel provide the qualitative data necessary to inductively answer the research questions supporting this investigation. The research questions and answers are of the following:

Research Question 1: Is SMC at risk for losing corporate knowledge by hiring contractors?

Yes, due to Contractors lack of interest in using tacit knowledge (OJT) for knowledge sharing and their neglect to use the knowledge management system made available for knowledge storage (as much as the other subgroups), Contractors place MCSW at a greater risk for losing (tacit and explicit) knowledge. However, this is a reflection of their discontent towards the current SMC knowledge management system, primarily in its information repository.

Military use two of four explicit knowledge transfer methods (continuity and Livelink). They use mentorship for tacit knowledge sharing the most of the subgroups. Archived email and personal knowledge sources are the military's preferred methods for storing tacit knowledge. It is good practice for them to store knowledge. However they should redirect their storage choice toward using a shared source so that a larger audience can gather their knowledge. Civilians use three of four explicit knowledge transfer methods (Hard copy documents, personal knowledge, and Livelink. Although this study indicates that civilians use Livelink (more than the other subgroups), they expressed lack of favor toward the system for knowledge sharing, but they expressed great interest in OJT/Mentoring for tacit knowledge sharing. In addition, they show desire to share but have few venues or opportunities to expand their shared knowledge circle. Contractors use one of four explicit knowledge transfer methods (Hard copy documents). They have the least interest in using OJT or Mentorship for tacit knowledge transfer. In addition, they have access Livelink, but least likely to use it to record knowledge due to the lack of relevant knowledge in the system, lack of configuration control over its content, and its lack of

accessibility. Instead, many of them use personal knowledge resources to retain their knowledge like many of the personnel but not as often as government workers. Contractors rely on tacit to help them do their job, but rarely use such sources to store their knowledge.

Research Question 2: Are SMC's knowledge retention methods useful for its employees?

No, this study suggests that the SMC knowledge management system (Livelink) may not be functionally useful for the majority of SMC's employees. Although they understand its information repository purposes, it is not functionally as useful as it could be because it is difficult for employees to find relevant knowledge to help them do their job. Government workers expressed frustration with the Livelink database, but showed more discontent with the lack of mentorship and work transition time for interpersonal instruction. Contractors expressed frustration with the system's lack of relevant knowledge needed to assist them find solutions or tools to help them do their job. They seek mostly assistance from peers on a "trust but verify basis." Contractors primarily use personal knowledge database storage although it is understood that it is not readily *accessible* and *available* for knowledge sharing with others. Overall, the participants want to use the system, but have concluded that SMC's knowledge system has marginal usefulness as an information source, but all three subgroups recognize a greater need for tacit knowledge to help them do their job from sources external to what is provided by SMC.

Research Question 3: What forms of knowledge transfer do contractors support?

The answer to this question can be reached by reviewing the knowledge events featured in the contractor transfer strengths chart. Contractors recognize the purpose of Livelink, but seem to prefer knowledge transfer via hard copy documents for explicit knowledge and oral communication for tacit knowledge.

Summary

There are two areas of improvement SMC may consider of implementation. The first is in its knowledge repository. SMC should revisit its database management strategy for Livelink. It should use standardization of folders across the organization, so all personnel are familiar with their neighboring program office's file structure. In addition, the network administrator policy needs some modifications to designate configuration control responsibilities. This would include the implementation of more user friendly search tools of new employees. Hiring an experienced individual with strong cataloging expertise "Livelink Librarian" could assist in providing clarity to the current filing structure. Meta tags highlighting contact information for all material posted within library section should be added to uploads.

The other area of improvement is in knowledge sharing. Cross organizational workshops bringing personnel from cross functions together should be implemented. Knowledge Management training should be added to all personnel training requirements, and new awards should be implemented to reward knowledge sharing. Mentorship programs are in place for military members but nothing for civilians and contractors. These opportunities should be

available for all subgroups. Personnel social mixers should be targeted to civilians and contractors to increase their participation of social exchanges.

V. Conclusions & Recommendations

Limitations

A limitation for this case study was its generalizability. Due to the exploratory nature of this investigation, a case study was selected for its methodology design. Case studies in probabilistic investigations are typically generalizable. Due to the size of the sample frame (number of participants for group and individual interviews) in the accessible population (SMC/MCSW), results for this case study used the nonprobabilistic sampling method. As stated earlier, this investigation had fifteen interview participants instead of the minimum of thirty participants required to make probabilistic claims, so the nonprobabilistic was used because it is typically assures that smaller groups are adequately represented.

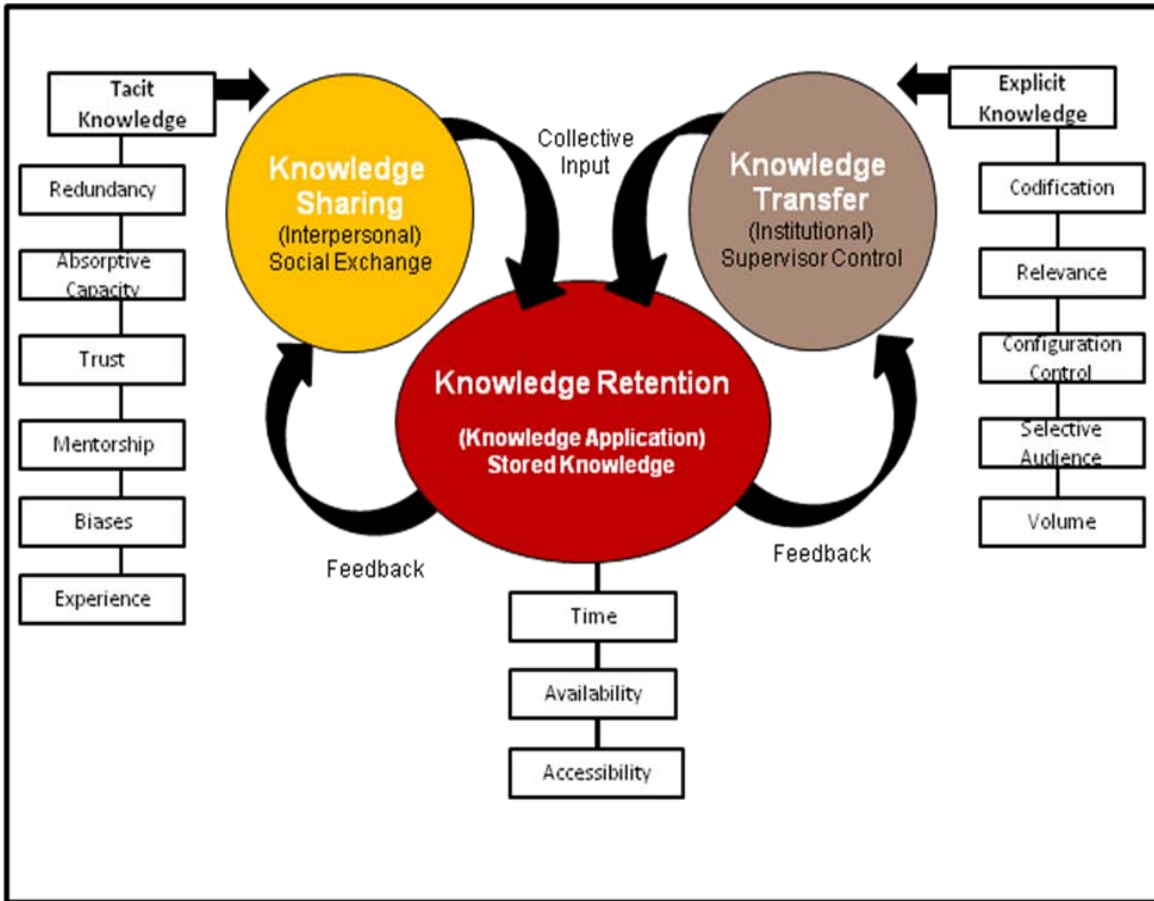
Recommendations for Future Research

Further Research

Future research can be done by expanding the number of personnel interviewed in other system program offices for knowledge management at the Space and Missiles Center (SMC). Results from this case study can be used as catalyst for conduct follow-on research of knowledge management practices in government procurement offices across the DoD. An additional case study can be done to better generalize results on a larger population at (SMC). A preliminary investigation should employ a sampling process to allow results to be accurately drawn from a

body of test subjects at MCSW. The participant sample size should correspond to the conceptual ideals for a study. I recommend it addresses knowledge transfer and retention in a majority contractor workforce, and provide a valid means to produce sufficient data to address research goals. A further study with a possibly a larger sampling frame defined by the military, civilian, and contractor personnel could produce results generalizable to the SMC population. This combination of probability (first) and purposive (second) sampling procedures is a very powerful (and fairly common) type of mixed methods sampling strategy (Tashakkori & Teddlie, 2003). An Air Force level evaluation of the procurement offices should be done by investigating the three acquisition centers; Aeronautical Systems Center, WPAFB, Space and Missiles Center, LAAFB, and the Electronics Systems Center (ESC) at Hanscom AFB. Sister services and DoD procurement agencies could ultimately be evaluated for knowledge transfer and retention to significantly decrease the knowledge loss. Knowledge management evaluations would act as the first step in solving the problem of knowledge loss that plagues sound acquisition practices for the procurement of weapons systems across the all government agencies. Although at that level of evaluation some generalities for may be valid as standard knowledge management operations for government procurement offices, not all procurement offices will have the same challenges, thus all may require nonstandard solutions (King & Marks, 2005). The solutions for effective knowledge transfer and retention will be on an individual institutional basis (Liebowitz, 2002).

Research Model



An area for future research would be in for further review of the research model used in this investigation. The model was designed with the premise that knowledge transfer is the produce of transmission and the absorption and use of that knowledge (Davenport & Prusack, 2000). For this investigation, knowledge transfer in the traditional sense, was divided into two themes, knowledge sharing and knowledge transfer. Knowledge sharing for tacit knowledge and knowledge transfer for explicit knowledge. The attributes are various aspects of knowledge transfer (in the traditional sense) as they are most heavily related to explicit and tacit knowledge. In the research model, knowledge sharing has attributes that would inhibit sound knowledge

transfer if not properly applied. For example, without the attribute of redundancy, one does not have the initial knowledge required to be able to gather knowledge shared in a tacit experience. Although redundancy is required for the transfer for explicit knowledge, it is more often the case with knowledge sharing via tacit experience. This is why redundancy is labeled as an attribute of knowledge sharing. All attributes listed under the three knowledge themes have an interchangeable element, so there are arrows between the themes to illustrate the shared nature of these attributes.

The area for further investigation is not only within the promise of the themes, but in the knowledge attributes supporting the themes. The model's effectiveness can be tested by using it as the premise for other knowledge transfer investigations. Furthermore, it could be further analyzed for strength of relevance as it relates to knowledge transfer for tacit and explicit knowledge.

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Appendix A

Share =
Weaknesses
refusing to share fear that they would
lose their job assurance if the info
was shared

Storage (Strengths)
continuity fluidly - can easily pass on
to others

Share = 1
Storage = 2
Reservoir = 3

Storage (Weaknesses)
it's not on a computer knowledge
program that is openly assessable to
others

Reservoir Knowledge (Weaknesses)
- people = don't share knowledge based
on job security

~~Share~~

Reservoir of Knowledge (Strength)
people - people can share specific experiences
that they've shared

KS4 (multi)

Both through online lessons learned
databases and through less experienced
officers who will be here when I leave.

STR

database - permanent
others - show through
example

WICPS

database - may never
be used or
location lost
others - can forget or
not understand

KT (one on one)

BRING REPLACEMENT KT TO MEETINGS REGARDING AREAS HE WILL HAVE RESPONSIBILITY AND TEACH AS WE GO.

STR

HE DOESN'T HAVE TO LEARN THINGS OVER TIME THAT TOOK ME MONTHS, QUICKER

WKNS

• SEES THINGS FROM MY POINT OF VIEW (Bias)

Where do I tap into knowledge to accomplish my mission?

- ^{1st} Coworkers, especially more experienced
- Various Communities of Practice
- Acquisition deskbook
- Google topics + Wiki topics in work
- DoD and NIST instructions
- Search TIDE + Livelink for relevant info

ICK

#1 place is from Aerospace team; onsite technical experts (SETA)

STR

extreme wealth of info and experience (cont)

WKNS

biases, may not be up on newer technologies

Share =
Strengths

Continuity guide listing steps in detail
communication verbally
training

Storage (Strengths)

Continuity Guides - can easily pass on
to others

Share = 1
Storage = 2
Reservoir = 3

Reservoir of Knowledge (Strengths)

people - people can share specific experiences
that they've shared

Share =
Weaknesses
refusing to share fear that they would
lose their job assurance if the info
was shared

Storage (Weaknesses)
it's not on a computer knowledge
program that is openly assessable to
others

Reservoir Knowledge / Weaknesses
- people = Don't share knowledge based
on job security



How do we share knowledge? Word of mouth ^{Q1 1 of 2}
Sfr.

- Focused.
- Accurate.

Knowledge sharing: Word of mouth ^{Q1 2 of 2}
Weakness.

- Objective. so

Knowledge storage

Q2 2 of 2

Weakness:

email binning
weakness:

- Number of message grows too large and harder to manage. ^{becomes} ✓

How do we store our knowledge

Q2 1 of 2

Str:

El flag and store important email

Str:

- Keep track of conservation complete

Who/where is my knowledge pool

Q3 1 of 2

El go to my supervision for programtic questions
and Aerospace experts for technical questions

Str:

- Both resources can provide great support

Q3 2062

Knowledge pool

I go to my supervisor for programmatic questions and Aerospace folks for technical questions.

Weakness

— Engineers sometimes missing the "Big picture".

How we share knowledge?

<u>Means</u>	+	-
verbally	Communicated effectively	not written down
email	saved, efficient	ambiguous
deliverables	Documented + Archived	If author/creator leaves, interpretation exists

What do I use to store knowledge?

<u>Means</u>	+	-
briefings	Audience, Awareness	committed to memory
binders	Documented	No context or reach back
filed electronically / Archived	Documented, history	maybe not public storage
my brain	Goes w/ me	reliability, mobility

What pools of knowledge??

<u>Means</u>	+	-
Aerospace SETA Co-workers Teammates	History, knowledge context, reasoning	May not be stored, people move on...
Internet	Efficient	maybe inaccurate
Archived Documents (live links / Binders)	- Stored - Easy to work w/ (scan, copy, etc)	- hard to interpret or reconstruct - Hard to find/locate

Knowledge databases that use

	Strength	Weakness
File sharing application	Online, accessible	Vulnerable
Tech Expert	Personable, Experienced	Availability
Program Documents	Formatted, consistent	Extensive, time consuming

How Do I Share Knowledge

	Weakness
Verbal	lost in translation, lengthy
Written	multiple iterations of exchange
Direction to Database	self guided w/ no expertise
Demonstration	may take a lot of time & preparation

What do I use to Store my knowledge

	Strength	Weakness
Electronic Files	easily shared	Vulnerable
Highlighted Docs.	full context available	not easily shared, multiple copies
Tech Expert	continuity	may leave, taken away from primary duties

How Do I Share Knowledge	Strength
- Verbal	real time Q&A
- Written	structured format
- Direction to Database	preexisting knowledge database
- Demonstration	real world exercise
-	
-	
-	
-	
-	
-	

KT - Weak

- 1) Memory's not what I remember it being
- 2) Files not always available (good short-term only) ^{go to long-term storage, I} _(move to new file)
- 3) **RELEVANCE** - Finding the needle in the haystack
 - ① IT - Relevant documents
 - prior examples may not be fully perfect relevant reliance on solutions to related but not identical problems not useful

KS - Str

- 1) Review comments, written or oral, on contract modifications, letters, acquisition strategy, other documents
- 2) Oral ~~text~~ exchanges in meetings
(configuration control board, source selection planning and RFP preparation)
- 3) Individual feedback / discussion / conversation
of buyers and project officers

KS - Weak

Personal Barriers

②

= personal responsibility

- 1) Interpersonal style - may limit ability to communicate fully, effectively
(my approach, others' perceptions) clear communication
- 2) Impatience w/ others
- 3) Tendency to judge/decide too quickly
(Time is + + + pressing)
where more thoughtful, ~~the~~ review of facts would be beneficial

KT - Str

- 1) Memory (recall in meetings where opinion emerged, not expected)
- 2) Contract files (permanent, detailed record of same or similar)
- 3) Personal files, paper and electronic Good
(frequently searching and reorganizing)
~~Personal files~~ → ready availability
primary, long-term storage
for example, legal opinions, sample docs

KS

52 Day 2

SHARE KNOWLEDGE (S)

- Teaching
- Coaching
- Showing

Lack of mentoring

(work)

Ability

(Time)

no experience
in field

- Training
- Lack of (related) h=ic

KS

Store Knowledge

- Computers
- written procedures

KS

What Knowledge Pools do I get information, etc.

- From training
- working experiences
- From supervisors

- Too much information at one time for some individuals.
- Not enough time
 - ① - Time at 7 programs
 - ② - Absorptive capacity
 - ③ - Personal
 - Verbal
 - Texts

- Not writing procedures for most of the tasks.
 - ② - TIME
 - ① - Lack of instruction (codified info)
 - current
 - ③ - understaffed (manpower)
 - ① - Inexperienced people
 - * ④ Turnover (Civ, Mil, cont)
 - Deployments
- | |
|---------------------|
| Shortage of people: |
| 1) Experienced |
| 2) # of people |

- Not listening
- Not enough time
- Not take training classes

53 Day 2
Str - How do you share KN?

Email

- Interoperable-standards
- COTS - no devel
- Easily store + cat (journal) msgs

Livelink

- Web based
- COTS
- share files multiple groups
- Easier to protect

Print

- easy to copy

Str Pools of Knowledge?
AFI's / OODI Publishing

- set standards vetted

SMC ACE - personal + SAF USA

- Understand processes
- - Know nuances that aren't in "regs"

Google

- Tons of information

WK Pools of Knowledge?
AFI's / OODI Publishing

- Not intuitive / as searchable

ACE + SAF

- Contacts can help or hurt depending on person

Google

- Too much info

VVK with Storage?

Email

- Personal copy - same as others
- version control
- Need to take action to move to others for use

Livelink

- Web Interface not always intuitive
- No Ktrs (Tragator)

STR What do you use to store Ki?

Email

- Personal copy - take on road w Laptop
- Forward on request

Livelink

- Store docs common location
- can train people to look for
- offers protection for FOUO
- Version control

WK - How do you share KN?

Email

- Need to remember group - or manage group email
- size limitations
- protection for FOUO + comp sensitive

Livelink

- difficult interface (relative - non intuitive)
- Military only - no KTRs
- process to get others access

Print - hard to store

KNOWLEDGE SHARING - STRENGTHSON-LINE RESOURCE

- DIVERSITY OF VIEW POINTS
- ADVANCE POSITION [LEVERAGE WORK]
- DEPTH OF CONTENT
- ACCESS

DIRECT INTERFACE (VERBAL, CALLS, F2F)

- USE FULL LEVELS OF COMM (BODY LANGUAGE)
- IMMEDIACY
- OPPORTUNITY FOR USER/GO-BACKS

KNOWLEDGE RESOURCES - STRENGTHSPEOPLE/NETWORKS

- ACCESS TO MOST SALIENT PERSPECTIVES
- RELATIONSHIP BUILDING
- SUPERBISM

DOMAINS/DOCUMENTS

- PRE DIGESTED
- RELIABLE

SERVERS/LIBRARIES/FILES

- ACCESS, VOLUME, TIMELINESS
- DIVERSITY

KNOWLEDGE RESOURCES - WEAKNESSESPEOPLE/NETWORKS

- DIFFERENT PERSPECTIVES
- MORE TIME CONSUMING

DOMAINS/DOCUMENTS

- ACCESS, UNCERTAIN RELEVANCE

SERVERS/LIBRARIES

- STALENESS, SLOWER PIPING, ACCESS

KNOWLEDGE STORING - WEAKNESSES

Automation

- High volume, weak access tools
- Incompatibilities - System to System
- Expectations / Stress of immediate synthesis

Hardcopy

- cumbersome access/organization

Team/Domain Collection/Growth

- Losses when talent moves

KNOWLEDGE STORING - STRENGTHS

Automation

- Range of IT systems [PC, PDA, Servers]
- Media (CD, Servers) - Flex
↳ Access ease, flex, tool performance

Hardcopy

- Notes, Briefs, Letters - Access/Use

Team/Domain Collection/Growth

- Individuals - Adaptable, Diversity

Knowledge Sharing - Weaknesses

On-Line Resource

- Context loss
- Data Latency / Configuration Mgt
- Access [Search Engine Efficacy]

Direct Interface

- Time consuming / Time Alignment
- Interruptions
- Fallibility of Language

(KT) What do I use to store knowledge?

1. Notes - (Personal Documents) + accessible - other's doct have (Lock availability)
2. Computer (Email personal drive) Folders - filing system? (Contingency) + accessible + portable - File Force Configuration (challenges)

KR

Pools of Knowledge

- ① Google (Info overload)
 - ① + large base of information
 - ② - too much info
 - ③ - lots of contig cont
- ③ LinkedIn + Misstoured data is available
 - ② Reference
 - ① unstructure
 - filing sys
 - too much
- ② Co workers
 - ① + Experience
 - ① - erroneous info
 - ② - just truth but verify

KR

In addition to personal experience, historical documents related to ~~present~~ present

problem, I especially rely on a handful of people whose judgment and experience are helpful —
(OIR)

① IPTG / Meetings
+ brainstorming - schedule
people

insights
① Availability
Accessibility

① open discussion
Different Experiences
" views

② - wrong people
Try to run the
meetings

⑤

5th Day 2

How do I share knowledge

② Email

① + quick broadcast

② + easy to read
(cost to use)

② (missed message)
not trust
- may not be read

① impersonal (lack of feedback)

③ Trainings

+ flexible - cost to use

+ can address questions

- accessible audience

- may miss
target
audience

efp

Continuity Folders (maintained)
- online access to continuity folders

ST - Benefit of different point
of view, of having some challenge
my understanding of the problem/solution

② - Trust but verify

① - Availability / Turnover

CVT

WK - ~~Need to avoid~~ relying on
their judgement in place of my own,
* ~~Just fit~~

Appendix B

		Participant Responses	Knowledge Events	Strong Knowledge Source	Ment	Config Control	Ability to Store/Codify	Avail	Selective Audiences	Trust	Relevance	Biases	Corporate Turnover	Access	Vol	Time	Absorptive capacity	Exp																
																			Military	Session 1	Str	Weak												
	KSS1	Continuity	Hard Copy Documents	X		2																												
	KSS2	Verbal	Oral Comm		1																													
	KSS3	Training	On the Job Training (OJT)					1																										
	KSW1	Continuity	Hard Copy Documents				2						1																					
	KTS1	Continuity	Hard Copy Documents				1																											
	KTW1	Continuity	Hard Copy Documents				1																											
	KTW2	Folders	Database	X		3	1							2																				
	KRS1	Contractors	On the Job Training (OJT)	X																														
	KRW1	Contractors	On the Job Training (OJT)		2					1																								
Session 2																																		
	KSS1	Email	Archived Email						1																									
	KSS2	Verbal	Oral Comm		2				1																									
	KSS3	Prog IT TIDE	Database	X																														
	KSS4	Livelink	Database	X				2																										
	KSS5	Community of Practice	On the Job Training (OJT)	X				3	2																									
	KSW1	Email	Archived Email				1																											
	KSW2	Verbal	Oral Comm				1																											
	KSW3	Prog IT TIDE	Database			4		3			1			2			5																	
	KSW4	Livelink	Database	X		4		3			1			2			5																	
	KSW5	Community of Practice	On the Job Training (OJT)								1	2																						
	KTS1	Personal	Personal Knowledge					1																										
	KTS2	Database	Database					1																										
	KTS3	Prog IT TIDE	On the Job Training (OJT)										1																					
	KTW1	People	Personal Knowledge																															
	KTW2	Database	Database					3	5	1	6			2			4																	
	KRS1	Co Workers	On the Job Training (OJT)	X																														
	KRS2	Internet	Web	X																														
	KRW1	Co Workers	On the Job Training (OJT)					2				1																						
	KRW2	Internet	Web								1																							
Session 3																																		
	KSS1	Prog IT TIDE	Database	X			2	3																										
	KSS2	People	On the Job Training (OJT)		1																													
	KSW1	Prog IT TIDE	Database							2				1																				
	KSW2	People	On the Job Training (OJT)		1								3	2				2																
	KSW3	Lack of Continuity	Hard Copy Documents			1							2																					
	KTS1	People	On the Job Training (OJT)	X	1																													
	KTS2	Continuity	Personal Knowledge	X			2						3																					
	KTW1	People	On the Job Training (OJT)											1																				
	KTW2	Continuity	Personal Knowledge			1																												
	KRS1	Aerospace	On the Job Training (OJT)	X																														
	KRW1	Aerospace	On the Job Training (OJT)										1					2																
	Mentioned																		Fav: 3	Fav: 0	Fav: 3	Fav: 3	Fav: 0	Fav: 0	Fav: 0	Fav: 0	Fav: 0	Fav: 0	Fav: 0	Fav: 0	Fav: 2	Fav: 1	Fav: 0	
	Do																		Unfav: 2	Unfav: 1	Unfav: 2	Unfav: 5	Unfav: 0	Unfav: 2	Unfav: 2	Unfav: 4	Unfav: 2	Unfav: 2	Unfav: 2	Unfav: 2	Unfav: 2	Unfav: 1	Unfav: 1	Unfav: 0
	Avg																		Fav: 1.42	Fav: 1	Fav: 1.6	Fav: 1.55	Fav: 1.25	Fav: 0	Fav: 2.5	Fav: 0	Fav: 1	Fav: 0	Fav: 0	Fav: 1	Fav: 2	Fav: 1	Fav: 2	Fav: 0
																			Unfav: 1.25	Unfav: 3.2	Unfav: 1.75	Unfav: 2.18	Unfav: 5	Unfav: 1.42	Unfav: 2	Unfav: 1.71	Unfav: 2	Unfav: 1.75	Unfav: 3.8	Unfav: 2	Unfav: 1	Unfav: 1	Unfav: 0	Unfav: 0

Table 3. Military Knowledge Matrix (Master)



Civilians																				
Session 1																				
KSS1	Review Comments	Oral/Doc																		1
KSS2	Meetings	Oral Comm																		1
KSS3	Individual Feedback	Oral Comm																		1
	Interpersonal																			
KSW1	Communication	Oral Comm																		2
		On the Job Training (OJT)																		1
	KSW2 Impatience																			1
		Personal Knowledge																		2
KTS1	Memory																			1
KTS2	Contract Files	Hard Copy Documents																		1
KTS3	Personal Files	Personal Knowledge																		2
	KTW1 Memory	Personal Knowledge																		1
		Hard Copy Documents																		2
	KTW2 Contract Files																			2
		Personal Knowledge																		1
	KTW3 Personal Files																			2
KRS1	Civilians	On the Job Training (OJT)	X																	
	KRW1 Civilians																			1
		On the Job Training (OJT)																		2
																				3
Session 2																				
KSS1	Teaching	Oral Comm	X																	
KSS2	Coaching	Oral Comm	X																	
	KSW1 Teaching																			
		On the Job Training (OJT)																		4
	KSW2 Coaching																			1
		On the Job Training (OJT)																		1
KTS1	Computers	Database																		
KTS2	Written Procedures	Hard Copy Documents																		1
	KTW1 Computers	Database																		1
		Hard Copy Documents																		1
	KTW2 Written Procedures																			2
		On the Job Training (OJT)																		3
	KTW3 Lack of Mentoring																			3
		On the Job Training (OJT)																		4
KRS1	Working Experiences	On the Job Training (OJT)																		2
	KRW1 Civilians																			1
		On the Job Training (OJT)																		3
																				2
																				1
Session 3																				
KSS1	Direct Interface	On the Job Training (OJT)	X																	
KSS2	Email	Archived Email																		1
KSS3	Livelink	Database	X																	
	KSW1 Direct Interface																			
		On the Job Training (OJT)																		1
	KSW2 Email	Archived Email																		2
	KSW3 Livelink	Database																		3
		On the Job Training (OJT)																		1
KTS1	Technical Domain	Personal Knowledge	X																	2
KTS2	Automation	Knowledge Documents																		4
KTS3	Hard Copies	On the Job Training (OJT)																		1
	KTW1 Technical Domain																			4
	KTW2 Automation	Database																		5
		Hard Copy Documents																		1
	KTW3 Hard Copies																			2
		On the Job Training (OJT)																		1
KRS1	People (Civilians)	On the Job Training (OJT)	X																	
KRS2	Servers/Library/Files	Web																		2
KRS3	Domain Documents	Database																		1
	KRW1 People (Civilians)																			3
		On the Job Training (OJT)																		2
	KRW2 Servers/Library/Files	Archived Email																		4
	KRW3 Domain Documents	Documents																		2
		On the Job Training (OJT)																		1
Session 4																				
KSS1	IPT Meetings/Open Discussion	On the Job Training (OJT)																		1
KSS2	Email	Archived Email																		2
KSS3	Briefings	Hard Copy																		1

	IPT Meetings/Open Discussion	Documents On the Job Training (OJT)					2			1					1					
	KSW1 Email	Archived Email																		
	KSW2 Briefings	Hard Copy Documents																		
	KSW3	Personal Knowledge																		
	KTS1 Notes	Personal Knowledge																		
	KTS2 Computer	Personal Knowledge																		
	KTW1 Notes	Personal Knowledge																		
	KTW2 Computer	Personal Knowledge																		
	KTW3 Livelink	Database	X			3														
	KRS1 Google	Web	X																	
	KRS2 Co Workers (Civilians)	On the Job Training (OJT)	X																1	
	KRS3 Livelink	Database																		
	KSW1 Google	Web																		
	KRW2 Co Workers (Civilians)	On the Job Training (OJT)																		
	KRW3 Livelink	Database	X				3													
			Mentioned		Fav: 3	Fav: 0	Fav: 3	Fav: 3	Fav: 0	Fav: 0	Fav: 0	Fav: 0	Fav: 0	Fav: 0	Fav: 0	Fav: 0	Fav: 0	Fav: 2	Fav: 1	Fav: 0
	Do	All			Unfav: 2	Unfav: 1	Unfav: 2	Unfav: 5	Unfav: 0	Unfav: 3	Unfav: 2	Unfav: 2	Unfav: 4	Unfav: 2	Unfav: 2	Unfav: 2	Unfav: 1	Unfav: 0	Unfav: 0	
			Avg		Fav: 0	Fav: 4	Fav: 1	Fav: 1	Fav: 2	1.66	Fav: 1.5	Fav: 0	Fav: 0	1.66	Fav: 1	Fav: 2	Fav: .33	Fav: 1		
					Unfav: 2	Unfav: 3.25	Unfav: 1.25	Unfav: 1.7	Unfav: 0	Unfav: 0.7	Unfav: 1.9	Unfav: 2.5	Unfav: 3	Unfav: 1.45	Unfav: 2.8	Unfav: 1.57	Unfav: 1.50	Unfav: 1	Unfav: 0	
	Total	Do	Mentioned		Fav: 3	Fav: 0	Fav: 3	Fav: 3	Fav: 0	Fav: 0	Fav: 0	Fav: 0	Fav: 0	Fav: 0	Fav: 0	Fav: 2	Fav: 1	Fav: 0		
					Unfav: 2	Unfav: 1	Unfav: 2	Unfav: 5	Unfav: 0	Unfav: 3	Unfav: 2	Unfav: 2	Unfav: 4	Unfav: 2	Unfav: 2	Unfav: 1	Unfav: 0	Unfav: 0		
			Avg		Fav: 0	Fav: 4	Fav: 1	Fav: 1	Fav: 2	1.66	Fav: 1.5	Fav: 0	Fav: 0	1.66	Fav: 1	Fav: 2	Fav: .33	Fav: 1		
					Unfav: 2	Unfav: 3.25	Unfav: 1.25	Unfav: 1.7	Unfav: 0	Unfav: 0.7	Unfav: 1.9	Unfav: 2.5	Unfav: 3	Unfav: 1.45	Unfav: 2.8	Unfav: 1.57	Unfav: 1.50	Unfav: 1	Unfav: 0	

Table 4. Civilian Knowledge Matrix (Master)

Contractors																			
Session 1																			
KSS1	One-on-One Consultation	Oral Comm	X																
KSS2	Web publication/collaboration	Web						2											3
KSS3	Group Meetings	On the Job Training (OJT)	X																
KSW1	Group Meetings	On the Job Training (OJT)																	2
KTS1	ADP Equipment / Contractor Systems	Database	X																1
KTW1	Culture that escheus documentation	Culture Database	X																1
KTW2	Livelink	Database	X																1
KRS1	USAF Epubs	Web	X																
KRS2	Personal Networking	On the Job Training (OJT)																	
KSW1	AFKM COPs / Portal	Web																	1
KSS1	Verbally	Oral Comm	X																
KSS2	Email	On the Job Training (OJT)																	
KSS3	Giving Documentation	Hard Copy Documents																	
KSW1	Verbally	Oral Comm																	1
KSW2	Email	Archived Email																	2
KSW3	Giving Documentation	Hard Copy Documents																	3
KTS1	Personal Drives	Personal Knowledge																	1
KTS2	Email Archives	Archived Email																	2
KTS3	CDs	Personal Knowledge																	1
KTS4	Hard Copy Files	Hard Copy Documents																	2
KTS5	Livelink	Database																	3
KTW1	Personal Drives	Personal Knowledge																	1
KTW2	Email Archives	Archived Email																	2
KTW3	CDs	Personal Knowledge																	1
KTW4	Hard Copy Files	Hard Copy Documents																	2
KTS5	Livelink	Database	X																1
KRS1	Pepole	On the Job Training	X																

Knowledge Sharing Strengths															
Knowledge Events	Strong Knowledge Source	Mentorship	Configuration Control	Ability to Capture Store/Codify	Selective Audiences to reduce waste	Trust	Relevance	Biases	Corporate Turnover	Accessibility	Volume	Time	Absorptive capacity in		Totals
													recipients	Experience	
Military															
Session 1 - Group 1															
On the Job Training (OJT)		1										1	2		14
Archived Email Database				2	1							1			9
Web															5
Hard Copy Documents															
Frequency		1	0	2	0	0	0	0	0	0	0	0	2	1	0
Total Points (Reverse Coding)		5	0	9	0	0	0	0	0	0	0	0	10	4	0
Session 2 - Individual Interview 1															
Hard Copy Documents	X		2												4
Oral Comm		1													5
On the Job Training (OJT)					1										5
Total Points (Reverse Coding)															
Session 3 - Individual Interview 2															
Archived Email		5	4	0	0	5	0	0	0	0	0	0	0	0	0
Oral Comm						1									5
Database	X	2			2	1									9
On the Job Training (OJT)	X				3	2									4
Personal Knowledge	X														7
Web															
Total Points (Reverse Coding)		4	0	0	7	14	0	0	0	0	0	0	0	0	0
Session 4 - Individual Interview 3															
Database	X			2	3										7
On the Job Training (OJT)		1													5
Personal Knowledge															
Total Points (Reverse Coding)		5	0	4	3	0	0	0	0	0	0	0	0	0	0
Frequency		3	1	1	3	4	0	0	0	0	0	0	0	0	0
Total Individual Average		4.66666667	1.333333333	1.333333333	3.333333333	6.333333333	0	0	0	0	0	0	0	0	0
Civilians															
Session 1 - Group 1															
On the Job Training (OJT)	X					1									5
Archived Email Database	X			1	1	2									9
Personal Knowledge	X														5
Hard Copy Documents															
Web															
Frequency		0	0	1	1	1	1	0	0	0	0	0	0	0	0
Total Points (Reverse Coding)		0	0	5	5	4	5	0	0	0	0	0	0	0	0
Session 2 - Individual Interview 1															
Oral Comm													1		5
Personal Knowledge													1		5
Hard Copy Documents															
On the Job Training (OJT)															
Total Points (Reverse Coding)		0	0	0	0	0	0	0	0	0	0	0	10	0	0
Session 3 - Individual Interview 2															
Oral Comm	X														
Database															
Hard Copy Documents															
On the Job Training (OJT)															
Total Points (Reverse Coding)		0	0	0	0	0	0	0	0	0	0	0	0	0	0
Session 4 - Individual Interview 3															
On the Job Training (OJT)					1										5
Archived Email										2		1			9
Hard Copy Documents				1											5
Web															
Database															
Total Points (Reverse Coding)		0	0	5	5	0	0	0	0	4	0	5	0	0	0
Frequency		0	0	1	1	0	0	0	0	1	0	1	2	0	0
Total Individual Average		0	0	1.666666667	1.666666667	0	0	0	0	1.333333333	0	1.6667	3.333333333	0	0

Contractors													
Session 1 - Individual Interview 1													
Oral Comm	X									2			4
Web			2							3			7
On the Job Training (OJT)	X												
Database													
Total Points (Reverse Coding)		0	0	0	4	0	0	0	0	0	7	0	0
Session 2 - Individual Interview 2													
Oral Comm	X			1									5
Personal Knowledge													
Archived Email													
Hard Copy Documents													
Database													
On the Job Training (OJT)													
Web													
Total Points (Reverse Coding)		0	0	0	5	0	0	0	0	0	0	0	0
Session 3 - Individual Interview 3													
Oral Comm	X										2		12
Hard Copy Documents			3					1					
On the Job Training (OJT)		2		1		3							12
Database													
Personal Knowledge													
Total Points (Reverse Coding)		4	0	3	5	0	3	5	0	0	4	0	0
Session 4 - Individual Interview 4													
On the Job Training (OJT)	X											2	9
Archived Email			1										
Oral Comm											1		5
Hard Copy Documents													
Database													
Personal Knowledge													
Total Points (Reverse Coding)		0	0	5	0	0	0	0	0	0	4	5	0
Frequency		1	0	2	3	0	1	1	0	0	3	1	1
Total Individual Average		1	0	2	3.5	0	0.75	1.25	0	0	2.75	1	1.25

Table 6. MCSW Knowledge Sharing Strengths

Knowledge Transfer Strengths															
Strong Knowledge Source	Mentorship	Configuration Control	Ability to Capture Store/Codify	Availability	Selective Audiences to reduce waste	Trust	Relevance	Biases	Corporate Turnover	Accessibility	Volume	Time	Absorptive capacity in recipients	Experience	Totals
X			1	1											5
				1											5
		0	1		0	0	0	0	0	0	0	0	0	0	
		0	5	10	0	0	0	0	0	0	0	0	0	0	
				1											5
		0	0	5	0	0	0	0	0	0	0	0	0	0	
				1					1						5
		0	0	5	0	0	0	0	5	0	0	0	0	0	5
X	1														5
X			2				3								7
	5	0	4	0	0	0	3	0	0	0	0	0	0	0	
	1	0	1	2	0	0	1	0	1	0	0	0	0	0	
	1.6666667	0	1.333333333	3.333333333	0	0	1	0	1.6666667	0	0	0	0	0	
X							2					3			7

	4		1		2				3					14
		1												5
	0	1	1	1	0	1	1	0	0	1	0	1	0	0
	0	2	5	5	0	4	4	0	0	3	0	3	0	0
			1			1			2					5
	0	0	0	5	0	0	5	0	0	4	0	0	0	9
			1											5
	0	0	0	5	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	10	0	0	0	0
	0	0	0	2	0	0	1	0	0	3	0	0	0	0
	0	0	0	3.33333333	0	0	1.66666667	0	0	4.66666667	0	0	0	0
X			2											4
	0	0	0	4	0	0	0	0	0	0	0	0	0	0
		1		2					1					5
	2	1				2		2	3					9
		1							1					12
	0	4	10	0	4	0	0	4	0	13	0	0	0	0
										1				5
			1		1				2					9
	0	0	0	5	2	9	0	0	0	0	12	0	0	12
		4	3		2		2		1					18
									1					9
	0	0	2	3	0	4	4	0	0	10	0	0	0	0
	0	1	3	3	3	2	1	1	0	5	3	0	0	0
	0	1	3	3	3.25	1	1	1	0	5.75	3	0	0	0

Table 7. MCSW Knowledge Transfer Strengths

Knowledge Retention Strengths															
Strong Knowledge Source	Ability to Configuration		Ability to Capture		Selective Audiences to				Corporate			Absorptive capacity in		Total	
	Mentorship	Control	Store/Codify	Availability	reduce waste	Trust	Relevance	Biases	Turnover	Accessibility	Volume	Time	recipients		Experience
X	2														4
X				1											5
	1	0	0	1	2	0	0	0	0	0	0	0	0	0	5
	4	0	0	10	0	0	0	0	0	0	0	0	0	0	
X															
	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
X															
X															
	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
X						2									4
			1												5
	0	0	1	0	0	1	0	0	0	1	0	0	0	0	5
	0	0	5	0	0	4	0	0	0	5	0	0	0	0	
X															
	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
X														1	5
	0	0	0	0	0	0	0	0	0	0	0	0	0	5	
X															
	0	0	0	1	0	0	0	0	0	0	5	0	0	5	5
	0	0	0	1	0	0	0	0	0	0	1	0	0	2	
	0	0	0	1.66666667	0	0	0	0	0	0	1.66667	0	0	3.33333333	
X							1	2							9
	0	0	0	0	0	5	4	0	0	0	0	0	0	0	

X	0													1	5						
	0													5	9						
	0													1	2						
	0													5	9						
X	5													3	4	2	1	15			
	0													1	9	0	0	5			
	0													1	4	0	1	0			
	0													0.25	0	2	2.75	0	4.5	0	1.25

Table 8. MCSW Knowledge Retention Strengths

Knowledge Events	Knowledge Sharing Weaknesses													Total	
	Strong Knowledge Source	Mentorship	Configuration Control	Ability to Capture Store/Codify	Selective Audiences to reduce waste	Availability	Trust	Relevance	Biases	Corporate Turnover	Accessibility	Volume	Time		Absorptive capacity in recipients
Military															
Session 1 - Group 1															
On the Job Training (OJT)	1			4	3				2			2	1		23
Hard Copy Documents				1							1	2			5
Database															9
Web	1	0	2	1	0	0	0	1	0	1	0	2	1	0	
Frequency															
Total Points (Reverse Coding)	5	0	7	3	0	0	0	4	0	5	0	8	5	0	
Session 2 - Individual Interview 1															
Hard Copy Documents					2						1				9
Database															
On the Job Training (OJT)															
Total Points (Reverse Coding)	0	0	0	4	0	0	0	0	0	5	0	0	0	0	
Session 3 - Individual Interview 2															
Archived Email				1											5
Oral Comm				1											5
Database	X		4		3			1		2	5				15
On the Job Training (OJT)								1	2						9
Personal Knowledge															
Web															
Total Points (Reverse Coding)	0	2	10	3	0	0	10	4	0	4	1	0	0	0	
Session 4 - Individual Interview 3															
Database							2				1				9
On the Job Training (OJT)	1								3	2		2			16
Hard Copy Documents			1						2						9
Total Points (Reverse Coding)	5	5	0	0	0	4	4	3	4	5	0	4	0	0	
Frequency	1	2	2	2	0	1	2	2	1	3	1	1	0	0	
Total Individual Average	1.66666667	2.33333333	3.33333333	2.33333333	0	1.333333	4.66666667	2.333333	1.33333333	4.66666667	0.333333	1.333333	0	0	
Civilians															
Session 1 - Group 1															
On the Job Training (OJT)													1		5
Archived Email				2	3		1	3							12
Database					1					2					12
Hard Copy Documents															

Web	0	0	1	2	0	1	1	0	0	1	0	0	1	0	
Frequency	0	0	1	2	0	1	1	0	0	1	0	0	1	0	
Total Points (Reverse Coding)	0	0	4	8	0	5	3	0	0	4	0	0	5	0	
Session 2 - Individual Interview 1															
Oral Comm							2						1	9	
On the Job Training (OJT)											1	2		9	
Personal Knowledge															
Hard Copy Documents															
Total Points (Reverse Coding)	0	0	0	0	0	0	4	0	0	0	0	5	9	0	
Session 3 - Individual Interview 2															
Oral Comm	1										5	2	3	4	15
Database															
Hard Copy Documents															
On the Job Training (OJT)															
Total Points (Reverse Coding)	5	0	0	0	0	0	0	0	0	0	1	4	3	2	
Session 4 - Individual Interview 3															
On the Job Training (OJT)							2		1			1			14
Archived Email				1											5
Hard Copy Documents			1	2											9
Personal Knowledge															
Database															
Web															
Total Points (Reverse Coding)	0	0	5	9	0	4	0	5	0	0	0	5	0	0	
Total Frequency	1	0	1	2	0	1	0	2	0	0	1	3	3	1	
Total Individual Average	1.666666667	0	1.666666667	3	0	1.333333	0	3	0	0	0.333333	4.666667	4	0.666666667	

Contractors

Session 1 - Individual Interview 1															
On the Job Training (OJT)													2	1	9
Culture															
Database															
Web															
Total Points (Reverse Coding)	0	0	0	0	0	0	0	0	0	0	0	0	4	5	
Session 2 - Individual Interview 2															
Oral Comm				1						2			3		12
Archived Email				2						1		3			12
Hard Copy Documents													1		5
Personal Knowledge															
Database															
On the Job Training (OJT)															
Web															
Total Points (Reverse Coding)	0	0	0	9	0	0	0	0	0	9	0	3	8	0	
Session 3 - Individual Interview 3															
On the Job Training (OJT)												1			9
Oral Comm							1	2						2	9
Hard Copy Documents								1							5
Database															
Personal Knowledge															
Total Points (Reverse Coding)	0	0	0	0	0	5	9	0	0	0	0	5	0	4	
Session 4 - Individual Interview 4															
Personal			1							2					9

Knowledge															
Oral Comm			1												5
Archived Email Database							2			1		3			12
Hard Copy Documents															
Web															
Total Points (Reverse Coding)	0	0	10	0	0	0	4	4	0	0	5	0	3	0	
Frequency	0	0	2	2	0	1	3	1	0	3	1	2	4	2	
Total Individual Average	0	0	2.5	2.25	0	1.25	3.25	1	0	2.25	1.25	2	3.75	2.25	

Table 9. MCSW Knowledge Sharing Weaknesses

Knowledge Transfer Weaknesses																
Strong Knowledge Source	Mentorship	Configuration Control	Ability to Capture Store/Codify	Selective Audiences to reduce waste			Trust	Relevance	Biases	Corporate Turnover	Accessability	Volume	Time	Absorptive capacity in recipients		Total
				Availability										Experience		
				1					2	3						12
	1	4		2		1	3					5				20
	1	1	0	2	0	1	1	1	1	0	1	0	0	0		
	5	2	0	9	0	5	3	4	3	0	1	0	0	0		
X		3		1							2					12
	0	3	0	5	0	0	0	0	0	4	0	0	0	0		
				3		1	5			2	4					15
						1										5
	0	0	0	3	0	10	1	0	0	4	2	0	0	0		
									1							5
	0	5	0	0	0	0	0	5	0	0	0	0	0	0		
	0	2	0	2	0	2	1	1	0	2	1	0	0	0		
	0	2.66666667	0	2.66666667	0	3.33333333	0.33333333	1.666667	0	2.66666667	0.666667	0	0	0		
				1		2	4	5		3						15
		5		3						1	4	2				15
	0	1	0	2	0	1	1	1	0	3	2	1	0	0		9
	0	1	0	8	0	4	2	1	0	13	6	4	0	0		
				4		2	1			3						10
	0	4	0	2	0	4	10	0	0	3	0	0	0	0		9
							1									5
							1					2				9
	3								4			2		1		14
	3	0	0	0	0	0	10	0	2	0	0	8	0	5		
X				2						1						9
		3					2			1						12
	0	3	0	4	0	0	4	0	0	10	0	0	0	0		
	1	2	0	3	0	1	6	0	1	4	0	2	0	1		
	1	2.33333333	0	2	0	1.333333	8	0	0.66666667	4.33333333	0	2.666667	0	1.66666667		

X				3										2				1	12
														2				1	9
	0	3	0	0	0	0	0	0	0	0	0	0	0	8	0	0	0	0	10
X																		1	5
				1										2					9
	0	0	0	5	0	9	0	0	0	0	0	0	0	0	0	0	0	0	0
X																		3	14
				1										2				4	12
	0	0	3	9	0	4	0	0	0	0	0	0	8	0	2	0	0	0	0
X																		2	16
				1										3				3	5
	0	5	0	4	0	0	0	0	0	0	0	0	4	3	0	0	0	0	0
	0	2	1	4	0	3	0	0	0	0	0	7	1	1	0	0	2	2	2
	0	2	0.75	4.5	0	3.25	0	0	0	0	5	0.75	0.5	0	0	2.5	2.5	2.5	

Table 10. MCSW Knowledge Transfer Weaknesses

Strong Knowledge Source	Knowledge Retention Weaknesses													Total	
	Mentorship	Configuration Control	Ability to Capture Store/Codify	Availability	Selective Audiences to reduce waste	Trust	Relevance	Biases	Corporate Turnover	Accessibility	Volume	Time	Absorptive capacity in recipients		Experience
				1					2						9
						2					1				9
	0	0	0	1	0	2	1	0	1	0	1	0	0	0	9
	0	0	0	5	0	8	5	0	4	0	5	0	0	0	0
	2														9
	4	0	0	0	0	5	0	0	0	0	0	0	0	0	0
					2										9
								1							5
				4	0	0	5	5	0	0	0	0	0	0	5
															5
								1				2			9
	0	0	0	0	0	0	0	5	0	0	0	4	0	0	0
	1	0	0	1	0	1	1	2	0	0	0	1	0	0	0
	1.33333333	0	0	1.33333333	0	1.6666667	1.66666667	3.3333333	0	0	0	1.3333333	0	0	0
									2		4	5		1	15
															12
	0	0	0	1	0	1	0	1	1	2	1	0	0	1	1
	0	0	0	4	0	4	0	2	5	10	3	0	0	5	5

				1		2			3						12
	0	0	0	5	0	4	0	0	3	0	0	0	0	0	
	0	0	0	0	0	0	0	0	3	0	0	4	0	5	12
						2				1					12
X					3			2		1			1		12
	0	3	0	0	0	4	4	0	5	5	5	0	0	0	5
	0	1	0	1	0	2	1	0	3	1	1	1	0	1	
	0	1	0	1.66666667	0	2.666667	1.33333333	0	3.66666667	1.66666667	1.666667	1.333333	0	1.66666667	
	0	0	0	0	0	0	0	0	0	5	4	0	0	0	9
	0	0	0	0	0	5	5	0	0	0	0	0	0	0	5
						1								2	9
						1	2								9
	0	0	0	0	0	10	4	0	0	0	0	0	0	0	
		2				1		3							12
	0	4	0	0	0	5	4	3	0	5	0	0	0	0	9
	0	1	0	0	0	5	3	1	0	2	1	0	0	1	
	0	1	0	0	0	5	3.25	0.75	0	2.5	1	0	0	0	

Table 11. MCSW Knowledge Retention Weaknesses

Appendix C

Knowledge Themes	Military / Civilian	Civilian / Contractor	Contractor / Military
KSS	.37	.17	-.20
KSW	.29	.49	.16
KTS	.35	.72	.61
KTW	.72	.26	.06
KRS	1.00	.81	0.00
KRW	.52	.14	.049

Table 12. Spearman's Rank Correlation Results

Vita

Captain Garland T. Mobley was born and raised in Detroit, Michigan, where he graduated Northwestern High School. He earned his commission to Air Force Officer from the Reserve Officer Training Corp (ROTC) Detachment 790, where he served as the Cadet Corps Wing Commander responsible for the largest body of cadets in the Southeast region. He graduated with a Bachelor of Science in Aeronautical and Industrial Technology with an emphasis in Electronics from Tennessee State University in Nashville, Tennessee.

Captain Mobley's first assignment was to the Flight Training System Program Office at Wright Patterson AFB, Ohio. He served as T-38 and T-6 Aeronautical Engineer and later joined the Fighter Bomber System Program Office as a Project Officer. In 2003 he was Chief then Lead Planner, Force Enhancement Capabilities and later served as a Director's Action Group Officer for the Center Commander at the Space and Missiles Center at Los Angeles AFB, California.

His education also includes a Master of Business Administration with a Project Management emphasis in from Wright State University in December 2003. He completed of the Undergraduate Space and Missile Training in May 2004 and the Flight Commander's Prep Course in Jun 2005. He graduated Squadron Officer's School by correspondence and Aerospace Basic Course in residence.

He was selected to attend the Air Force Institute of Technology (AFIT), Wight Patterson AFB, Ohio. Upon graduation he will have earned a Master of Science in Space Systems with three concentrations in C4ISR systems, Information Assurance, and Information Management.

Following graduation, he will be assigned to the Schriever AFB, Colorado as Chief, Space Innovation and Development Branch.

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14. ABSTRACT There is no measure for the loss of corporate memory. Organizations build a reservoir of knowledge in its employees, and this knowledge becomes a critical ingredient in an organization's ability to carry out its mission. Knowledgeable people are extremely valuable and once they leave, their organizationally-applied knowledge leaves with them. This study introduces specific knowledge attributes that significantly impact effective tacit and explicit knowledge transfer and retention. Under this construct the proposed investigation explores a government program office to see if replacing experienced government employees with outsourced personnel impacts corporate knowledge retention. The study concludes that a loss of corporate knowledge can occur within U.S. government procurement program offices when government personnel are replaced with contractors who do not transfer their knowledge. When the organization does not have a useful knowledge management system outsourced employees have a lack of trust in the system, a lack of transferred knowledge can be expected. For this reason, contractors use other means to store and transfer their knowledge in systems not available or accessible to the organization.				
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