Institutionalization of Knowledge Management in the Federal Government: An Exploration of the Mechanisms

by

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A Dissertation submitted to the

Graduate School-Newark

Rutgers, The State University of New Jersey in

partial fulfillment of the requirements

for the degree of Doctor of Philosophy

written under the direction of

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May, 2015

ABSTRACT OF THE DISSERTATION

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Despite knowledge management studies being widely attributed to the business field, it was Public Administration that actually pioneered scholarly work on the subject. In 1975, the *Public Administration Review* published a knowledge management symposium that not only coined the term "knowledge management," but also broadly examined "knowledge administration." Relevant to the study of knowledge management is the idea of promoting knowledge sharing within the organization. Since the 1990s, when U.S. federal agencies initiated their efforts on knowledge management, knowledge sharing has become a key management proposition to the executive leadership within the federal government. There are two main driving forces for promoting knowledge sharing in U.S. federal agencies. First, an aging workforce requires the U.S. federal government to prepare for the transfer of knowledge from one generation of employees to the next. Second, knowledge sharing could be crucial for the U.S. federal workforce to accomplish the diverse and challenging missions of the U.S. federal government. For an agency to accomplish its mission, we need a better understanding of the mechanisms that lead to knowledge sharing. Using an institutional theory perspective, this study hypothesizes that culture, incentives and technology influences knowledge sharing behavior in U.S. federal agencies. The study uses a mixed methods design in which both qualitative and quantitative research methods are applied to obtain a better understanding of the

institutionalization of knowledge sharing in U.S. federal agencies and to empirically verify the theoretical framework proposed in the study. Using the survey responses of U.S. federal employees within the executive branch agencies, the study finds that while culture and incentives influence knowledge sharing behaviors within an agency, technology has a neutral effect on knowledge sharing behavior within an agency. Given the scarcity of research in Public Administration on knowledge management, this research will contribute empirical work to the literature that hopes to not only deliver theoretical fruitfulness but also provide managerial direction to public sector leaders.

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Chapter 1: Introduction - Knowledge Management in Public Administration

Overview

Beyond early conceptions of knowledge, the mere art of individual and organizational survival have underscored the need to view knowledge as a practice. Under this view, the production and consumption of information allows individuals, markets and bureaucracies to organize themselves through the aptly act of knowing. It is this pragmatic perspective that has provided for the advent of knowledge management within organizational life.

In the academic field, the subject of knowledge management has been of primary interest to scientists working on organizational theory. The field was propelled by the increasing need of practitioners to understand how to better optimize and leverage intellectual assets within the organization. Given the competitive pressures of the market combined with the foreseen explosion of information in the 1980s, it should not be surprising that these efforts started in the private sector. The leading journal in management, *Harvard Business Review*, published a series of articles that became cornerstones to the business field (Argyris, 1991; Brown, 1991; Drucker, 1988; Garvin, 1993; Kleiner and Roth, 1997; Leonard and Straus, 1997; Nonaka, 1991; Quinn, Anderson and Finkelstein, 1996). According to Frappaolo (2002), knowledge management as a term was common parlance among the business community by 1997. Despite knowledge management studies being widely attributed to the business field, it was Public Administration that actually pioneered scholarly work on the subject. *Public Administration Review*, the leading journal of the field, published a knowledge management symposium that not only coined the term "knowledge management," but

also broadly examined "knowledge administration" (Caldwell, 1975; Carroll, 1975; Goerl, 1975; Gates, 1975; Henry, 1975; Keating, 1975; McCaffery, 1975). Although predicted to dissipate as a management priority, its interest continues to emanate because of the increasing amount of knowledge assets generated in organizations.

Knowledge management is a relevant area of study in the public management field. This dissertation channels the direction of the research towards focusing on the ultimate goal of a knowledge manager: promoting knowledge sharing within the organization. Therefore, the purpose of this research is to empirically address the phenomena of knowledge sharing within U.S. federal agencies. The research asks the question: "How do U.S. federal agencies institutionalize knowledge sharing within the bureaucracy?"

Foundations of Knowledge Management

To proceed with a discussion on knowledge management, it is necessary to obtain a basic understanding of the philosophical origins of the concept of 'knowledge' and the prevailing notions of 'knowledge' as a science today. The quest for understanding what is and how we obtain knowledge has captivated every academic discipline since the very beginnings of the academia. For example, Plato defined knowledge as a "justified true believe." In this sense, the quest for knowledge has turned into the scientific mission of finding the truth. Despite the many theories on knowledge today, no single accepted agreed upon definition of knowledge exist. This is due to the complex, ambiguous and abstract nature of knowledge. However, most researchers agree on a knowledge management continuum in which data is transformed to information, information to knowledge and knowledge to wisdom (Dalkir, 2011; McNabb, 2006; Milner, 2007). I

view knowledge as a process outcome in which data and information play the connecting links. Drucker (1988) defined information as data endowed with relevance and purpose. The generation of information is dependent on context, and knowledge is required to generate basic information. However, it is not until one exercises judgment that a knowledge innovation occurs.

The early works on knowledge by Polanyi (1964, 1966) increased the acceptance of individual knowledge being conceptualized as having an explicit and tacit nature. Because tacit knowledge is so difficult to share, organizations viewed humans' tacit knowledge of great value to innovate and improve performance relative to competitors. Tacit knowledge refers to the mental models humans develop through experience given a level of cognition. Due to tacit knowledge, one knows more than one can tell. On the other hand, explicit knowledge can be easily articulated in language and symbols. More profusely, the works of Nonaka and Takeuchi (1995) introduced the spiral of knowledge creation by stating that knowledge is created, used, embodied and disseminated through the interaction of tacit and explicit knowledge among individuals in the organization. The importance of this model is that it stresses knowledge sharing as a precondition of knowledge creation while distinguishing the process in which knowledge transfer occurs. In Nonaka and Takeuchi's (1995, p. 70) words "Unless shared knowledge becomes explicit, it cannot be easily leveraged by the organization as a whole."

Knowledge is thought to be one of the most important assets in today's economy but also one of the most underutilized assets. This is due to the difficulty of transferring and sharing knowledge among individuals, teams and organizational boundaries. The problem of knowledge conversion was of particular interest for Nonaka and Takeuchi

(1995) when studying innovation within the private sector. Through their research, there was an appreciation for how insights in organizations could be highly subjective; and through human interaction, the best way to share such insights was through metaphors, slogans, or symbols (Dalkir, 2011). In their model, what leads to an innovation (i.e. new products or processes) is how a group interacts with tacit and explicit knowledge. In a group setting, knowledge is found in the mental models, experiences, perspectives and judgments of its members. From a practical sense, to know implies to have some special form of competence, to be acquainted with something or someone, or to recognize something as information (Lehrer, 1990). To know involves some sort of tacit knowledge and it is the tacit dimension that Nonaka and Takeuchi (1995) view as a significant contributor to knowledge creation or innovation within an organization. They conclude that to create knowledge, an organization should focus on enabling conditions for collective knowledge.

Knowledge Management in Federal Government

The origin of knowledge management in the public sector could be traced back to the 1990s resulting from the proliferation of information and communication technologies. However, these efforts would have also not been possible without the advent of the knowledge worker in organizational life. Peter Drucker first coined the term 'knowledge worker' in the 1970s and recognized the profound change in management practices resulting from an increasingly educated worker. Saussois (2003, p. 108) defines knowledge workers as "people who do not perform tasks that can be observed and measured with scientific measuring instruments (such as people's schedules or the sequencing of operations in basic units), but who handle symbols." Given that the

government sector is mainly composed of knowledge workers, we can conclude that as a sector, government operates within a knowledge intensive environment (Bontis, 2007; Ferguson, Burford, and Kennedy, 2013; Milner, 2007; Sandhu, Jain and Ahmad, 2011).

Although knowledge management practices in the U.S. federal government have largely been driven by entrepreneurial efforts, the need for policy driven knowledge management continues to be both a challenge and a balancing act given the risks of information security within the new organizational models. Also, since national security concerns must be considered, disclosure of information is done at the appropriate level of clearance and on a need to know basis. According to Bontis (2007) and McNabb (2006), three trends in the U.S. government sector are currently driving the knowledge management efforts: First, the expected high turnover of the federal workforce due to the retirement of the baby boomers. Second, an emphasis in delivering services to citizens and government partners via e-government infrastructure. Third, given scarce resources, there is a need for government to offer an integrated service model that will achieve operational efficiency while reducing the cost of managing government.

The retirement and mobility of the U.S. federal workforce brings concerns about lost knowledge. Lost knowledge entails "the decreased capacity for effective action or decision making in a specific organizational context" (DeLong, 2004, p. 21). Since lost knowledge is a strategic threat, the U.S. federal government has promoted knowledge management as a way to mitigate potential operational risks within the organizational context.

Within the digital State, there is also a push to implement e-government (Bontis, 2007). E-government is the application of information and communication technologies

to simplify and improve transactions between government and other stakeholders such as constituents, businesses and other governmental agencies (McNabb, 2006; Moon, 2002). A recent event that exemplifies the importance given to e-government in the United States is an Executive Order signed in May 2013. President Obama signed the "Making Open and Machine Readable the New Default for Government Information." The order stated that "government information shall be managed as an asset throughout its life cycle to promote interoperability and openness, and, wherever possible and legally permissible, to ensure that data are released to the public in ways that make the data easy to find, accessible and usable."[1] Furthermore, as the movement towards government transparency progresses and technology becomes ubiquitous, knowledge management in the public sector could prove to be a wealth of information for all its stakeholders reflecting the institutional changes of a digital State.

Citizens driven demand for a more efficient State also played an important part in the rollout of knowledge management practices within the public sector. Since the late 1970s, New Public Management (NPM) has advocated for more private sector management tools in order to improve service efficiency (Riccucci, 2010). In the U.S. the National Performance Review of the 1990s and the President's Management Agenda in the 2000s catalyzed the use of free-market mechanisms to achieve efficiency within the bureaucracy. The U.S. federal government aimed to become more entrepreneurial and citizen-centric through the promotion of arrangements that allow citizens to choose government services. In this environment, the operational structure of government becomes more complex requiring a better management of information and knowledge assets (Milner, 2007).

[1] As quoted in KM World, September 2013 issue, www.kmworld.com

The September 11 attacks have propelled the need for information sharing among national security agencies both in the U.S. and abroad. To this end, the U.S. government has developed knowledge sharing resources that are collaboratively used among U.S. federal agencies whose missions depend on safety and security. Another area that has found increasing interest for knowledge management is disaster relief programs. In the United States, much was learned from the lack of knowledge sharing during the hurricane Katrina disaster resulting in renewed knowledge sharing strategy efforts. Understanding knowledge sharing for collaboration at the national and international level becomes a key competency for managers in federal agencies that ensure optimal responses when a natural disaster strikes.

The Value of Knowledge Management in Government

Within public administration, knowledge management pays in three ways (McNabb, 2006): First, it recognizes that the knowledge held by an organization's employees and the many interested and involved individuals from outside the agency constitute an agency's intellectual capital. Second, the establishment of best practices and efforts to become a learning organization should guide the agency to optimizing time, costs and quality. Third, identifying the knowledge based is fundamental to all processes in e-government.

Organizations rely on knowledge management in order to address the intellectual capital assets within their organization. In the private sector, organizations aim at extracting tacit knowledge from its employees and convert it to a proprietary asset by obtaining patents, copyrights and enhanced managerial processes. In the public sector, the demand for knowledge is driven by the need to produce new policy content and

process, the pressure to increase productivity and the quality of public services (Hartley and Benington, 2006). While in the private sector the goal is to maximize potential earnings, the public sector aims to enhance the quality of its services while increasing efficiency. Since in the public sector the staff has been identified as the key organizational memory, the eminent retirement of the large government workforce in the coming years makes knowledge management planning a key issue. In addition, the recent economic downturn has resulted in budget cuts and early retirement exacerbating the issue of a drain in knowledge within the sector (McAdam and Reid, 2000).

Developed nations spend considerably in information technology in order to allow for the capturing and management of knowledge. Today, these investments are mainly focused on building human capital within the government workforces, e-government efforts and national security (Hartley and Benington, 2006). Current research suggests that central governments among OECD countries increased knowledge management efforts following the failure to prevent the 9/11 attacks. It is proposed that only through the collaboration of different security departments we might be able to prevent well-organized terrorist strikes (Bontis, 2007). As a point of reference on the importance put towards investing in information, the U.S. IT Dashboard projected for 2014 an $82 billion yearly expenditure in information technology. However, technology itself does not ensure that knowledge management efforts are adequate. What is the role of information technology within knowledge management? Given the complexity of human intelligence, technology is only an enabler of knowledge management. Davenport and Prusack (2000, p. 316) states that, “What we must remember is that this new information technology is only the pipeline and storage system for knowledge exchange.” Given the

huge investments in technology within government, the key question is how governments can obtain an adequate return on such investments.

A proposal that has received attention internationally is the movement towards e-government. E-government involves the use of information and communication technologies with citizens and businesses to ensure better service quality through electronic delivery channels such as Internet, digital TV, mobile technology and other emerging technologies (McNabb, 2006). Citizens will benefit from this knowledge management initiative since it facilitates the modernization of public services and encourages public administrators to think of citizens as customers. E-government has increased adaptability to user needs, and in this way, improved the citizen's ability to access government services (Coleman and Perry, 2011). Inter-organizationally, public administrators might be more responsive to citizens by handling their inquiries immediately. Knowledge management also promotes consistency of government services and equal treatment of citizens (Bontis, 2007).

As it relates to the government workforce, management of organizational knowledge is called a powerful lever to improve efficiency, effectiveness and capability within the organization (Lesser and Wells, 1999). Knowledge management helps public administrators rethink the way an agency delivers its services. Some of the value added benefits of knowledge management within government agencies are the ability to educate the citizen, the leveraging and sharing of explicit and tacit knowledge, better decision making, and the capture of best practices. It is through the development of a knowledge-competent workforce that governments demonstrate to individuals and private businesses the value of education and expertise (Bontis, 2007). Since the days of scientific

management, much progress has been made in understanding the important element of external motivation of employees in order to increase work productivity. External motivation of the work force is also tied to the ability of being able to retain the knowledge base of the government workforce. Establishing the relationship between knowledge and productivity, Bontis (2007, p. 166) states:

> "Knowledge may also be retained by increasing the job satisfaction of public servants, and that achieved by introducing a sense of community among employees and by allowing them to utilize their talents fully, to take initiative, and to be rewarded for both personal and organizational achievements."

Finally, government agencies should strive under the value of administrative transparency. Management should share information with regular employees and vice-versa. In organizations, knowledge gaps and information failures will inevitably remain but knowledge management practices can greatly reduce its adverse impact.

Significance of Knowledge Management in Public Administration

Knowledge management is an interdisciplinary field. Furthermore, researchers find that the field lacks paradigmatic consensus. The knowledge management literature presents both a traditional and practice perspective (Ferguson, Burford and Kennedy, 2013). The traditional top-down approach follows a prescriptive set of best practices. The practice perspective focuses on social interaction where knowledge is negotiated and evolving. The two perspectives lead to different views around the challenges encountered by knowledge management. While traditional authors focus on the importance of knowledge management for retaining organizational knowledge, practice-based view authors look at the broader issue of leveraging knowledge and innovation (Ferguson, Burford and Kennedy, 2013). Reviewing the public administration literature,

I conclude that there are three views to the study of knowledge management in organizations: (1) knowledge as an asset, (2) knowledge as a process, and (3) technology as an enabler. So far, we have considered knowledge as an asset; and to some extent discussed technology as an enabler. However, the literature has given less focus to knowledge as a process.

Relevant to the study of knowledge management is the idea of promoting knowledge sharing within the organization. Given that people are considered the catalyzers of a knowledge management system, academics have devoted attention to the social process of knowledge sharing. Since the 1990s, when federal agencies initiated their efforts on knowledge management, knowledge sharing has become a key management proposition to the executive leadership within the U.S. federal government. There are two main driving forces for promoting knowledge sharing in federal agencies. First, an aging workforce requires the federal government to prepare for the transfer of knowledge from one generation of employees to the next. Second, knowledge sharing could be crucial for the federal workforce to accomplish the diverse and challenging missions of the federal government. For an agency to accomplish its mission, we need a better understanding of the mechanisms that lead to knowledge sharing.

Structure of the Dissertation

The remainder of this study is organized in five chapters. Chapter 2 will provide a literature review of knowledge sharing and advance the researcher's question. Chapter 3 presents the theoretical model, hypotheses and methods for the study. In Chapter 4, I test the theory by building a regression model for knowledge sharing using data from U.S. federal employees. Within Chapter 5, I assess the qualitative evidence for the

theoretical model through the views of subject matter experts and a review of the long term strategic plans of U.S. federal agencies. Finally, I present my conclusions of the study and provide direction for future research.

Chapter 2: Literature Review and Research Question

Overview

Although well-known interdisciplinary and mature literature exists on knowledge management, public administration scholars have not yet produced extensive research on this management practice. This is despite the fact that the public sector is mainly knowledge intensive (Richards and Duxbury, 2014; Willem and Buelens, 2007) and depends on workers sharing their knowledge in order to improve the efficiency, effectiveness and quality of the government services provided to the constituents. As it relates to this study, the U.S. federal government in particular has adopted knowledge management as a strategy in a push to improve an agency's ability to accomplish its congressionally mandated mission.

I reviewed the knowledge management literature from a historical, conceptual and empirical standpoint. The goal of using this progressive framework is to enlighten the process of searching for an empirical model that could be used by both scholars and practitioners interested in improving the practice of knowledge management in the government.

The structure of this chapter is as follows: First, I present knowledge management definitions from the literature. After providing a historical overview of knowledge management, I proceed to introduce knowledge management as presented in the organizational literature. Then, I address the importance given in organizations to the identification of knowledge-based assets. As the subject of this study, I continue by reviewing the literature covering the phenomena of knowledge sharing with a particular

emphasis on empirical studies. In conclusion, I advance arguments on current gaps within the knowledge sharing literature and present a research question aimed at empirically strengthening the existing literature.

Knowledge Management Definition

Knowledge management is viewed as a science of complexity (Dalkir, 2011). Within academia, knowledge management emerged from the interest of the well-established field of organizational learning (Taylor and Wright, 2004). However, it acquired an independent dimension with the recognition that knowledge management is an enabler of organizational learning (Easterby-Smith and Lyles, 2011; Rashman, Withers and Hartley, 2009). While organizational learning looks into the cognitive and behavioral aspects of organizations, knowledge management focuses on improving the return of knowledge as an asset. Knowledge management is driven by the desire to control scarce and mobile human resources (Currie and Suhomlinova, 2006). There are two extreme views on knowledge management (Dalkir, 2011): Some people view knowledge management as encompassing everything to do with knowledge. Others view knowledge management as being more "narrowly defined, an information system that dispenses organizational know-how." Within the general literature, a diverse set of definitions exist for knowledge management. A well accepted general definition is provided by Bowditch, Buono and Stewart (2008) which define knowledge management as "the ways in which organizations process, capture, share, and use information." Given the advent of massive data, the perspective of Saussois (2003, p. 115) is also telling: "One definition of knowledge management would thus be organizing the attention of players in data-saturated systems." I like the definition of McNabb (2006, p. 23) for

purposes of understanding knowledge management efforts in the public sector: "Knowledge management is a set of tools, procedures, and activities, held together by a unifying philosophy. That philosophy is sharing knowledge for public sector innovation."

To develop a definition of knowledge management, I reviewed the Public Administration Review (PAR) of November/December 1975 with the symposium on knowledge management. This symposium was concerned with the question of "how to develop, regulate and use knowledge more effectively for the achievement of public values and objectives" (Carroll and Henry, 1975). As recognized by the editors, the articles had little guidance for practicing managers on the "know-how" of knowledge management. At the outset, these scholars recognized the significance of the growing amount of information and its dissemination for the post-modern era. It positioned knowledge as being the resource of greatest need for public administrators. One aspect in which the articles agree, as it relates to generating definitions for the concept of knowledge management, is that effective knowledge is socially shared. Information generated through "technical and procedural know-how" is insufficient for effectiveness. The authors call for "knowledge of trends, interactions and synergistic effects" (Caldwell, 1975). In this manner, a difference between information and knowledge was emphasized early on within the literature. In summary, knowledge is derived from information. A transformation of information into knowledge occurs through validation (Caldwell, 1975). Therefore, I define knowledge management as the methods and processes that are used to create, share and use institutional and organizational knowledge.

Historical Foundations of Knowledge Management

The notion of managing knowledge is intuitively captured in the classics of modern management theory from the tenets found in the scientific management school to the tenets of its subsequent critics in the human relations school. The idea of organizational knowledge being proprietary dates back to the introduction of Scientific Management by Frederick W. Taylor (1911) and, today, it represents major work in management consulting circles. For Taylor, scientific management was the enterprise search for the best way to perform a task. The ultimate goal of obtaining knowledge from a worker's task was an increase in the efficiency of the enterprise. However, Taylor's efforts were focused on extracting knowledge from the worker rather than promoting collaborative knowledge sharing. Consequently, in his pursue of extracting the worker's knowledge, he alienated the worker from management. This outcome led to greater acceptance of the ideas for a more dynamic administration as proposed by Mary Parker Follet (1924). She envisioned management and laborer integrating knowledge for the purpose of decision-making. Furthermore, viewing knowledge as experience, she anticipated the advent of knowledge management: "And the organization of experience is the task of the leader in any business or industry" (Follet, 1973, p. 223). Later works in management within the orthodox period of public administration (Barnard, 1938; Simon, 1947) were able to present a more mature view of the executive interacting with knowledge within the organizational structure. However, these were still bureaucracies and sharing knowledge was not a spontaneous endeavor. The common thought among bureaucrats was that "knowledge is power" and withholding information was a strategy used to maintain such power (Saussois, 2003).

Knowledge Management in Organizations

The question of how to manage knowledge began to be increasingly important as the models of bureaucracy began to be disrupted through the advent of the "information-based organization" and the "knowledge worker" (Drucker, 1957, 1988). The 1980s and 1990s were characterized by a change in the culture of the private sector in which the bureaucratic model was dismantled in favor of a more flexible organization (Milner, 2007). In a bureaucracy, knowledge was contained in documented policies and procedures, but now the emerging forms of organization valued the employees' knowledge or expertise.

These rapid changes also permeated the public sector, but not with equal goals due to different stakeholder orientations. As Osborne and Gaebler (1992, p. 20) stated, "Business leaders are driven by the profit motive; government leaders are driven by the desire to get reelected." The key difference in the public sector is that beyond making a sound business case for knowledge management, the policy must also have some political payback related to the changes implemented and the investment outlay (Milner, 2007). According to Milner (2007), there are five changes in the public sector resulting from the move towards a more flexible and responsive structure:

- Need for government to enable itself to facilitate services in a more targeted and user-friendly manner
- Imperative to build partnerships across public services as well as with external agencies
- A local and integrated approach to public service delivery
- Access to services through 'information age government'
- Integrating services and sharing resources to cut cost

These changes reflect a more decentralize public administration where knowledge is more diffused within government agencies and across governmental partnership networks.

Viewing organizations as living social systems, McNabb (2006) states that the system's architecture defines the way people, technology and knowledge assets are organized to form the knowledge management system. Following is a list of the fundamental blocks of all knowledge management systems, according to McNabb (2006):

- Information needs of the agency
- Its people
- Its technology
- Its processes
- Its culture

We can marry this view with the notion that knowledge is a human endeavor. Therefore, knowledge resides in the user, in this case, the employee within the organization (Milner, 2007). Given that knowledge resides in the individual, the organization is at risk of losing knowledge when an employee leaves (DeLong, 2004; Ipe, 2003).

Knowledge management has epistemic cultures characterized by different social, discursive and material practices (Newell, Robertson, Scarbrough and Swan, 2009). In the public sector, the paradigm of the New Public Management (NPM) has influenced the introduction of knowledge management (Milner, 2007). NPM embeds the changes of the new organization now driven by technology and professionalization, which do not necessarily correspond to a traditional bureaucracy. NPM argues that markets and networks are sometimes more efficient than bureaucracies (Lane, 2000). As it relates to knowledge, extending the organization and governance of the State to incorporate

networks and market players increases the pool of knowledge available within the bureaucratic State. However, new forms of organizations require knowledge driven policies that adapt to the changing conditions of how knowledge is shared with the different players in the polity. These policies include the classification, quality and use of information, risks and protection, maintenance and exploitation, information strategy, integration to organizational activity, and identification of roles and responsibilities (Milner, 2007). In organizations, knowledge today has acquired a utilitarian meaning (Tsoukas, 2011). Particularly, NPM founded on neo-liberal beliefs and under economic models of rational choice assumes "the rational use of knowledge for rational purposes" (Hartley and Benington, 2006, p. 106).

Since the introduction of the NPM paradigm, empirical studies of knowledge networks in the public sector have been of increasing importance (Binz-Scharf, Lazer and Mergel, 2012; Bundred, 2006; Hartley and Benington, 2006; Zhang and Dawes, 2006). A study conducted by Binz-Scharf, Lazer and Mergel (2012) aims to understand knowledge search and interdependence in a network of DNA forensic laboratories. The study highlights the importance of informal professional networks in the knowledge search. The researchers also find that isomorphism among laboratories occurs due to the power that federal government authorities have to implement selected practices. While the Binz-Scharf, Lazer and Mergel (2012) study focuses on mechanisms for knowledge sharing in networks, Zhang and Dawes (2006) are more concerned with the network structure in itself. In their study, they propose a model emphasizing the importance of policy, management, and technology choices in shaping experiences and ultimate outcome of knowledge networks within the public sector. From a decade of research,

Hartley and Benington (2006) infer that the success of an inter-organizational network depends on how the network is formed and sustained, how differences and conflicts are tackled, how knowledge is shared and applied, under what circumstances, and with advantages and disadvantages for whom. The researchers highlight the differences in knowledge creation and transfer between the private and public sectors as follows (Hartley and Benington, 2006):

- The primary concern of the public sector is on producing democratic debate, governance frameworks, and policies and services. These areas are intangible, interactive and relational.
- The driver for knowledge generation and use in the public sector is not to create competitive advantage but to respond to the needs, demands and pressures from users, communities and governments.
- Models of knowledge sharing in the public sector need to take into account power relations and political processes.
- Knowledge generation within the public service sector takes place not within a single organization but across boundaries between the state, the market and civil society, between different levels of government; and between different services.
- Comparative elements are important in knowledge transfer and learning within the public sector.

These authors also note that the knowledge actively shared in knowledge networks is adapted rather than adopted. Sharing is enhanced when knowledge differences among members are articulated and explored. The researchers advance the need for developing more relational approaches to knowledge creation, transfer and application, as well as, theories that take into account the political and contested nature of knowledge in the public sector.

Much of the knowledge management work that has taken place since the 1990s, relies on the assumption that an organization's success in leveraging knowledge will improve organizational effectiveness. Although not much empirical work exists on the subject, researchers have associated knowledge management capabilities with

organizational effectiveness (Coleman and Perry, 2011; Gold, Malhotra and Segars, 2001; Yang 2007; Zheng, Yang and McLean, 2010). Lack of knowledge sharing impedes the effective management of knowledge in organizations and organizational effectiveness (Ipe, 2003).

The Search for Knowledge-Based Assets

Knowledge management assumes that knowledge flows in two directions: from employee to supervisor or among employee members (Rashman, Withers and Hartley, 2009). This has led to the creation of knowledge management systems as a medium of capturing and disseminating information flows. However, there are two paradoxes with knowledge (Dalkir, 2011). First, we have the paradox of value: 'The easier to extract knowledge, the less value it actually embodies'. Therefore, tacit knowledge is of great value. Second, we have the paradox of transfer: 'Knowledge transfer does not require physical contiguity but codification and abstraction.' The aim of an organization is then to capture the 'know-how' of employees in a codified form in order to enable organizational learning. This management view has led the knowledge management practitioner to focus on identifying knowledge-based assets within organizations. In cooperative environments, the concept of a knowledge base is relevant to ensure quality products, services and processes. A general definition of knowledge base is: "The fundamental body of knowledge available to an organization, including the knowledge in people's heads, supported by the organization's collection of information and data" (Dalkir, 2011, p. 469). According to McNabb (2006, p. 77), the term knowledge base refers to "the complete collection of all expertise, experience, and knowledge of those within a public organization."

In the literature, knowledge-based asset is a relatively new concept but very relevant in the understanding of what should be managed within an organizational knowledge base. Knowledge assets can facilitate the creation of knowledge in organizations when appropriately identified for the task characteristics under consideration (Chou and He, 2004). Dr. Randy M. Kaplan[2] defines a knowledge-based asset as anything valued without physical dimensions, embedded in people and derived from the processes, systems, and culture associated with an organization. According to McNabb (2006), the term knowledge asset implies a management understanding that information is a critical part of the asset base of a government agency.

The knowledge-based asset is in organizational memory. Casey (1997) defines organizational memory as a shared interpretation of the past. According to Bontis (2007), knowledge within an organization can be found within three specific domains:

- Human capital – This domain refers to the tacit knowledge existing in people's heads and their capacity to solve organizational problems.
- Structural capital – This domain refers to the infrastructure and knowledge embedded in technology, processes, and routines.
- Relational capital – This domain refers to the knowledge embedded in the relationships established with the external environment.

According to Argote (1999), organizational memories are embedded in individuals, technology and, structure and routines. In an interesting interpretation of the scientific management movement, Argote (1999) argues that one of the principles of this movement was to capture the knowledge of the individual employee so the organization was no longer vulnerable to the turnover of its workforce. From this, she concludes that the late 1800s and early 1900s witnessed a shift from organizational memory being embodied primarily in the individual to its independent existence in "records, rules and

[2] Definition found online at *faculty.kutztown.edu/.../Knowledge%20Management%20-%20Knowled*

procedures." Extending this argument, bureaucracy emerged as a preferred organizational model in which knowledge turned into records within the bureau or corporation, and hierarchy-legitimized knowledge prevailed.

There are consequences depending on where knowledge is embedded in the organization (Argote, 1999). When knowledge is embedded in an individual, the organization will suffer upon the employee's departure assuming the knowledge is tacit. On the other hand, moving the individual within the organization allows for transferring knowledge to other business areas. A disadvantage of relying on individuals is that individuals might not be willing to share their knowledge. In addition, the cost of transferring the knowledge might increase given the difficulty of reaching a large number of recipients. Knowledge embedded in technology is codified and easier to transfer within the organization. For technology transfer to be successful, it might require the transfer of a few individuals as well (Argote, 1999). Nevertheless, research shows that, even when knowledge is embedded in technology, it might not necessarily result in large productivity gains when transferred within the organization and it is subject to obsolescence (Argote, 1999). Finally, when knowledge is embedded in structure and routines, both process and production efficiency increases but not necessarily innovation. This is because "embedding knowledge in a routine enhances persistence," a barrier for adaptation to new environmental conditions (Argote, 1999, p. 91).

The practice of knowledge management begins with a knowledge audit (McNabb, 2006). A knowledge audit is a tool that helps an organization identify its information needs and knowledge assets, and then assess the gap between information needs and assets. According to Dalkir (2011), a knowledge audit will provide information about:

- Identification of core knowledge assets and flows
- Identification of gaps in knowledge
- Areas of information policy and ownership that need improving
- Opportunities to reduce information handling cost
- Opportunities to improve coordination and access to commonly needed information
- A clearer understanding of how knowledge is impacting the business

A knowledge audit is particularly recommended before making a decision to invest significant monetary resources in an information system. Since people are the users of the information systems, the information audit is a prudent attempt to ensure that the users will be able to reap the benefits of the knowledge information system under consideration. Once the gap analysis is performed, a knowledge management strategy document can be generated with a road map of short-term as well as long-term knowledge management initiatives (Dalkir, 2011).

It is knowledge that is organized in relevant and clear categories that allows new members of the organization to access and use knowledge when needed (McNabb, 2006). To ensure high reliability on its knowledge-based assets, the organization must ensure that the information generated from its knowledge repositories is free of errors. Dalkir (2011, p. 470) defines knowledge repository as "a place to store and retrieve explicit knowledge" and the foundation upon which a firm creates its knowledge assets. Therefore, the source data and information must be of the highest quality in order to prevent being victim of the popular adage "garbage in, garbage out" (Dalkir, 2011). Therefore, the importance of managing information itself is paramount to the concept of knowledge management (Milner, 2007). This is because the quality of the information becomes relevant to the effectiveness of knowledge categorization within the organization (Saussois, 2003; Taylor and Wright, 2004). According to Davenport (1997,

p. 144), the process of categorization is a quintessential human activity: "People define initial categorization schemes, mediate between others with differing views, monitor the capture process for evidence that new categories are needed, and finally update the categorization scheme at frequent intervals. Like scanning, to do it well is a labor-intensive process." An adequate information infrastructure should allow an organization to drive the process of developing knowledge repositories with adequate categorization schemes (Taylor and Wright, 2004). Throughout the process, the quality of information generated becomes relevant to the quality of the repositories been created. To this end, Milner (2007, p. 9) states that "Without good access to appropriate information in the right format, available at the right time and accessible to the right people, the knowledge generation and sharing processes are likely to be considerably diminished in value." As knowledge repositories are an investment in the intellectual capital of the organization, only information with value and utility should be managed. Dalkir (2011) outlines the costs that are incurred in transferring knowledge:

- Moving cost incurred by data processing and transmission.
- Codification cost due to searching and selection under uncertainty.
- Abstraction cost due to knowledge generalization over wider spaces.
- Diffusion cost when communicating with large audiences for effective response.
- Absorption cost of getting recipients to internalize knowledge.
- Impacting cost of applying knowledge in concrete situations.

As it relates to the valuation of knowledge-based assets, there is no consensus in the literature (Leliaert, 2009). According to Sveiby (1997), intangible measures are not difficult to design but the outcomes seem difficult to interpret. In general, organizations have found difficulty in justifying the needs of measuring and interpreting the value of knowledge.

The Phenomena of Knowledge Sharing

Knowledge Sharing in Organizations

A great deal of research has focused on understanding the factors that influence knowledge sharing within the organization. While knowledge sharing is not new, "systematizing knowledge-sharing activities is a rather modern phenomenon" (Husted and Michailova, 2002, p. 63). Sharing knowledge improves knowledge and knowing capability of the collective (Newell, Robertson, Scarbrough and Swan, 2009). In organizational life, knowledge sharing efforts are often driven by the desire to control scarce and mobile labor resources (Currie and Suhomlinova, 2006). Organizational knowledge sharing occurs through informal interactions, formal interactions within and across teams, employee contributions to databases, and in communities of practice (Bartol and Srivastava, 2002).

Paulin and Suneson (2012) have acknowledged the blurriness in the use of knowledge management terms in published research. "Knowledge sharing" and "knowledge transfer" are often used interchangeably. The distinction of these two terms sometimes occurs at the level of analysis or the level of definition of knowledge. At the level of analysis, knowledge sharing is used often by researchers focusing on the individual level while knowledge transfer is used more frequently when the focus are groups, units and organizations. At the level of definition, researchers often use knowledge transfer when referring to knowledge as an object while researchers who view knowledge as constructed tend to use knowledge sharing more often.

In the literature, the most common cited definition for knowledge sharing is by Argote and Ingram (2000, p. 151): "the process through which one unit is affected by the

experience of another." Another often-cited definition presented in the literature is by Willem and Scarborough (2002): "Knowledge sharing process is defined as exchange of knowledge between at least two parties in a reciprocal process allowing reshaping and sense-making of the knowledge in the new context." We also present the definition developed by Kim and Lee (2006, p. 371): Knowledge sharing is "the ability of employees to share their work-related experience, expertise, know-how, and contextual information with other employees through informal and formal interactions within or across teams or work units." Further enhancing the prior views, Willem and Buelens (2007) advance that knowledge sharing is a process that goes beyond transmitting knowledge; it also includes processing knowledge and using that knowledge. When these definitions are assessed, it is of relevance to identify the element of reciprocity in knowledge sharing. Resulting from the element of reciprocity, knowledge sharing is distinguished from information sharing or reporting within an organization in that information sharing is unidirectional and unrequested (Connelly and Kelloway, 2003). Information reporting more often refers to an exchange of information through routines and structured processes (Ipe, 2003). Although most of the time knowledge sharing is a two-way process, it could often turn into a one-way process when the organization is mainly concerned with organizational performance and knowledge loss (Leonard, 2007).

Although traditionally viewed as an omnipresent process in organizations, knowledge sharing research shows that the process is multifaceted and complex (Ipe, 2003; Leonard, 2007; Newell, Robertson, Scarbrough and Swan, 2009). Leonard (2007) and Argote (1999) provide reasons why the study of knowledge sharing as a process is a difficult task. First, knowledge is complex in its content. Individuals might share

knowledge of "facts (know-what), cause-and-effect relationships (know-why), skill-based processes (know-how), and interpersonal networks (know-who)" (Leonard, 2007, p. 59). Second, knowledge is not always conducive to transfer since it is not easily separable from its source. Often referred to the "stickiness" of knowledge, to a greater or lesser extent, all shared knowledge involves difficult to convey tacit knowledge. Furthermore, the "stickiness" of knowledge could also relate to embedded cultures within the organization. Third, knowledge is contextual. Shared knowledge can only achieve its purpose if comprehended by the receiver.

Institutional theory emphasis on cognition (Scott and Meyer, 1994; Scott, 2008; Scott, 2014) opens the door to interdisciplinary work on interpretative foundations of knowledge (Kasper and Streit, 1998; Meyer, 2008). Two problems with roots in the constitutionality of human ignorance drive knowledge sharing: uncertainty of the future and scarce resources (Kasper and Streit, 1998). As it relates to "future uncertainty," humans appreciate when given help to reduce uncertainty, as it enhances their confidence. At the same time, given scarcity of resources, humans appreciate arrangements that can help reduce time and effort on "search and coordination." From an economics standpoint, using the division of labor and knowledge, people become specialists but that requires them to cooperate (Kasper and Streit, 1998). Competitive implications in knowledge sharing behavior have been modeled using the classic exercise in game theory of the prisoners' dilemma. Humans are hesitant to share their knowledge if they think the other party will swindle unwarranted rewards or not reciprocate in the future, making the sharer being "played the fool" (Kluge, Stein and Licht, 2001).

A diverse set of literature relates how relational and political powers create barriers to knowledge sharing in public organizations (Rashman, Withers and Hartley, 2009). Organizations that suffer high levels of knowledge-sharing hostility might have a potential knowledge transmitter being concerned about surviving power games and the potential receiver aiming at maintaining the status quo, while considering mistakes and failures as taboo for both stakeholders (Husted and Michailova, 2002). When knowledge is subject to bureaucratic control (Turner and Makhija, 2006), knowledge developed outside the bureaucracy can be construed as deviant (Ferguson, Burford and Kennedy, 2013). Resulting from a resistance to change, organizations often find it difficult to listen to those with radical innovations (Saussois, 2003). In situations of competition among units of government, social identity or threat of status prevents knowledge from being shared (Pfeffer and Suton, 2000). Bundred (2006) summarizes reasons for poor knowledge sharing in the public sector as follows:

- Organizational and professional boundaries
- Lack of trust between professions
- Cultural tensions
- Lack of awareness of best practices from other parts of the public (and private) sector

The literature has also advanced the understanding of the pervasive role of ICTs in helping promote or frustrate knowledge sharing efforts (Hendriks, 1999; Roberts, 2000). A well-recognized captivation with information systems might cloud needed focus to fight knowledge hoarding behaviors within the organization (Goh, 2002; Husted and Michailova, 2002). However, it is the capacity for knowledge transfer through ICTs that has been of interest in the literature (Bolisani and Scarso, 1999; Hendriks, 1999; Roberts, 2000). Of particular interest to researchers are the shortcomings of ICTs to

transfer know-how, which requires co-location and co-presence (McDermott, 1999; Roberts, 2000). It is only by combining human and information systems that organizations build capacity for learning (McDermott, 1999).

This begs the question of how to effectively use information technology for knowledge sharing. Hendricks (1999) views the use of ICT for knowledge sharing contingent upon the personal, contextual and task, but advances the following factors that stimulates the will to share knowledge through technology:

- Lower temporal, physical and social distance barriers
- Facilitates access to information repositories
- Improves the knowledge sharing process
- May help locate elements relevant to the knowledge sharing process

Therefore, the role of information technology in the knowledge management literature is well represented by the words of Davenport and Prusak (2000, p. 316): "What we must remember is that this new information technology is only the pipeline and storage system for knowledge exchange. It does not create knowledge and cannot guarantee or even promote knowledge generation or knowledge sharing in a corporate culture that doesn't favor those activities."

Organizational incentives for knowledge sharing are viewed as a needed support structure to promote the phenomena (Bartol and Srivastava, 2002; Cabrera and Cabrera, 2002; Goh, 2002; Yang and Maxwell, 2011). When incentivizing knowledge sharing, an important issue in the literature concerns with whether to reward behavior at the individual, team or work unit level (Bartol and Srivastava, 2002). Another question of interest relates to the type of reward most likely to promote knowledge sharing behavior, extrinsic or intrinsic (Bartol and Srivastava, 2002). Knowledge contributions to databases and intranets have been found particularly suited to merit-based rewards

(Bartol and Srivastava, 2002; Hall, 2001). However, the appropriateness of intrinsic rewards in voluntary efforts such as communities of practice are also relevant to the understanding of individual motivation to contribute to a collective effort (Bartol and Srivastava, 2002).

Knowledge Sharing as a Social Dilemma

Researchers have advanced the socio-psychological perspective of knowledge sharing as a social dilemma (Cabrera and Cabrera, 2002; Dupuy, 2004). The interest is in identifying factors that prevent cooperation and designing interventions that might improve cooperation. To this end, the theoretical construct of trust has received considerable attention in the knowledge sharing literature. In general, researchers argue that trust is a precursor for knowledge sharing (Dupuy, 2004; DeLong, 2004; Goh, 2002; Huemer, von Krogh and Roos, 1998; Ichijo and Nonaka, 2007; Newell, Robertson, Scarbrough and Swan, 2009; von Krogh, Ichijo and Nonaka, 2000; Wathne, Roos and von Krogh, 1996). Although sharing of knowledge is the start of trust, most organizations are places of distrust (Dupuy, 2004). Although the literature offers many definitions and types of trust, the key issues around trust are dealing with risk and uncertainty, and willingness to accept vulnerability (Newell, Robertson, Scarbrough and Swan, 2009). Those aspects of trust play a key role in the ability of an individual to share knowledge. Since trust is developed overtime, the literature on cooperative arrangements could be enlightening in producing empirical relationships (Wathne, Roos and von Krogh, 1996). Despite the relationship between trust and knowledge sharing not yet being well articulated empirically, Huemer, von Krogh and Roos (1998) have split its conception into two categories: the cognitive and the social and moral. Furthermore,

they illustrate the dimensions by stating that while cognitivist emphasizes a strategic relationship, the social and moral derives its existence from human passion. At the organizational level, trust is created in an organization when there is a sense of mutual dependence, trustworthy behavior is part of the performance review, and there are expectations on individual reliability (von Krogh, Ichijo and Nonaka, 2000). However, bureaucratic structures tend to suffer from a lack of trust (Zand, 1997), therefore knowledge management could enable its creation.

Knowledge sharing avoidance could create a social fence when in the short-run an individual avoids sharing knowledge that in the end results in a loss for the collective (Cabrera and Cabrera, 2002). Experiments have confirmed that the higher the cost of knowledge sharing behavior the less its frequency (Bowles and Gintis, 2011). Therefore, interventions are of crucial importance when there is a social dilemma creating an under-supply of contributions and these could come from restructuring the pay-offs for contributions, increasing perceptions of contribution efficacy and making more salient the sense of group identity and personal responsibility (Cabrera and Cabrera, 2002).

Knowledge Sharing in Diverse Organizations

Although some research on how diversity influences knowledge sharing has been published (Wang and Noe, 2010), the literature is scarce. Researchers continue to struggle in the development of theories and methods to study diversity, not withstanding, diversity in knowledge sharing behaviors (Lauring, 2009). Only few theoretical or empirical studies relate cultural diversity with the knowledge sharing process and the omission is unfortunate given that diverse groups have high potential of generating knowledge assets (Lauring, 2009). Researchers have found that access to organizational

networks is not always equitable (Timberlake, 2005) and it is informal networks that appear to have a great deal of knowledge benefits for employees (Durbin, 2011). However, the understanding of how diversity impacts knowledge sharing is relevant as "Knowledge is often bound to other social structures (e.g. language, identity) and may therefore be confined to certain communities of practice" (Lauring, 2009, p. 391).

Empirical Studies on Knowledge Sharing

As it could be appreciated in Appendix 2.1, the complexity of studying the knowledge sharing phenomena has resulted in a proliferation of multiple and diverse empirical models. Within the existing literature, exacting theoretical constructs for the purpose of building on existing research is a challenging endeavor. Since the goal of this study is the construction of a theoretical model for the purpose of making empirical claims, below I individually reviewed empirical studies addressing the phenomena of knowledge sharing.

Early empirical work did not directly assess knowledge sharing as a dependent variable but constructed the concept around collaborative climate (Sveiby and Simons, 2002). Although the work emphasizes collaborative culture as a determinant factor (Goh, 2002), it also recognizes that as a theoretical construct culture is diffused and contested (Rainey, 2009; Sveiby and Simons, 2002). Despite its broadness, the literature supports the following reasons for why culture in an organization exercises a large influence on knowledge sharing (De Long and Fahey, 2000; Ipe, 2003):

- Shapes assumptions about which knowledge is important.
- Controls the relationship between the different levels where knowledge resides (organizational, group and individual).
- Creates the context for social interaction.
- Determines the norms regarding the distribution of knowledge between an organization and the individual in it.

While Sveiby and Simons (2002) operationalizes collaborative climate as the construct that facilitates knowledge sharing, this view fails to empirically account for factors that influence individuals and/or organizations to promote knowledge sharing. More recent empirical work accounts for knowledge sharing directly as a dependent variable and present a view, either separately or in combination, of individual and organizational factors. In the empirical literature I have reviewed, the theoretical perspectives taken include the resource view of the firm, motivational factors, interpersonal factors, individual characteristics, cultural factors and institutional factors. None of the research reviewed take a strict technological perspective, but most importantly, not all researchers include technological factors when assessing the determinants of knowledge sharing. Methodologically, using the technology variable could be problematic when the researcher ignores the human actor as an agent and, the organizational and institutional pressures that exercise an influence in the technology choices that are used to deliver knowledge sharing outcomes (Newell, Robertson, Scarbrough and Swan, 2009).

From a solely individual characteristics perspective, I have reviewed two empirical works within the literature. The first study by Yang (2008) points out to the importance of nurturing individual attitudes of learning and sharing to develop knowledge sharing behavior in individuals as part of a larger knowledge management effort within an organization. In another example of empirical work, Wang, Noe and Wang (2014) point out how individual factors of accountability, incentives and personality traits relate to the propensity to share knowledge.

Research work that adopts an organizational resources perspective has received considerable attention in the empirical literature covering the knowledge sharing phenomena (Coleman and Perry, 2011; Kim and Lee, 2006; Taylor and Wright, 2004; Yang and Chen, 2007; Willem and Buelens, 2007). The methodologies used by researchers either isolate variables in a multivariate regression model or take into consideration the inter-relationship among variables through a structural equation model.

Taylor and Wright (2004) argue that managers need to assess organizational readiness to adopt knowledge sharing attitudes and behaviors within the organization. They identify six organizational antecedents to effective knowledge sharing. These factors are open leadership climate, learning from failure, information quality, performance orientation, satisfaction with change processes and a vision for change. All the factors identified are statistically significant in predicting the readiness of an organization to share knowledge effectively. However, the two strongest factors were an open leadership climate and information quality, this last one showing the value of using vetted information within the organization.

Yang and Chen (2007) also construct an organizational resource model, but align their theoretical thinking by adopting the Resource-Based View of the firm as grounding theory. In their study, the predictor variables for knowledge sharing are defined by organizational capabilities around culture, structure, people and technology. In their multivariate regression model, they include gender, age, education and firm size as control variables. The researchers find that knowledge capabilities around structure, people and technology are correlated to knowledge sharing activities at a statistically significant level. Although the correlation for culture is close to significant at 0.05, the

variable fails to demonstrate the strongest correlation. As it relates to control variables, the only statistically significant correlation found is for education.

Kim and Lee (2006) introduce a model in which knowledge sharing capabilities are broadly defined around aspects of culture, structure and information technology. In their research, they contrast a nested regression model of public and private employees. They find that knowledge sharing in the public sector is positively associated with social networks, performance based-reward systems and information technology. In this study, social networks are represented as an aspect of culture, while performance-based rewards are represented as an aspect of structure. As it relates to information technology, the researchers measured both utilization and ease of use. Information technology application usage was statistically significant for both public and private employees, but ease of use was statistically significant only for private employees.

Willem and Buelens (2007) propose a model to measure knowledge sharing effectiveness and intensity by relying on an organization's structure and characteristics. With a mixed sample of public sector organizations in Belgium, the researchers use three coordination systems variables (formal, lateral and informal), three contextual organizational variables (power games, trust and identification) and incentives as a control variable. Through a structural equation model, the study makes the following inferences:

- Formal systems have a negative effect on intensity of knowledge sharing.
- Lateral coordination resulted in higher knowledge sharing intensity and effectiveness.
- Informal coordination resulted in positive knowledge sharing effectiveness.
- Trust results in positive knowledge sharing effectiveness and intensity.
- Identification improves knowledge sharing effectiveness.
- Although power games are not significant on its own, they could influence knowledge sharing effectiveness when linked to informal coordination.

- Incentives influence knowledge sharing intensity.

Willem and Buelens (2007) conclude in their study that effective coordination is not only based on formal systems but also on lateral coordination combined with culture driven characteristics, such as high levels of trust and identification and the absence of power games. Consistent with the findings of Kim and Lee (2006), they also state that incentives for cooperative behavior are necessary implying a need to formally evaluate coordination systems.

Relying on the design and variables of Willem and Buelens (2007) study, Coleman and Perry (2011) surveyed a single public sector organization in the United States and found a more limited number of statistically significant variables. Although both lateral coordination and incentives are statistically significant, incentives had the highest weight on information sharing.

In a study combining organizational and individual characteristics, Connelly and Kelloway (2003) use survey methodology with a sample of respondents from diverse industries within Canada. In this study, demographic variables are integral to the theoretical model. This is in contrast to studies where demographic variables are represented as control variables. In this study, knowledge sharing predictors are defined as social interaction culture, management's commitment, technology, age, gender, organization size and organizational tenure. Through multivariate regression, the researchers find statistical significance in the impact of management's commitment, social interaction culture and organizational size on knowledge sharing behavior. Although technology was not a predictor of knowledge sharing, the researchers portray it as a supporting symbol for management in their efforts to promote knowledge sharing

behavior. Connelly and Kelloway (2003, p. 295) states, "If management spends a significant amount of resources on either purchasing or developing and implementing such technology, employees could interpret this as a signal of management's support for this ideal, and act accordingly." However, the researchers further state that management's emphasis on technology could also be interpreted as the result of technology acquisition being a simpler task to accomplish than cultural change.

Among the empirical studies focusing exclusively on technology as an enabler are Papadopoulos, Stamati and Nopparuch (2013). Their research investigates the factors that promote employees to share knowledge via weblogs or blogs. The study is relevant given that blogs depend on collaborative technology to make knowledge sharing a possible outcome. Their theoretical model consists of motivators triggered by social influence, technology acceptance and social cognitive factors. Using survey responses from business organizations in Thailand, they developed a path model that makes a distinction between attitude towards knowledge sharing and intention of knowledge sharing. The researchers find that self-efficacy and attitude towards knowledge sharing positively influences the intention to share knowledge. At the same time, the perceived enjoyment and personal outcome expectation from blogging positively influences attitude towards knowledge sharing.

The empirical literature has been less forthcoming of research focusing on the process of knowledge sharing or transfer. Being aware of this gap, Richards and Duxbury (2014) developed a theoretical model around absorptive capacity. Focusing on knowledge acquisition in groups, they measure variables that predict the increase of group knowledge overtime. They narrow the predictor variables to amount of individual

prior knowledge, common knowledge among group members, managerial practices and perceptions of knowledge applicability. Since their data is collected from individuals within 28 work groups, any assumption of independence is violated. Therefore, the researchers built a multi-level hierarchical linear model to test assumptions around the predictor variables from a questionnaire answered by individuals representing 7 public sector organizations within Canada. This model supports the view that knowledge acquisition that originates at the individual level, through a process of mutual interaction among individuals within the group, manifest in group knowledge acquisition. Although the cognitive perspective has long supported that prior knowledge is a precondition for new knowledge, the researchers find that an individual that is already knowledgeable about a particular domain might be less likely to seek out new knowledge on that domain at the group level. They describe this relationship between prior knowledge and knowledge acquisition as being U-shaped, meaning that "too little" or "too much" individual knowledge might be obstructive to the knowledge acquisition process. At the same time, knowledge applicability or relevance positively influences knowledge acquisition. As it relates to the group process, homogeneity of knowledge might propel knowledge sharing. In an interesting moderating relationship, middle managers in public organizations play the role of boundary spanners by influencing how employees perceive knowledge relevance within the work group.

The institutional perspective is a new paradigm of increasing interest in knowledge management scholarly circles (Geels, 2004; Newell, Robertson, Scarbrough and Swan 2009; Rashman, Withers and Hartley, 2009). Since institutional theory emphasizes cognition, it is of high relevance to the study of knowledge sharing (Currie

and Suhomlinova, 2006; Scott, 2008). Currie and Suhomlinova (2006) argue that institutional forces that are regulatory, normative and culturally cognitive can enhance or inhibit knowledge sharing. On the one hand, isomorphism enables "similarities in organizational structures, processes, and mental models" that are conducive to knowledge sharing (Currie and Suhomlinova, 2006, p. 4). This argument has also been prominently advanced by sociologist W.R. Scott (1994) who considers share meanings as indispensable to collective activity. On the other hand, professional groups within organizations might share different mental models leading to knowledge containment (Currie and Suhomlinova, 2006). Professionalization of the work force creates knowledge sharing boundaries through the process of knowledge compartmentalization (Rashman, Withers and Hartley, 2009, Senge, 1990). For example, even within communities of practice, experts dominate knowledge sharing interactions (Currie and Suhomlinova, 2006). In the case of the U.K. healthcare system, regulatory forces in the 1990s drove medical research and practice apart. This inhibited the U.K. NHS from becoming a learning organization where academics and practitioners would cooperate. The case study shows the necessity of moving away from the organizational level analysis prevalent in contemporary knowledge sharing research in order "to consider the embeddedness of organizational activities in a network of relationships operating in an organizational field" (Currie and Suhomlinova, 2006, p. 23).

By collectively assessing the empirical models considered above, I conclude that there is no consistent theoretical framework explaining the phenomena of knowledge sharing. Most of the studies have a small sample size from a focused sector, limiting extrapolation of the statistical inferences that are provided. Since many of the studies are

exploratory, they lack a parsimonious representation of the knowledge sharing phenomena.

The Study Research Question

From the literature reviewed, we can appreciate how management science has historically been interested in the subject of knowledge. Although the identification of knowledge-based assets has been of recent interest in the academic literature, it has pragmatically captivated the attention of managers driving organizational performance and/or competitive advantage. In public management, the knowledge management literature is not extensive but has recently received considerable attention in an attempt to leverage organizational knowledge for improved business processes and service. Leveraging organizational knowledge demands from management an ability to promote knowledge sharing among employees. To understand organizational knowledge sharing, we need a grounding theory that allows for parsimonious thinking into a complex phenomenon such as knowledge sharing. In public management, institutional theory provides a lens to better understand knowledge management in U.S. federal agencies. The knowledge management field has not produced much research linking knowledge sharing to institutional forces that are regulatory, normative and culturally cognitive (Currie and Suhomlinova, 2006; Newell, Robertson, Scarbrough and Swan, 2009). Therefore, the study proposes a research question that takes into consideration the opportunity to develop an empirical model around institutional theory to understand knowledge sharing in organizations.

Knowledge sharing mechanisms is the focus of the research question. In articulating the research question, I followed certain characteristics from Creswell

(2009): Open-ended question, single focus to explore in detail, directional verb, specifies the participants and the research site, positions the independent variable first and concludes with the dependent variable. Therefore, the research question to be explored in detail for this study is:

> *"How do U.S. federal agencies institutionalize knowledge sharing within the bureaucracy?"*

The scope of the research question should be of interest to academics in public management. It is important to understand knowledge sharing behavior if we want to increase cooperation that contributes to organizational effectiveness at U.S. federal agencies.

Appendix 2.1 Empirical Studies in Knowledge Sharing

Research Study	Theoretical Model	Measurement of DV	Sample Size	Research Design	Research Methodology	Knowledge Sharing Factors
Sveiby and Simons (2002)	Culture Theory narrowed to collaborative climate.	Survey item addressing collaborative climate.	8,277	Expert panel and survey	Factor analysis, experimental testing, categorical data analysis (ANCOVA)	Collaborative climate (organizational culture, immediate supervisor, employee attitude, work group support)
Connelly and Kelloway (2003)	Broadly Organizational Citizenship Behavior (OCB)	5 survey items addressing knowledge sharing culture.	126	Survey	Multivariate regression	Organizational factors (management's support, culture, organization's size, technology) and individual factors (age, gender, organizational tenure)
Taylor and Wright (2004)	Broadly defined as culture and information infrastructure of the organization.	Survey item measuring effective knowledge sharing.	132	Informant interviews, observation, document analysis, case study, survey	Factor analysis and multivariate regression	Open leadership climate, information quality, satisfaction with change processes, learning from failure, a vision for change, performance orientation
Currie and Suhomlinova (2006)	Institutional Theory	Qualitative interviews supplemented by documentation addressing knowledge sharing in organizations.	NA	Case study	Content analysis of interviews and documents	Regulatory, normative and cultural-cognitive

Research Study	Theoretical Model	Measurement of DV	Sample Size	Research Design	Research Methodology	Knowledge Sharing Factors
Kim and Lee (2006)	Broadly defined as employee knowledge-sharing capability.	3 survey items addressing knowledge sharing capabilities.	322	Interview, survey	Factor analysis and multivariate regression	Culture, structure (includes incentives), information technology
Yang and Chen (2007)	Resource-Based View of the Firm	7 survey items addressing knowledge sharing behavior.	256	Survey	Factor analysis and multivariate regression	Organizational knowledge capability, cultural knowledge capability, structural knowledge capability, human knowledge capability, technical knowledge capability
Willem and Buelens (2007)	Broadly defined as coordination mechanisms in cooperative episodes.	6 survey items addressing knowledge sharing intensity and 5 survey items for effectiveness of knowledge sharing.	358	Survey	Path analysis and structural equation modeling	Formal systems, lateral coordination, informal coordination, incentives, identification, power games and trust
Yang (2008)	Individual attitudes	12 survey items measuring knowledge sharing.	499	Survey	Multivariate regression	Attitude to learning, sharing and storing.

Research Study	Theoretical Model	Measurement of DV	Sample Size	Research Design	Research Methodology	Knowledge Sharing Factors
Coleman and Perry (2011)	Broadly defined as organizational structures.	Survey item addressing information sharing effectiveness.	407	Survey	Structural equation modeling	Power games, identification, trust, lateral coordination, incentives, informal coordination, formal systems
Wang, Noe and Wang (2011)	Individual factors	Rater's overall rating of knowledge sharing quality and quantity.	100	Quasi-experiment	Hierarchical regression	Extraversion, agreeableness, conscientiousness, neuroticism, openness
Papadopoulos, Stamati and Nopparuch, (2012)	Motivation to share knowledge	Survey item: I will share knowledge using blog.	175	Survey	Path analysis and multivariate regression	Social influence factors: subjective norm, social identity, group norm Technology acceptance factors: perceived usefulness, perceived ease of use, perceived enjoyment Social cognitive factors: self-efficacy, personal outcome expectation, altruism
Richard and Duxbury (2014)	Absorptive capacity	Survey items measuring knowledge acquisition.	179	Survey	Hierarchical linear modeling	Amount of individual prior knowledge, common knowledge among group members, managerial practices, perceptions of knowledge applicability

Chapter 3: Theoretical Model, Hypotheses and Research Design

> "Is there a law of civilizations which imposes upon them a common direction or, at least, a common goal, and, consequently, a law of increasing resemblances, even without imitation?"
>
> Gabriel de Tarde, The Laws of Imitation, 1903

Overview

This study takes institutional theory (North, 1990; Williamson, 1975; 1985; 1994; Scott and Meyer, 1994; Scott, 1987; 2014) as grounding framework to understand knowledge sharing in U.S. federal agencies. Public Administration scholars Frederickson, Smith, Larimer and Licari (2011, p. 67) have said that the field has "broadly accepted institutionalism is emerging." Institutionalism is not viewed as a theory but rather a framework, where language and a set of assumptions guide empirical research and theory building in public administration (Frederickson, Smith, Larimer and Licari, 2011; Lowndes, 1996). Institutional isomorphism in the public sector is of particular contemporary interest to scholars in public management (Ashworth, Boyne, Delbridge, 2009; Currie and Suhomlinova, 2006; Frumkin and Galaskiewicz, 2004).

Institutional Framework

Institutional theory ignores the individual as sole actor and emphasizes the role of social structures or institutions as drivers of social phenomena. Institutions are the carriers of organizations in which, under their own governance structures, strategic choice and invention become the actor's role (Scott, 1994). According to Scott (1994, p. 56), three organizational elements allow for the construction of organizational forms as follows (directly quoted):

1. meaning systems and related behavior patterns, which contain

2. symbolic elements, including representational, constitutive and normative components, that are
3. enforced by regulatory processes.

North (1990, p. 4) sees institutions as rule systems: "Institutions include any form of constraint that human beings devise to shape human interaction." Another widely accepted definition is given by Friedland and Alford (1991, p. 243): "Institutions are supraorganizational patterns of human activity by which individuals and organizations produce and reproduce their material subsistence and organize time and space." Institutions exist because the very art of survival necessitates humans to deal with collective action problems and economize on cost in market type of arrangements (Scott, 1994).

The study focuses on the Executive Branch agencies of the U.S. government as a distinctive organizational field. According to DiMaggio and Powell (1983, p. 143) the concept of organizational field refers to "those organizations that, in the aggregate, constitute a recognized area of institutional life…" by participating in a common meaning system defined by symbolic processes and/or common regulatory processes (Scott, 1994; 2014). The professions and agents of the State mainly drive rationalization processes in organizational fields (Scott, 1994). In the tradition of organizational fields, institutionalization through rationalization processes have been of interest to sociologists at least since the late 1970s (DiMaggio and Powell, 1983; Meyer and Rowan, 1977; Tolbert and Zucker, 1983).

The study of organizational practices using an institutional perspective is not new. Scott and Meyer (1994) analyzed the rise of employee training programs in firms and agencies using an institutional perspective. Two institutional arguments were advanced

by these researchers: First, the State and professional associations create legal requirements and professional ideologies that make employee training necessary and rational. Second, institutional processes operate to diffuse beliefs in the desirability of employee training. A similar set of arguments can be made of knowledge management when studied at the organizational field level of the U.S. federal government.

As organizational fields become highly structured resulting from coercive, mimetic or normative forces, the administrative structures within those organizations could become more similar or isomorphic over time (DiMaggio and Powell, 1983). Knowledge management adoption in the U.S. federal government provides a strong case of institutional isomorphism given the cross-agency networks driven by the professional practice of knowledge management. The literature advances the concept of *institutional isomorphism* to explain how organizations become similar through their adaption to technical pressures and societal forces (Boxenbaum and Jonsson, 2008). Isomorphism takes place when organizations and other institutions become similar or identical to each other in form (Rainey, 2009). Isomorphism processes also provide the argument for legitimization. Deephouse and Suchman (2008, p. 55) states that "The more numerous the adopters of a practice, the more widespread its acceptance and the greater its legitimacy." When administrative practices become widely adopted, one witnesses the isomorphic processes within institutions.

An early precursor of institutional isomorphism as an organizational theory, Weber described how the 'iron cage of rationality' and competitive forces in society pressure organizational bureaucracies towards similarity in structure and action (Boxenbaum and Jonsson, 2008). A common view is that efficiency-seeking adaptation

leads to isomorphism as organizations search for rationalized administrative methods (Boxenbaum and Jonsson, 2008). In this respect, administrative practices surface to address what is perceived as an administrative inefficiency and are believed to address such inefficiencies. In groundbreaking work, DiMaggio and Powell (1983) argued that although competitive forces initially lead to organizational structuration, the State and the professions have become the great rationalizers of contemporary institutions. They further articulated three mechanisms that help explain the adoption of similar structure and practices in organizations: 1) Coercive isomorphism stemming from political influence and the problem of legitimacy; 2) Mimetic isomorphism resulting from standard responses to uncertainty; and 3) Normative isomorphism relating to the forces of professionalization. It is also asserted that administrative practices have the potential of being diffused, furthering the process of institutional isomorphism. U.S. federal agencies might be subject to diffusion pressures arising from legal mandates, peer pressure across agencies, or internal professional networks (Boxenbaum and Jonsson, 2008).

As posed by Heugens and Lander (2009), an important institutional theory debate revolves around the question of whether managers adopt similar managerial practices for legitimacy or for performance enhancing reasons. Upon a review of the literature on organizational performance, they concluded that a "key managerial task" is the striking of a balance between legitimacy and performance. As studied by Tolbert and Zucker (1983), civil service reform is a good example of this pattern of adoption as it relates to an organizational field. Initially, the reform was driven by administrative government needs. Later adoption, however, related to the legitimization needs of the structural form of municipal administration.

The adoption of knowledge management techniques in U.S. federal agencies results from its authorization under the Code of Federal Regulations (CFR), which represents administrative law. The codification of knowledge management in the federal government is a significant public management event as it uses the power of administrative law to establish a strategic initiative. The relevance of Institutional Theory is that, through the vigor of administrative law, knowledge management strategy represents a means for agency and control for the successful achievement of strategic aims. Within the U.S. federal government, the Office of Personnel Management (OPM) has taken the greatest role in the institutionalization of knowledge management practices as authorized by the CFR (Georgieff, 2013). Scott and Meyer (1994) argue that there are "institutional agencies" that affect "institutional processes." Accordingly, "These agents have the capacity to generate and enforce more general symbolic frameworks – both cognitive and normative belief systems – having the power to shape organizations … Organizations are rewarded for conforming to requirements generated by such actors irrespective of whether they support improved performance" (p. 247 -248).

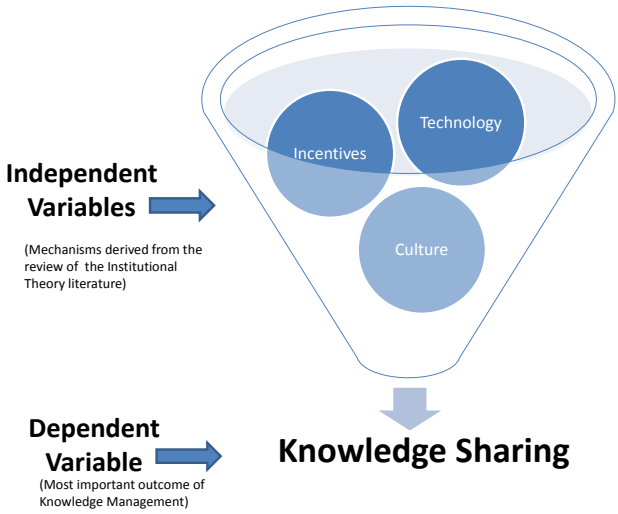
Federal agencies are an ideal context to study knowledge sharing using an institutional framework given the authorized nature of the process in accordance to the CFR. Such regulation provides the rationalization for institutionalizing knowledge management in U.S. federal agencies. Following institutional theory, *Institutionalization* "is the process by which a given set of units and patterns of activities come to be normatively and cognitively held in place, and practically taken for granted as lawful (whether as a matter of formal law, custom, or knowledge)" (Meyer, Boli and Thomas, 1994, p. 10). If we claim that knowledge management policy in the federal government

has institutionalization characteristics, then, we beg the question of which mechanisms within the agency will achieve such ends.

Theoretical Model

Figure 3.1 illustrates a theoretical model that follows on the tradition of institutional research in that a complex phenomenon is reduced to a limited number of fundamentals to be empirically tested (Groenewegen, Spithoven and van den Berg, 2010). In studying the phenomena of knowledge sharing at the U.S. federal level, I use culture, incentives and technology as independent variables representing institutional structures of rules and routines (Scott, 1994) measured for a diverse set of U.S. federal agencies.

Figure 3.1: Institutionalization of Knowledge Sharing



Mechanisms in the Institutionalization of Knowledge Sharing

I theorize that there are three institutionalization mechanisms within U.S. federal agencies that are used to promote the behavior of knowledge sharing: culture, incentives and technology. As previously stated these are mechanisms of rules and routines that are grounded in the framework, language and assumptions found in the work of institutional

theory scholars. From an organizational field perspective, these mechanisms form the "Institutionalization of Knowledge Sharing" framework which I have used in this study. McAdam, Tarrow and Tilly (2001, p. 24) define mechanisms as "delimited class of events that alter relations among specified sets of elements in identical or closely similar ways over a variety of situations." The importance of mechanisms in institutional theory is that they "focus attention on how effects are produced" (Scott, 2014, p. 144). Although in institutional theory mechanisms are often presented at the society level of analysis (Groenewegen, Spithoven and van den Berg, 2010; Scott, 2014), studying mechanisms at the organizational field level of analysis allow for managers and policy-makers to better understand empirical claims in order to improve the managerial and policy-making practice. Below, I provide an overview of each mechanism's role within the framework.

Culture

Culture is a central mechanism for the institutionalization of knowledge sharing. According to Geertz (1973, p. 12), "Culture consists of socially established structures of meaning." Culture as an institutional mechanism represents the "ideas and values" of the organizational field (Meyer, Boli and Thomas, 1994). Within institutional theory, culture has an ontological character. It assigns "reality to actors and action, to means and ends; and it has a significatory aspect, endowing actor and action, means and ends, with meaning and legitimacy" (Scott and Meyer, 1994, p. 17). Furthermore, the institutional framework views culture narrowly as institutional rules that encompass ideas and values but completely separate from material interests and action (Kasper and Streit, 1998; Scott and Meyer, 1994). Despite the seemingly narrow focus that culture takes within

institutional theory, Scott (2014) has recently dwelt on the sociological work done on culture and its implication for institutional theory. Relevant to this study, culture is a driver of institutional change as it relates to the adoption of knowledge sharing practices within a federal agency. Consequently, organizational culture is a major mechanism for knowledge sharing (De Long and Fahey, 2000; Sveiby and Simons, 2002). The implementation of knowledge management practices "almost always require a cultural change" (Dalkir, 2011, p. 232). Adapting De Long and Fahey (2000) four-part framework, we can make a number of assertions linking culture and knowledge within a federal agency environment:

1. What knowledge is important in a federal agency is shaped by values and norms.
2. Culture dictates what knowledge belongs to the agency and what knowledge remains in control of the individual.
3. Agency's culture establishes the context for social interaction.
4. Culture shapes the process by which new knowledge is created, legitimated, and shared within the agency.

Incentives

Incentives are salient in institutional economics as they are a motivating force in social life (Scott, 2014). As it relates to organizations, pecuniary and nonpecuniary incentives are designed by managers to promote "correct motivation to work toward a shared goal" (Groenewegen, Spithoven, and van den Berg, 2010, p. 39-40). Incentives, when used appropriately, can motivate knowledge sharing behavior. Dalkir (2011, p. 309) defines incentive as "a reward or some form of positive feedback given when a desired behavior is exhibited." Empirically, incentives for knowledge sharing has been deemed necessary for promoting knowledge sharing behavior within organizations (Bartol and Srivastava, 2002; Kim and Lee, 2006; Willem and Buelens, 2007). Bontis

(2007, p. 161) argues that, "the institutionalization of government [knowledge management] practices needs to be accompanied by the elimination of managerial constraints and the development of performance-based reward systems." Incentives are classified based on the different ways we can motivate the agent to pursue an action (Dalkir, 2011). Callahan (2004) developed a useful taxonomy for incentive using three broad classes (directly cited from Dalkir, 2011, p. 436):

- Remunerative incentives (or financial incentives) exist where an agent can expect some sort of material reward in exchange for acting in a particular way.

- Moral incentives are said to exist where a particular choice is widely regarded as the right thing to do, as particularly admirable, or where the failure to act in a certain way is condemned as indecent. A person acting on a moral incentive can expect a sense of self-esteem, approval, or even admiration from her community; a person acting against a moral incentive can expect a sense of guilt, condemnation, or even ostracism from the community.

- Coercive incentives are said to exist where a person can expect that the failure to act in a particular way will result in physical force being used against him or her (or her loved ones) by others in the community – for example, by punishment, imprisonment, firing, or by confiscating or destroying their possessions.

Incentives in institutional theory include both rewards and sanctions for not performing the intended behavior. Typically, incentives play a large role in institutional theory where is often presented using the principal-agent context (Scott, 2014). Incentives provide inducement for agents to conform to a principal's condition (Scott, 1987). However, more recent work by Scott (2014, p. 147) shows that some scholars are embracing the normative pillar rather than emphasizing incentives as a motivating force in social life within organizations:

> "If the increasing returns argument privileges the role of incentives, then the commitment argument highlights the role of *identity*: Who am I (or who are we), and what is the appropriate way for me (us) to behave in this situation?"

Incentives have a normative pillar in organizations when used as mechanisms of commitment as they can be "infuse with value" (Scott, 2014; Selznick, 1957).

Technology

In institutional theory, technologies are considered artifacts subject to structuration in that the same technology might provide different effects on the practice of its use (Scott, 2014). We can view technology as a material artifact influencing knowledge sharing behavior. Ciborra (1996), in what could be considered seminal writing, associated technology with knowledge sharing in organizations. New technologies have changed the way in which we share information. The influencing results from the ability of technology to accommodate social structure and human agency while reducing the cost of knowledge sharing (Scott, 2014). Technology can lower barriers to knowledge sharing by cutting through spatial, temporal and functional boundaries (Coleman and Perry, 2011; Hayes, 2011; Roberts, 2000). Furthermore, it allows for efficiency by lowering the cost of acquisitions and retrieval of information (Coleman and Perry, 2011; Hendriks, 1999).

However, adoption of technology that supports knowledge sharing is often "driven by social pressure for legitimacy and not simply by their efficiency in solving problems" (Newell, Robertson, Scarbrough and Swan, 2009, p. 59). This study explores how the institutionalization of knowledge sharing through technology is impacted by isomorphism within an organizational field (Hayes, 2011). An example of this can be found in the Enterprise Architecture initiatives promoted as a major push within U.S. federal agencies for knowledge sharing through shared service platforms and web-based services. McNabb (2006) defines Enterprise Architecture as the term used to identify

information technology that encompasses the entire organization and not only its component parts. McGee and Prusak (1993) further assert that information architecture was first used in the 1980s to refer to an enterprise-wide model for all data creation and movement in an organization (McNabb, 2006). Enterprise Architecture aims to transfer 'best practices' across the organization by embedding knowledge in a software package. However, the effort might fail when "the definition of 'best practice' is a socio-political process of negotiation, rather than an objective reality" (Newell, Robertson, Scarbrough and Swan, 2009, p. 150).

Research Propositions

Based on the theoretical grounding of the model as presented in Figure 3.1, the following hypotheses are offered:

> H1: Culture, incentives and technology influence the institutionalization of knowledge sharing behaviors in federal agencies.
>
> H2: Knowledge sharing behaviors are influenced by the cultural orientation of federal agencies.
>
> H3: Knowledge sharing behavior in federal agencies increases with incentives.
>
> H4: Knowledge sharing behavior in federal agencies increases with the adoption of technology.

Below, I present a table showing each predictor variable and the expected direction of the empirical relationship based on prior studies.

Table 3.1 Predictor Variables: Knowledge Sharing Relationship Direction from Prior Studies

Culture	**Incentives**	**Technology**
Kim and Lee (2006): + Sveiby and Simons (2002): + Connelly and Kelloway (2003): +	Kim and Lee (2006): + Willem and Buelens (2007): + Coleman and Perry (2011): +	Connelly and Kelloway (2003): - Kim and Lee (2006): +

Research Methodology: Sample, Data, Measurement and Analysis

I present a mixed methods study that relies on non-experimental research procedures that include survey analysis, subject matter expert meetings and public archival research. According to Riccucci (2010, p. 109), mixed methods or triangulation is particularly applicable to applied fields given that it offers "flexibility in efforts to find solutions to practical, real-world problems." This study does not establish causality but associations between variables of interest following a theory-grounded, situational, feasible, redundant and efficient design (Kline, 2009).

Given the number of documents in the public domain, U.S. federal government initiatives in knowledge management are conducive to public archival research. Some of the documents I rely on are strategic plans, memorandums, magazines, on-line newsletters and professional blogs. To support quantitative research, I rely upon survey and operational data analysis.

For the survey analysis, I use the 2012 Employee Viewpoint Survey (EVS) directed by the Office of Personnel Management (OPM). The survey consists of 98 items including 14 demographic questions and 84 items measuring perceptions about how effectively agencies manage their workforce (OPM, 2013). Most items have a Likert-scale of six responses: Strongly Agree, Agree, Neither Agree nor Disagree, Disagree, Strongly Disagree and No Basis to Judge/Do Not Know. Due to time and resource limitations for the study, the survey analysis focuses on the 15 cabinet level agencies (also known as the Executive Branch departments). Appendix 3.1 provides a list of the Executive Branch departments with information regarding their scope of activities.

The 2012 EVS survey has lately received increased attention in academic research (Caillier, 2013; Fernandez and Moldogaziev, 2013; Ko and Hur, 2014; Mahler, 2012). The EVS is a general-purpose opinion survey of federal employees within 82 agencies as of 2012. It is a self-administered survey available to the whole employee population within the agency. An important dimension of the survey is the Human Capital Assessment and Accountability Framework (HCAAF) used by the federal government and discussed earlier in this document. One of the focuses of the framework is knowledge management. Even though I did not take part in the design of the survey, I have familiarized myself with the data collection design through available information on the actual survey from OPM and the U.S. government criteria for statistical surveys (OMB, 2006). Since general-purpose surveys cannot possibly include all the questions that are relevant to future researchers, building an appropriate model that includes relevant variables is a challenge (Lee and Forthofer, 2005).

In addition to the EVS, the model relies on operational data from the IT Dashboard. The IT Dashboard is a publicly available web based resource that provides the public with information about the operations and performance of IT investments in the U.S. federal government[3]. Specifically, this study obtains data from the 2013 Federal IT Spending Budget downloaded from the IT Dashboard website.

Research Design: Sample and Data

Sample

Public Archival: To produce a sample of public records, I conducted an open Internet search on subject matter experts, as necessary, to provide official documents. I

[3] Refers to the web address https://www.itdashboard.gov/ as accessed July 6, 2014.

conducted archival research online and in professional magazines and newsletters for potential knowledge management documents related to the U.S. federal government.

Survey: The EVS survey was administered in April 2012 (OPM, 2013) via email to full-time and part-time permanent employees of 82 federal agencies, 37 departments and 45 independent agencies. The overall response rate for the survey was 46.1% (n = 687,687). The strong response rate provides a representative sample of the federal employee population that will lead to confidence in the empirical results. The original survey uses weights to represent the demographic characteristics of the federal employee population. Since I am only focusing in the cabinet level agencies rather than the entire survey sample, the statistical model presented is unweighted.

Subject Matter Expert Meetings: Experts consisted of employees and consultants to the federal government willing to be informants of knowledge management strategy in the U.S. federal government. The sample size reflects the recruiting success of the research project.

Data

Public Archival: Public records included strategic plans, memorandums and documents written by subject matter experts. As stated earlier, source documents also included articles in professional magazines, as well as, online blogs and newsletters.

Survey: The data structure of the 2012 EVS is simple since there is only one sampling level, the federal agency. The federal agencies or entities play the role of clusters from where the employee sample is drawn. In this cross-sectional design survey, two data units have the potential for analysis: agencies and employees. Although the survey micro data is cleaned, there are missing values attributed to non-response and "Do

not Know" items. Since the EVS survey has multiple purposes, the study focuses on a few questions relevant to the theoretical model.

Subject Matter Expert Meetings: I produced a meeting and interview protocol that follows theoretical implications of the study and agency specific informational inquiry on knowledge sharing strategies.

Measurement

In describing the theoretical model, I have identified and defined the variables of interest. Using the EVS, I show below the survey questions or operational data that could help us with quantifying each construct or variable in the theoretical model as shown in Figure 3.1. Of particular concern is the validity of the constructs and I performed statistical test to measure both reliability and validity.

Dependent/Outcome Variable: Knowledge Sharing

Item 26. Employees in my work unit share job knowledge with each other.

Independent/Predictor Variables

A. Culture

Item 1. I am given a real opportunity to improve my skills in my organization.

Item 3. I feel encouraged to come up with new and better ways of doing things.

Item 20. The people I work with cooperate to get the job done.

Item 30. Employees have a feeling of personal empowerment with respect to work processes.

Item 31. Employees are recognized for providing high quality products and services.

Item 53. In my organization, leaders generate high levels of motivation and commitment in the workforce.

Item 54. My organization's leaders maintain high standards of honesty and integrity.

B. Incentives

Item 22. Promotions in my work unit are based on merit.

Item 24. In my work unit, differences in performance are recognized in a meaningful way.

Item 25. Awards in my work unit depend on how well employees perform their jobs.

Item 32. Creativity and innovation are rewarded.

Item 33. Pay raises depend on how well employees perform their jobs.

C. Technology

Using deductive reasoning, I developed an operational definition for technology prevalence in agencies. The prevalence of technology in the agency can be approximated by dividing 2012 IT spending by the number of employees in the agency. The resulting metric is the "IT spending per Employee" variable.

Control Variables

Item 86. What is your supervisory status?

[A] Non-Supervisor/Team Leader
[B] Supervisor/Manager/Executive

Item 87. Are you:

[A] Male
[B] Female

Item 88. Are you:

[1] Minority
[2] Non-minority

Item 90. What is your age group?

[A] Under 40
[B] 40 or older

Item 92. How long have you been with the Federal Government (excluding military service)?

[A] 10 or fewer years
[B] 11 or more years

Analysis

Given the research question, the analytic plan relies on triangulation of data collected and secondary research data. For the qualitative analysis, I performed discourse and coding analysis. For the quantitative analysis, I used logistic regression in StataMP 13 software statistical package. Prior to this study, I had no previous research experience with the EVS survey and U.S. IT Dashboard data. Therefore, the theoretical fruitfulness of the quantitative analysis with this data, given my theoretical model, was not tested in advance.

For archival documents and subject matter expert meetings, I used discourse and coding analysis techniques with the goal of "organizing the data into broader themes and issues" that will help in the validation of the theoretical model (Maxwell, 2005, p. 107). Special attention was paid to contextual issues that allow for idiosyncratic insights into knowledge management strategies that are particular to an agency. The main validity threat I foresee is within the qualitative data. It is a known fact that the public sector has the tendency to adopt management practices, such as budgeting methods, not necessarily because of proven efficacy but rather because of an accepted management norm (Pfeffer, 1982). Grounded on legitimacy reasons, an expert might react positively to the notion that knowledge sharing improves an agency's ability to achieve mission success. Such a response could also provide indications of institutionalization of knowledge management

practice in which proven results are not as relevant as the norms been institutionalized within the agency.

As previously stated, the quantitative analysis relies on the EVS survey and the U.S. IT Dashboard data. Initially, I focused on performing a preliminary analysis and exploration of data within the survey aided by StataMP 13 statistical software (Lee and Forthofer, 2005). An adequate strategy for survey analysis "maximizes theoretical fruitfulness" and allows the researcher to arrive to conclusions that are more confident. Since the hypotheses are grounded on the literature, the theory should be supported if the empirical data confirms the hypothesis (Rosenberg, 1968). Given the large sample size of the EVS survey, the quantitative analysis should provide adequate basis to test the hypotheses statements. However, empirical support from hypothesis testing in survey analysis represents a weaker confirmation than experimentation results. Through triangulation with qualitative data analysis, I was able to expand on explanations of "why" and "under what circumstances" (Rosenberg, 1968). In the process, I experienced a complex intellectual interplay between the stated hypothesis statements and findings that guided recommendations for the direction of future research (Kline, 2009; Rosenberg, 1968).

As previously stated, the available item choices within the EVS survey are ranked. Therefore, we do not know how far apart the agreement levels are. Consequently, we need a regression technique that avoids the assumption of equal-sized intervals between the response options (Frone, 1997). The *proportional odds models* are appropriate in this case. These models are interpreted using the Odds Ratio, which is a measure of relative risk.

Conclusion

This study answers the research question: *How do U.S. federal agencies institutionalize knowledge sharing within the bureaucracy?* The theoretical model anchored in institutional theory predicts that culture, incentives and technology are key mechanisms influencing the institutionalization of knowledge sharing in federal agencies. Both qualitative and quantitative research methods were used to obtain a better understanding of the institutionalization of knowledge sharing in federal agencies and to empirically verify the proposed hypotheses. Given the scarcity of research in Public Administration on knowledge management, this research contributes empirical work to the literature that hopes to not only deliver theoretical fruitfulness but also provide managerial direction to public leaders.

Appendix 3.1: Cabinet Level Departments by the Year Established by Act

Department	Year	Description
Department of Defense	**1949***	The Department of Defense is responsible for providing the military forces needed to deter war and protect the security of our country. The major elements of these forces are the Army, Navy, Marine Corps, and Air Force, consisting of about 1.3 million men and women on active duty. They are backed, in case of emergency, by 825,000 members of the Reserve and National Guard. In addition, there are about 600,000 civilian employees in the Defense Department.
Department of Justice	**1870**	The Department of Justice serves as counsel for the citizens of the United States. It represents them in enforcing the law in the public interest. Through its thousands of lawyers, investigators, and agents, the Department plays the key role in protection against criminals and subversion, ensuring healthy business competition , safeguarding the consumer, and enforcing drug, immigration, and naturalization laws.
Department of State	**1789**	The Department of State advises the President and leads the Nation in foreign policy issues to advance freedom and democracy for the American people and the international community. To this end, the Department compiles research on American overseas interests, disseminates information in foreign policy to the public, negotiates treaties and agreement with foreign nations, and represents the United States in the United Nations and other international organizations and conferences.
Department of the Treasury	**1789**	The Department of the Treasury serves as financial agent for the U.S. Government, manufacturing coins and currency, enforcing financial laws, and recommending economic, tax, and fiscal policies
Department of the Interior	**1849**	The Department of the Interior protects America's natural resources and heritage, honors our cultures and tribal communities, and supplies the energy to power our futures.
Department of Agriculture	**1862**	The Department of Agriculture provides leardership on food, agricultural, and enviromental issues by developing agricultural markets, fighting hunger and multrition, conserving natural resource, and ensuring standards of food quality through safeguards and inspections.
Department of Commerce	**1913***	The Department of Commerce promotes the Nation's domestic and international trade, economic growth, and technological advancement by fostering a globally competitive free enterprise system, supporting fair trade pratices, compiling social and economic statistics, protecting Earth's physiscal oceanic resources, granting patents and registering trademarks, and providing assistance to small and minority-owned businesses.
Department of Labor	**1913***	The Department of Labor promotes the welfare of job seekers, wage earners, and retirees by improving working conditions, advancing opportunities for profitable employment , protecting retirement and health care benefits, matching workers to employers, strengthening free collective bargaining, and tracking changes in economic indicators on a national scale. The Department administers a variety of Federal labor laws to guarantee workers' rights to fair, safe, and healthy working conditions, including minimum hourly wage and overtime pay, protection against employment discrimination, and unemployment insurance.
Department of Health and Human Services	**1953**	The department of Health and Human Services works to strengthen the public health and welfare of the American people by providing access to affordable, quality health care and childcare, ensuring the safety of food products, preparing for public health emergencies, and improving research efforts to diagnose, treat, and cure life-threatening illnesses.
Department of Housing and Urban Development	**1965**	The Department of Housing and Urban Development is the principal Federal agency responsible for programs concerning th Nation's housing needs, fair housing opportunities, and improvement and development of the Nation's communities.
Department of Transportation	**1966**	The Department of Transportation establishes national transportation policy for highway planning, and construction, motor carrier safety, urban mass transit, railroads, aviation, and the safety of waterways, ports, highways and pipelines.
Department of Energy	**1977**	The Department of Energy's mission is to advance the national, economic, and energy security of the United States; to promote scientific and technological innovation in support of that mission; and to ensure the enviromental cleanup of the national nuclear weapons complex.
Department of Education	**1979**	The Department of Education establishes policy for, administers and coordinates most Federal assistance to education. Its mission is to ensure equal access to education and to promote educational excellence throughout the Nation.
Department of Veterans Affairs	**1988**	The Department of Veterans Affairs operates programs to benefit veterans and members of their families. Benefits include compensation payments for disabilities or death related to military service; pensions; education and rehabilitation; home loan guaranty; burial; and a medical care program incorporating nursing homes, clinics, and medical centers.
Department of Homeland Security	**2002**	The Department of Homeland Security leads the unified national effort to secure America. It will prevent and deter terrorist attacks and protect against and respond to threats and hazards to the Nation. The Department will ensure safe and secure borders, welcome lawful immigrants and visitors, and promotes the free flow of commerce.

Source: United States Government Manual, 2013

*** Redesignation by act**

Chapter 4: Quantitative Analysis and Findings

Overview

As stated in Chapter 3, the purpose of the quantitative techniques for this study is to test the three mechanisms available to leaders in U.S. federal government agencies for furthering the institutionalization of knowledge sharing: culture, incentives, and technology. As I demonstrated, these mechanisms are prevalent within the institutional theory literature. The empirical model seeks to explain to what extent an employee's positive attitude towards an organization's culture and incentives and the organizational proliferation of technology affects his or her perceptions on whether or not knowledge is shared within his/her work unit. Knowledge sharing is a complex social phenomena generally viewed as a positive behavior within organizational life. The empirical model presented in this chapter attests to the complexity of the phenomena of knowledge sharing. First, I provide an overview of the data structure. Second, I present general and demographic statistics of the survey sample. Then, I provide scales for each of the two independent latent variables and data for the observed independent variable. Finally, statistical models are presented to enlighten our understanding of the hypothesized relationships as follows:

> H1: Culture, incentives and technology influence the institutionalization of knowledge sharing behaviors in federal agencies.
>
> H2: Knowledge sharing behaviors are influenced by the cultural orientation of federal agencies.
>
> H3: Knowledge sharing behavior in federal agencies increases with incentives.
>
> H4: Knowledge sharing behavior in federal agencies increases with the adoption of technology.

Data Structure: Informant Perceptions and Operational Data

As stated in Chapter 3, I rely on the 2012 EVS survey administered by OPM. The EVS looks for employees perceptions of their work environment, which is subjective data. I use the information shared by these employees, who are performing the role of informants in the analysis. Throughout the analysis, I look at how federal employees' perceptions of knowledge sharing could be predicted using latent and observed variables. Perceptions are reconstructions of reality through the observations and values of other people (Dunn, Seaker and Waller, 1994).

While the technology variable in the model relies on directly observable data, the theoretical model also includes culture and incentives as latent variables that need to be measured in order to test the research propositions. The EVS data is conducive to using latent variables due to the ability to specify a number of items relating to the predictors we would like to capture in our theoretical model. A latent variable is defined as "an unobserved entity presumed to underlie observed variables" (Kerlinger, 1986, p. 37). Two of our institutionalization mechanisms are unobserved variables: culture and incentives. In order to operationalize the measures, we use a subset of questions from the EVS. The aim is to build a scale for each latent variable, using the individual items, in order to obtain a more parsimonious measurement of the predictive phenomena under consideration. Theoretically, these scales are limited by the secondary data available from the EVS instrument developed by the U.S. government within the Office of Personnel Management (OPM). A focus on addressing empirical concerns for the theoretical model presented in Chapter 3 will drive our inductive approach in the construction of the scales for each of the latent variables.

Survey Sample: General and Demographic Statistics

Table 4.1 summarizes the number of participants and response rates for the Executive Branch departments. As shown in the table, our sample consists of 594,579 employees of the Executive Branch departments. The highest response rate at 65% was obtained by the Department of Education, while the lowest response rate at 31% was obtained by the Department of Veteran Affairs. Over 50% of participants are employees of either the Department of Homeland Security or one of the four elements of the Department of Defense. The overall response rate for the Executive Branch departments is 44%, just two points below the response rate for the original survey sample.

Table 4.1: Executive Branch Departments Survey Participation Summary

Agency	Element	# of EVS Participants	# of Employees*	Response Rate	% of All Participants*
Department of Homeland Security	HS	82,218	176,813	47%	14%
United States Department of the Army	AR	77,948	227,918	34%	13%
United States Department of the Navy	NV	67,604	171,149	40%	11%
United States Department of the Air Force	AF	61,907	152,106	41%	10%
Department of the Treasury	TR	54,890	92,407	59%	9%
Department of Agriculture	AG	42,569	74,945	57%	7%
Department of Justice	DJ	35,023	93,895	37%	6%
Department of Health and Human Services	HE	29,146	59,603	49%	5%
Department of the Interior	IN	27,287	51,388	53%	5%
Department of Transportation	TD	25,892	41,560	62%	4%
DoD Fourth Estate	DD	25,003	58,831	43%	4%
Department of Commerce	CM	19,872	33,911	59%	3%
Department of Veterans Affairs	VA	13,303	43,052	31%	2%
Department of State	ST	10,379	21,668	48%	2%
Department of Labor	DL	7,653	15,429	50%	1%
Department of Energy	DN	6,467	13,672	47%	1%
Department of Housing and Urban Development	HU	4,741	8,303	57%	1%
Department of Education	ED	2,677	4,131	65%	0%
Total		**594,579**	**1,340,783**	**44%**	**100%**

Source: Employee Value Survey, 2012

* Denotes a calculated figure based on information from the EVS, 2012

Table 4.2 shows the item wording for the dependent variable along with a general demographics breakdown.

Table 4.2: Dependent Variable with Demographics Information

Item 26. Employees in my work unit share job knowledge with each other.

n = 594,579 Scale	Supervisor	Female	Minority	Age 40 or older	Tenure 11 or more years
Strongly Agree	25%	21%	20%	21%	21%
Agree	56%	49%	49%	51%	52%
Neither Agree nor Disagree	11%	14%	16%	14%	14%
Disagree	5%	9%	8%	8%	8%
Strongly Disagree	3%	6%	6%	5%	5%
Missing Values	0%	1%	1%	1%	1%
Total for Demographic Category	116,028	234,300	178,785	426,446	298,603
Total as a % of all Participants	20%	39%	30%	72%	50%
P-value*	0.000	0.000	0.000	0.000	0.000

* P-value is based on chi-square test (4 d.f.).

The demographics breakdown relies on the control variables in our model and highlights the following important employee patterns in the sample within the Executive Branch departments:

- 20% of the employees are supervisors
- 39% are female employees
- 30% are minority employees
- 72% are employees that are at least 40 years old
- 50% of the employees within the sample have been in the federal government for at least 11 years

In addition, I performed a chi-squared test on the demographic categories under consideration. The chi-square "tests for a correlation or association between two (or more) categorical variables" (Pfeifer, 2006). At the highest statistical confidence level of $p < 0.001$, the degree of agreement that knowledge is shared within the work unit depends on the demographic category under consideration.

Table 4.3 shows employee's responses to Item 26, our dependent variable, by the fifteen Executive Branch agencies.

Table 4.3: Dependent Variable Employee's Responses by Agency

Item 26. Employees in my work unit share job knowledge with each other.

Agency	Positive Responses	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree	Total Respondents
Department of Defense (1)	72%	5%	8%	15%	52%	20%	230,549
Department of Agriculture (2)	72%	5%	8%	15%	54%	18%	42,243
Department of Commerce (3)	75%	4%	7%	14%	53%	23%	19,656
Department of Justice (4)	72%	5%	8%	15%	51%	21%	34,682
Department of Labor (5)	74%	6%	8%	13%	50%	24%	7,575
Department of Energy (6)	74%	5%	8%	13%	52%	22%	6,429
Department of Education (7)	75%	6%	7%	12%	50%	25%	2,655
Department of Health and Human Services (8)	71%	5%	9%	14%	49%	22%	28,843
Department of Homeland Security (9)	69%	6%	9%	16%	52%	17%	81,641
Department of Housing and Urban Development (10)	71%	7%	9%	13%	48%	23%	4,707
Department of the Interior (11)	71%	5%	9%	15%	51%	19%	27,059
Department of State (12)	77%	3%	6%	13%	53%	24%	10,288
Department of Transportation (13)	75%	4%	7%	14%	52%	22%	25,686
Department of the Treasury (14)	82%	3%	5%	10%	50%	32%	54,459
Department of Veterans Affairs (15)	71%	6%	8%	15%	51%	20%	13,196
Total	73%	5%	8%	14%	52%	21%	589,668
P-value*	0.000						

Note: Excludes "Do not know" responses.
*P-value is based on chi-square test (56 d.f.).

As shown in the table, the highest positive responses were received by the Department of the Treasury at 82%, while the lowest positive responses were received by the Department of Homeland Security at 69%. As for the demographic categories, I performed a chi-square test of association. At the highest statistical confidence level of $p < 0.001$, the degree of agreement that knowledge is shared within the work unit depends on the agency under consideration.

Measurement of Latent Predictors: Culture and Incentives

Using a theoretical model that is well grounded in the literature, I have specified a priori the relationship between certain items measured in the EVS questionnaire and each construct (Suhr, 2006). As it relates to culture, I selected from the EVS questionnaire certain items reflecting the agency's ability to remain a learning organization, spur innovation, promote cooperation, empower employees, strive for quality, and retain a strong leadership and ethical environment. As it relates to incentives, the EVS items

selected measure the perception of merit pay and rewarding creativity and innovation. Merit has been fundamental to the history of the U.S. civil service system (Brook, 2000). However, merit pay in the civil service continues to be a paradoxical proposition within the academic literature (Kellough and Lu, 1993; Weibel, Rost and Osterloh, 2010).

Culture and incentives in the U.S. federal government can certainly be measured along dimensions that are more expansive. However, the EVS reflects those aspects strategically valued within the U.S. federal government workforce in order to ensure that the agency's accomplishes its congressionally mandated mission. Although the items measured by the survey might theoretically limit content validity, the scales adequately reflect culture and incentives aspects strategically valued within the U.S. federal bureaucracy. In addition, the areas of culture and incentives covered within the scales are recurrent themes within the public administration literature providing, in this way, substantive validity. In Appendix 4.1 and 4.2 at the end of the chapter, I provide a summary of the EVS items included in the culture and incentive scale, respectively, as well as a summary of the statistical output of the tests I performed to validate the scales.

Relevant to the measurement models is the scale reliability, which refers to the internal consistency of the survey items I used to measure the latent variables. I test in Stata the reliability of the potential scale items using Cronbach's Alpha. The Cronbach's Alpha, also known as the "scale reliability coefficient," increases as the inter-correlation among the measured items increase. We are looking for a set of items that vary together statistically with a coefficient of at least 0.70 (Dunn, Seaker and Waller, 1994; Nunnally, 1978). As shown within Appendix 4.1 and 4.2, the items included in the culture and

incentives scales have a strong reliability when we consider each respective scale's Cronbach's Alpha of 0.90.

For building the culture and incentives scale, I used principal factors analysis in Stata to measure the unidimensionality of the potential scale items. We would like to know whether only one factor accounts for the variance in the correlation of a scale (Hurley, Scandura, Schriesheim, Brannick, Seers, Vandenberg and Williams, 1997). The first Stata output is the unrotated principal factors. Following the Kaiser convention of retaining factors with eigenvalues equal or greater than one, the results attest to one factor estimate for both the culture and incentives scale items. This test of unidimensionality supports the construct validity of the measurement model for each scale. I followed the principal factors analysis with an orthogonal varimax rotation to obtain precise factor loadings, which are the weights and correlations between each variable and the factor[4]. The higher the load the more relevant the survey item is in defining the factor's dimensionality.

We are now ready to develop the scales, which measure agency's culture and incentives as perceived by the federal employees who completed the 2012 EVS survey. To do this we will estimate scales based on the factor score using the regression method. The factor score is a standardized value with a mean of 0 and a standard deviation of 1. In this case, the factor score is an appropriate methodology as it facilitates comparison among the predictor variables and helps with missing responses found in the survey items. In addition to this, an advantage of a factor score over the mean or total score

[4] Torres-Reyna, Oscar. Getting Started in Factor Analysis (using Stata). Available at http://dss.princeton.edu/training/Factor.pdf

methodology is that the factor score weights each of the items differently, based on how central it is to the factor.

Measurement of Observed Predictor: Information Technology

Our observed predictor variable is information technology. For our theoretical model, we are interested in measuring the impact of an agency's investment in information technology on employee's perceptions of knowledge sharing. In order to obtain federal IT investment figures, I relied on the U.S. IT Dashboard. The IT Dashboard is a publicly available web based tool that provides information on federal agency's IT investments. In 2009, an Open Government Directive called upon the Chief Technology Officer and Chief Information Officer to create an Open Government Dashboard. That same year the IT Dashboard was launched as part of the effort to create a more transparent reporting on information technology investments in the federal government. According to the website, the IT Dashboard provides the public and agency leaders with unprecedented visibility of ongoing IT projects. The platform is the authoritative source of IT performance reporting across the federal government.

Given that the agency's employee provides the survey data, the ideal predictor variable should also reflect the agency's IT investment per employee. As illustrated in Table 4.4 below, I obtained from the 2013 IT Dashboard the 2012 IT investment figures for the Executive Branch agencies and calculated a per employee figure based on the number of employees within each one of the agencies. According to the table, the Department of Education invested the most per employee at $135,000 while the Department of the Interior invested the least at $20,000.

Table 4.4: 2012 Information Technology (IT) Investments for Executive Branch

Federal Agency	Invesment Actuals ('000)	Total Employees	Investment Per Employee ('000)
Department of Agriculture	$ 2,538,245	74,945	$ 34
Department of Commerce	$ 2,474,387	33,911	$ 73
Department of Defense	$ 35,032,133	610,004	$ 57
Department of Education	$ 556,721	4,131	$ 135
Department of Energy	$ 1,578,574	13,672	$ 115
Department of Health and Human Services	$ 7,180,650	59,603	$ 120
Department of Homeland Security	$ 5,557,802	176,813	$ 31
Department of Housing and Urban Development	$ 353,034	8,303	$ 43
Department of the Interior	$ 1,033,089	51,388	$ 20
Department of Justice	$ 2,752,755	93,895	$ 29
Department of Labor	$ 576,986	15,429	$ 37
Department of State	$ 1,374,476	21,668	$ 63
Department of Transportation	$ 2,996,398	41,560	$ 72
Department of the Treasury	$ 3,407,336	92,407	$ 37
Department of Veterans Affairs	$ 3,167,899	43,052	$ 74
Total	**$ 70,580,485**	**1,340,783**	**$ 53**

Control Variables: Supervisor, Gender, Minority, Age and Tenure

Since the predictor variables capture organizational mechanisms that could be used to promote the institutionalization of knowledge sharing, I have focused on controlling for individual factors that could mediate such relationship. In addition of being interested in data from the EVS that measures perceptions of knowledge sharing as an outcome and two of our predictors (culture and incentives), we can also rely on the demographic information that is provided by the survey. The following demographic factors included in the EVS questionnaire are of theoretical interest: Supervisory and minority status, gender, age and tenure. Connelly and Kelloway (2003) study (previously reviewed as part of the literature in Chapter 2) includes gender, age and tenure as individual factors complementing the organizational factors presented in their theoretical model. In our model, I extend the individual factors by also including minority and supervisory status as control variables. Although I found no precedent for the

supervisory status in the literature, the minority status has been of interest to scholars that study the knowledge sharing phenomena (Wang and Noe, 2010).

Predictive Model for Knowledge Sharing in the Federal Government

The data or item choices provided in the survey for the dependent variable are ranked. Therefore, we do not know how far apart the agreement levels are. We need to rely on statistical methods that allow for ordinal data analysis. My interest is in modeling the likelihood of U.S. federal government employees agreeing that knowledge is shared within their work unit based on a series of predictors I theorize to play an influential role in the institutionalization of knowledge sharing. Consequently, I find that logistic regression models are appropriate in this case. When the outcome variable is ordinal, the appropriate statistical method is generally an ordered logistic regression model. This is because the ordinal regression technique avoids the assumption of equal-sized intervals between response options, which fits well with the Likert scale data commonly obtained from surveys (Frone, 1997). Ordinal regression models use the maximum likelihood estimation techniques. Maximum likelihood estimation chooses the estimates of model parameters that are most likely to give rise to the pattern of observations in the sample data (Pampel, 2000). Since the dependent variable is not normally distributed, a link function is used to "vary linearly with the predicted values (rather than assuming that the response itself must vary linearly)" (Liao, 1994). The log-odds or logit function is the most generally used since it allows for the odds ratio conversion, an intuitively appealing approach to interpret the coefficient parameters. The odds ratio is a measure of relative risk. For our model interpretation purposes, the odds ratio is the ratio of being in one categorical group to the odds of being in another categorical group.

The traditional estimation of the ordinal logit model is valid for data that meets the proportional odds assumption. Because in the traditional model the relationship between all pairs of groups is the same, there is only one set of coefficients or only one model. According to Liao (1994), an issue in the traditional estimation is whether the coefficient estimates are invariant to the thresholds. The assumption is that the effect of the predictors is constant regardless of the choice of the outcome categories. If this assumption does not hold, the traditional ordinal logit model output will provide erroneous standard errors and biased coefficients. When modeling survey data, the proportional odds assumption is often violated. Since we are particularly interested in modeling the variance in employee's attitudes, exacting the model will imply testing for the proportional odds assumption. Williams (2006) suggests running the model in Stata as an ordered logit regression and then testing the model for the proportional odds assumption.

After running the traditional model, I tested the proportional odds assumption of ordinal regression using the Brant test (Brant, 1990). As shown in the table below, the chi-square values are significant at the $p < 0.05$ level for all predictor and control variables except for the information technology variable. Therefore, we can conclude that the proportional odds assumption has been violated for all variables except the information technology (IT) variable.

Table 4.5: Results of the Brant Test of Significance

Variable	Chi2	P>chi2	df
All	8663.58	0.000	24
Culture	807.91	0.000	3
Incentives	1496.97	0.000	3
IT	6.01	0.111	3
Supervisor	560.22	0.000	3
Female	855.41	0.000	3
Minority	260.85	0.000	3
Age Group	87.55	0.000	3
Tenure	11.75	0.008	3

When the proportional odds assumption is violated, Long and Freese (2001) provides several options for modeling the data. The alternative that appears to be well fitted for the data is the partial proportional odds model (PPOM). The PPOM relaxes the proportional odds assumption and "allows the coefficients that violate the proportional odds assumption to vary across logistic equations" (Muttarak and Pothisiri, 2013). Therefore, depending on the ordinal category, the coefficients will have different effects on the outcome (Fullerton and Xu, 2012; Muttarak and Pothisiri, 2013).

Below, I show how the PPOM is statistically written as a generalized ordinal logit model (Muttarak and Pothisiri, 2013):

$$P(Y_i > j) = \mathrm{g}(\mathrm{X}\beta_j) = \frac{\exp(\propto_j + X_i\beta_j)}{1 + [\exp(\propto_j + X_i\beta_j)]} \text{ with } j = 1,2 \ldots, M-1$$

Where M is the number of categories of the ordinal dependent variable (in this case five) and β_j is unique for each j for the coefficients that the proportional odds assumption is violated otherwise $\beta_j = \beta$. In my model, the PPOM is equivalent to a series of four binary logistic regressions where categories of the outcome are combined. The dependent variable is defined as the degree to which an employee agrees that job knowledge is shared in their work unit as follows: Y1 for "Strongly Disagree", Y2 for "Disagree", Y3

for “Neither Agree nor Disagree”, Y4 for “Agree” and Y5 for “Strongly Agree”. In this case, we will have the following set of four binary models using the logistic distribution as the cumulative distribution:

- Model 1: Category Y1 contrasted with Y2, Y3, Y4 and Y5
- Model 2: Category Y1 and Y2 contrasted with Y3, Y4 and Y5
- Model 3: Category Y1, Y2 and Y3 contrasted with Y4 and Y5
- Model 4: Category Y1, Y2, Y3 and Y4 contrasted with Y5

I estimated the PPOM model in StataMP 13 using the gologit2 program with the autofit option. Gologit2 is a user written program to estimate generalized logistic regression models for ordinal dependent variables (Williams, 2006). Although the conceptual meanings of the values taken by the dependent variable are irrelevant, the program is written in such a way that larger values are assumed to correspond to “higher” outcomes (Williams, 2006). Since this logic follows the Likert style responses in the EVS, there is no need to recode the variables. For reference purposes, I have included the descriptive statistics for all the regression variables in Appendix 4.3.

As presented in Exhibit 4.1, I generated four models (or M - 1 following the model equation) using the gologit2 program in Stata in order to describe the existing relationship between the outcome and the predictors. Each model compares a lower level(s) of the dependent variable against higher level(s) of the dependent variable. As shown by the likelihood ratio chi-square test, the model is statistically significant at the $p < 0.001$ level, providing very strong support for the hypothesis that one or more beta coefficients differ from zero. We can also assess the model’s Pseudo R-squared, which at 0.15 is considered respectable. Overall, we can appreciate the difficulty of isolating the knowledge sharing phenomena to just the institutionalization mechanism predictors.

Although I am not surprised at finding that, with the exception of Model 4, all predictor and control variables are statistically significant in all the models, it is surprising to find that all the intercepts are both statistically significant and have the strongest beta coefficient impact when compared to the variables. This might provide evidence that not only the predictor and control variables have a low probability of occurring due to chance, but also that the outcome could have happened even when taking into consideration all the variables in the model.

Interpreting the model output of the PPOM presented in Exhibit 4.1 is more challenging than the traditional ordinal logistic regression due to its multidimensionality, as determined by the number of logit functions needed to describe the relationship. When using the gologit2 program in Stata, positive coefficients indicate that higher values on the predictor variable make it more likely that the survey respondents will be in a higher category of the outcome than the current one(s). In contrast, negative coefficients indicate that higher values on the predictor variable increase the likelihood that the survey respondents will be in the lower category of the outcome than the current one(s) (Williams, 2006). One can also use the odds ratios and its respective percentage change as shown in Exhibit 4.1. The closer the odds ratio is to zero, the lower are the odds of being in a higher category versus the current category. When the odds ratio equals one, the odds of either outcome are identical. If the odds ratio is above one, the higher are the odds of being in a higher category versus the current one.

Exhibit 4.1: Odds Ratio Estimated from PPOM Predicting Knowledge Sharing

N = 435,748	Model 1				Model 2				Model 3				Model 4			
Predictor Variables	**Coef.**	**SE**	**OR**	**%**	**Coef.**	**SE**	**OR**	**%**	**Coef.**	**SE**	**OR**	**%**	**Coef.**	**SE**	**OR**	**%**
Culture Scale	1.021 *	0.014	2.778	178	0.876 *	0.009	2.401	140	0.715 *	0.007	2.044	104	0.859 *	0.009	2.361	136
Incentives Scale	1.430 *	0.018	4.179	318	0.764 *	0.010	2.147	115	0.579 *	0.007	1.784	78	0.574 *	0.008	1.775	78
Information Technology	-0.002 *	0.000	0.998	0	-0.002 *	0.000	0.998	0	-0.002 *	0.000	0.998	0	-0.002 *	0.000	0.998	0
Control Variables																
Supervisor	0.171 *	0.023	1.187	19	0.195 *	0.014	1.215	22	0.217 *	0.010	1.242	24	-0.071 *	0.010	0.931	-7
Female	-0.405 *	0.015	0.667	-33	-0.375 *	0.010	0.687	-31	-0.198 *	0.008	0.820	-18	-0.007	0.008	0.993	-0.7
Minority	-0.411 *	0.015	0.663	-34	-0.292 *	0.010	0.747	-25	-0.371 *	0.008	0.690	-31	-0.243 *	0.009	0.785	-22
Age group	-0.123 *	0.019	0.884	-12	-0.175 *	0.013	0.840	-16	-0.252 *	0.010	0.777	-22	-0.170 *	0.011	0.844	-16
Tenure	0.061 *	0.017	1.063	6	0.049 *	0.011	1.050	5	0.033 *	0.008	1.034	3	-0.003	0.009	0.997	-0.3
Constant	5.248 *	0.026	190.259	18926	3.063 *	0.015	21.389	2039	1.690 *	0.012	5.419	442	-1.400 *	0.011	0.247	-75
Model Statistics																
Log likelihood	-476688.99															
LR Chi2 (d.f.)	172899.62 (29) *															
Pseudo R2	0.154															

Significance level denoted by: * $p < 0.001$

Model 1: Compares level 1 versus 2-5 on the knowledge sharing continuum

Model 2: Compares levels 1 and 2 versus 3-5 on the knowledge sharing continuum

Model 3: Compares levels 1-3 versur 4 and 5 on the knowledge sharing continuum

Model 4: Compares levels 1-4 versus 5 on the knowledge sharing continuum

At the highest statistical significance level of $p < 0.001$, the output of the models in Exhibit 4.1 shows the following relationships between the outcome and the predictor variables:

- In all instances and while controlling for all other variables, if the employee has a positive perception of the agency's culture, he/she is more likely to agree that knowledge is shared within their work unit. We find the highest impact in Model 1 where we can appreciate the odds of being in a higher category increase by 178% for a one standard deviation increase in the culture scale.

- In all instances and while controlling for all other variables, if the employee has a positive perception of incentives in the agency, the employee is more likely to agree that knowledge is shared within their work unit. We find the highest impact in Model 1 where we can appreciate the odds of being in a higher category increase by 318% for a one standard deviation increase in the incentives scale.

- In all instances and while controlling for all other variables, technology investments have a neutral effect on knowledge sharing perceptions in the work unit.

- At the lowest level of the satisfaction scale, incentives have a stronger effect than culture on employee's perceptions on whether knowledge is shared in their work unit. This pattern is reversed in Models 2-4.

At the highest statistical significance level of $p < 0.001$, the output of the models in Exhibit 4.1 shows the following relationships between the outcome and the control variables:

- As seen in Model 4, for those employees that "Strongly Agree", their sex or tenure are not significant predictors of whether knowledge is shared in their work unit. However, both variables are significant in Models 1-3 showing opposite directional effects. On the one hand, being a female makes it less likely to agree that knowledge is shared in the work unit. On the other hand, tenure in the agency makes it more likely to agree that knowledge is shared in the work unit.

- It is not likely that supervisors "Strongly Agree" that knowledge is shared but very likely to be in the lower categories.

- Minorities and people aged 40 or older are not likely to agree that knowledge is shared in the work unit. Across all models, the odds of being in a higher category

consistently and significantly decrease for both minorities and people aged 40 or older.

- In Model 1 and 2, female and minority status have the strongest odds effects. Model 1 shows that the odds of being in a higher category than "Strongly Disagree" decrease by 33% and 34%, respectively for female and minority status.

When testing a hypothesis using regression models, one is particularly concerned with multicollinearity among the predictor variables. Multicollinearity occurs when two or more predictor variables are highly correlated. When this happens, prediction of the coefficient estimate under consideration might not be as accurate. In order to test for multicollinearity, I have performed a correlation analysis and a Variance Inflation Factor (VIF) test. Below I show the correlation matrix with significance showing that no correlation is greater than 0.85. This test attests to the presence of discriminant validity and shows that the predictors within the theoretical model are distinct (Dunn, Seaker and Waller, 1994).

Table 4.6: Regression Variables Correlation Matrix

	Knowledge	Culture	Incentives	IT	Supervisor	Female	Minority	Age Group	Tenure
Knowledge	1								
Culture	0.5278*	1							
Incentives	0.5112*	0.8259*	1						
Information Technology	0.0074*	0.0702*	0.0599*	1					
Supervisor	0.0911*	0.1227*	0.1721*	-0.0279*	1				
Female	-0.0568*	-0.0221*	-0.0219*	0.0366*	-0.0897*	1			
Minority	-0.0637*	0.0014	0.0129*	0.0254*	-0.0425*	0.1060*	1		
Age Group	-0.0125*	0.0318*	0.0424*	0.0337*	0.1295*	-0.0174*	-0.0256*	1	
Tenure	-0.0136*	-0.0190*	0.0140*	-0.0098*	0.1618*	0.0876*	-0.0119*	0.4124*	1

Significance level denoted by: * $p < 0.001$ level.

Furthermore, I performed the VIF test that quantifies the severity of multicollinearity among the predictor variables. The results below show that no predictor variable has a VIF greater than 5 providing evidence that multicollinearity is not a concern for the regression model (Acock, 2014).

Table 4.7: Variance Inflation Factor for Regression Model

Variable	VIF	SQRT VIF	Tolerance	R-Squared
Culture	3.17	1.78	0.3154	0.6846
Incentives	3.20	1.79	0.3126	0.6874
IT	1.01	1.01	0.9898	0.0102
Supervisor	1.08	1.04	0.9279	0.0721
Female	1.03	1.02	0.9694	0.0306
Minority	1.01	1.01	0.9872	0.0128
Age Group	1.22	1.1	0.8227	0.1773
Tenure	1.24	1.11	0.8064	0.1936
Mean VIF	1.62			

Effects Model

As stated earlier, I obtained a cross-agency data sample from the EVS questionnaire. We can further analyze the cross sectional dimension of such data set. Statistically, there might be agency effects fixed over time and potentially correlated with the predictor variables. Perceptions of knowledge sharing within the work unit might differ due to factors that are agency specific. Public administration scholars have discriminably called attention to an agency's point of view when discussing the federal bureaucracy. They point out to the fact that "agencies are dominated by people who have not served in any other agency and who have been in government service for most of their lives" (Wilson, Dilulio and Bose, 2011). This might result in unique agency cultures that endure overtime. In addition, employee's attitudes and ideologies might influence knowledge sharing and they could be overrepresented in certain agencies. For example, liberal views are often overrepresented in social service agencies while conservative views are often overrepresented in defense agencies (Wilson, Dilulio and Bose, 2011). In statistics, we associate these phenomena with cross-sectional

heterogeneity, and control for it using effects coding. In order to test for U.S. federal agency effects, prior work has used deviation coding (Lavena, 2013). This coding pattern helps in the analysis of effects from the grand mean. Therefore, the model compares each respective agency against the grand mean of all agencies combined.

Using deviation coding, I generated the agency's dummy variables. Controlling for the different agencies, I ran the gologit2 regression program. I find some evidence of fixed effects in the model. As shown within the effects model in Exhibit 4.2, the coefficients of the agency dummy variables represent the difference between the average perceived knowledge sharing level in that agency compared to the grand mean across all agencies, taking into consideration all the other predictor variables in the model. On the one hand, a negative coefficient for an agency dummy variable will entail that the knowledge sharing level prediction for that particular agency is less than the grand mean prediction of all agencies. On the other hand, a positive coefficient for an agency dummy variable will entail that the knowledge sharing level prediction for that particular agency is more than the grand mean prediction of all agencies.

After controlling for agency type, the direction and significance for all predictor remained the same with the exception of the Information Technology variable, which now is statistically significant at $p < 0.01$ level in Model 3 and no longer significant in Models 1 and 2. Also, the direction and significance for all the control variables remained the same with the exception of Model 4 in which now Female is statistically significant at the $p < 0.001$ level and tenure is statistically significant at the $p < 0.01$ level.

We can also appreciate from the agency fixed effects model output in Exhibit 4.2, the direction and significance of the coefficients for the agency dummies. Of particular interest is that the Department of the Treasury and the Department of Commerce, among the group of agency dummies, share strong percentage of change in the odds ratios but in opposite direction from the grand mean. Qualitative data gathering for these agencies could highlight potentially interesting patterns in their institutionalization of knowledge sharing through culture, incentives and technology.

Exhibit 4.2: Odds Ratio Estimated from PPOM with Agency Effects Predicting Knowledge Sharing

N = 435,748	Model 1				Model 2				Model 3				Model 4			
Predictor Variables	**Coef.**	**SE**	**OR**	**%**	**Coef.**	**SE**	**OR**	**%**	**Coef.**	**SE**	**OR**	**%**	**Coef.**	**SE**	**OR**	**%**
Culture Scale	1.042 ****	0.014	2.835	184	0.897 ****	0.009	2.453	145	0.739 ****	0.007	2.093	109	0.881 ****	0.009	2.413	141
Incentives Scale	1.421 ****	0.018	4.141	314	0.754 ****	0.010	2.125	113	0.566 ****	0.007	1.762	76	0.558 ****	0.008	1.747	75
Information Technology	0.000	0.001	1.000	0	0.001	0.001	1.000	0	0.003 ***	0.001	1.003	0	0.003 ****	0.001	1.003	0
Control Variables																
Supervisor	0.167 ****	0.023	1.181	18	0.196 ****	0.014	1.217	22	0.225 ****	0.010	1.252	25	-0.055 ****	0.010	0.946	-5
Female	-0.425 ****	0.016	0.654	-35	-0.406 ****	0.010	0.667	-33	-0.241 ****	0.008	0.786	-21	-0.073 ****	0.009	0.930	-7
Minority	-0.430 ****	0.016	0.651	-35	-0.310 ****	0.011	0.733	-27	-0.394 ****	0.008	0.674	-33	-0.266 ****	0.009	0.767	-23
Age group	-0.110 ****	0.020	0.896	-10	-0.169 ****	0.013	0.844	-16	-0.250 ****	0.010	0.779	-22	-0.166 ****	0.011	0.847	-15
Tenure	0.074 ****	0.017	1.077	8	0.057 ****	0.011	1.059	6	0.030 ****	0.009	1.031	3	-0.031 ***	0.009	0.969	-3
Agency Dummy Variables																
Department of Agriculture (2)	0.065	0.044	1.067	7	0.027	0.031	1.028	3	0.023	0.025	1.023	2	-0.064 **	0.025	0.938	-6
Department of Commerce (3)	-0.197 ****	0.051	0.821	-18	-0.204 ****	0.033	0.815	-19	-0.292 ****	0.025	0.747	-25	-0.318 ****	0.024	0.727	-27
Department of Justice (4)	-0.067	0.050	0.935	-6	-0.087 **	0.035	0.917	-8	-0.081 ***	0.029	0.922	-8	-0.030	0.029	0.971	-3
Department of Labor (5)	0.026	0.067	1.026	3	0.110 **	0.048	1.117	12	0.232 ****	0.038	1.261	26	0.326 ****	0.038	1.385	39
Department of Energy (6)	-0.079	0.104	0.924	-8	-0.081	0.073	0.922	-8	-0.159 ***	0.060	0.853	-15	-0.195 ***	0.060	0.823	-18
Department of Health and Human Services (8)	-0.029	0.091	0.971	-3	-0.157 **	0.066	0.855	-15	-0.284 ****	0.054	0.753	-25	-0.251 ****	0.054	0.778	-22
Department of Homeland Security (9)	0.190 ****	0.042	1.209	21	0.160 ****	0.030	1.173	17	0.174 ****	0.025	1.190	19	0.095 ****	0.025	1.099	10
Department of Housing and Urban Development (10)	0.092	0.073	1.096	10	0.120 **	0.053	1.127	13	0.222 ****	0.043	1.248	25	0.324 ****	0.045	1.383	38
Department of the Interior (11)	-0.176 ***	0.062	0.838	-16	-0.201 ****	0.044	0.818	-18	-0.120 ***	0.036	0.887	-11	-0.081 **	0.036	0.922	-8
Department of State (12)	-0.037	0.064	0.964	-4	-0.014	0.041	0.986	-1	-0.051 *	0.030	0.951	-5	-0.030	0.028	0.971	-3
Department of Transportation (13)	0.041	0.042	1.042	4	0.002	0.028	1.002	0	-0.031	0.022	0.969	-3	-0.047 **	0.022	0.954	-5
Department of the Treasury (14)	0.268 ****	0.042	1.307	31	0.389 ****	0.029	1.475	48	0.540 ****	0.023	1.716	72	0.586 ****	0.022	1.796	80
Department of Veterans Affairs (15)	0.037	0.050	1.038	4	0.092 **	0.036	1.096	10	0.006	0.028	1.006	1	-0.104 ***	0.030	0.901	-10
Constant	5.168 ****	0.084	175.515	17452	2.97 ****	0.060	19.510	1851	1.500 ****	0.049	4.482	348	-1.589 ****	0.049	0.204	-80
Model Statistics																
Log likelihood	-474488.50															
LR Chi2 (d.f.)	177300.59 (84) ****															
Pseudo R2	0.157															

Note: Deviation coding used to compare agency versus the grand mean of all agencies. The Department of Defense is coded -1. Department of Education dropped because of collinearity.
Significance levels denoted by: **** p < 0.001, *** p < 0.01, ** p < 0.05 and * p < 0.10

For all predictor and control variables, I show in Table 4.8 a comparison of the percentage change in odds between the model without agency fixed effects and the model that includes the agency fixed effects. The strongest change in odds effects are seen in the Culture Scale. This might provide evidence that cultural orientation of an agency is more sensitive to the phenomena of knowledge sharing. In addition, the odds ratio related to the Culture Scale improves while the odds ratio related to the Incentive Scale worsen when controlling for agency's fixed effects.

Table 4.8: Percentage Change in Odds between Base and Fixed Effects (FE) Model

Outcome Variable: Item 26. Employees in my work unit share job knowledge with each other.

	Model 1			Model 2			Model 3			Model 4		
Predictor Variables	Without FE	With FE	Diff.	Without FE	With FE	Diff.	Without FE	With FE	Diff.	Without FE	With FE	Diff.
Culture Scale	178	184	6	140	145	5	104	109	5	136	141	5
Incentives Scale	318	314	-4	115	113	-2	78	76	-2	78	75	-3
Information Technology	0	0	0	0	0	0	0	0	0	0	0	0
Control Variables												
Supervisor	19	18	-1	22	22	0	24	25	1	-7	-5	1
Female	-33	-35	-1	-31	-33	-2	-18	-21	-3	-0.7	-7	-6
Minority	-34	-35	-1	-25	-27	-1	-31	-33	-2	-22	-23	-2
Age group	-12	-10	1	-16	-16	0	-22	-22	0	-16	-15	0
Tenure	6	8	1	5	6	1	3	3	0	-0.3	-3	-3

Aggregate Model

The models that have been presented in the prior sessions followed the level of the theorized process.[5] Based on the logic of the EVS questionnaire, the knowledge management process at U.S. federal agencies occurs at the work unit level. Therefore, a model built using a scale that describes employee's attitudes is the appropriate level of analysis. Also, modeling knowledge sharing behavior this way allows for individual behavior to be explained by the individual attitudes of employees. This follows the argument that influencing employee's attitudes toward culture and incentives is the most

[5] See 12/20/2005 teaching note from Aaron at http://pages.uoregon.edu/aarong/teaching/G4074_Outline/node12.html

effective approach to institutionalizing knowledge sharing within the U.S. federal agencies.

However, a model that has been advised to be included for purposes of robustness takes an entity view of the U.S. federal agencies. From this perspective, the individual behavior is explained by aggregating the employees' attitudes in order to formulate a representation of the entity's culture and incentive level. The logic of this argument follows from technology being represented by a variable that does not change at the individual level. Therefore, I aggregate the culture and incentive variables by assigning each employee within the agency the population mean. In this way, we aggregate all the predictor variables to the agency level. While predictor variables are at the agency level, the control variables are at the individual level.

Although significant at $p < 0.001$, when compared to the model in Exhibit 4.1, the aggregate model in Exhibit 4.3 produces a particularly low Pseudo R-squared at 0.0089. When one compares two models on the same data, the Pseudo R-squared is higher for the model with the greater likelihood.[6]

At the highest statistical significance level of $p < 0.001$, the output of the model in Exhibit 4.3 shows the following relationships between the outcome and the predictor variables:

- In all instances and while controlling for all other variables, agencies' culture level makes it less likely for employees to agree that knowledge is shared within the work unit.

- In all instances and while controlling for all other variables, agencies' incentives level makes it more likely for employees to agree that knowledge is shared within the work unit.

[6] FAQ: What are Pseudo R-squareds? UCLA: Institute For Digital Research and Education. From http://www.ats.ucla.edu/stat/mult_pkg/faq/general/Psuedo_RSquareds.htm (accessed December 18, 2014)

- In all instances and while controlling for all other variables, technology investments have a neutral effect on knowledge sharing perceptions in the work unit.

When we compare the model presented in Exhibit 4.1 with the aggregate model in Exhibit 4.3, one can appreciate that, with the exception of tenure, all the relationships between the outcome and the control variables remain the same. In all instances and while controlling for all other variables, tenure in the agencies makes it less likely to agree that knowledge is shared in the work unit.

Exhibit 4.3: Odds Ratio Estimated from PPOM with Aggregate Scales Predicting Knowledge Sharing

N = 528,573	Model 1				Model 2				Model 3				Model 4			
Predictor Variables	**Coef.**	**SE**	**OR**	**%**	**Coef.**	**SE**	**OR**	**%**	**Coef.**	**SE**	**OR**	**%**	**Coef.**	**SE**	**OR**	**%**
Aggregate of Culture Scale	-0.440 *	0.055	0.644	-36	-0.643 *	0.046	0.526	-47	-0.762 *	0.042	0.467	-53	-0.641 *	0.045	0.527	-47
Aggregate of Incentives Scale	1.822 *	0.044	6.182	518	1.822 *	0.044	6.182	518	1.822 *	0.044	6.182	518	1.822 *	0.044	6.182	518
Information Technology	-0.001 *	0.000	0.999	0	-0.001 *	0.000	0.999	0	-0.001 *	0.000	0.999	0	-0.001 *	0.000	0.999	0
Control Variables																
Supervisor	0.673 *	0.02	1.96	96	0.572 *	0.012	1.771	77	0.500 *	0.008	1.648	65	0.258 *	0.008	1.294	29
Female	-0.329 *	0.013	0.72	-28	-0.331 *	0.008	0.719	-28	-0.186 *	0.006	0.830	-17	-0.055 *	0.007	0.946	-5.4
Minority	-0.380 *	0.013	0.684	-32	-0.229 *	0.009	0.795	-21	-0.272 *	0.007	0.762	-24	-0.141 *	0.007	0.869	-13
Age group	-0.047 **	0.017	0.954	-5	-0.074 *	0.011	0.929	-7.1	-0.131 *	0.008	0.877	-12	-0.048 *	0.009	0.953	-5
Tenure	-0.098 *	0.014	0.906	-9	-0.070 *	0.009	0.932	-6.8	-0.073 *	0.007	0.93	-7	-0.132 *	0.008	0.876	-12.4
Constant	3.333 *	0.018	28.014	2701	2.220 *	0.012	9.271	827	1.291 *	0.01	3.636	264	-1.124 *	0.01	0.325	-68
Model Statistics																
Log likelihood	-677016.61															
LR Chi2 (d.f.)	12186.26 (26) *															
Pseudo R2	0.0089															

Significance level denoted by: * p < 0.001, ** p < 0.01

Model 1: Compares level 1 versus 2-5 on the knowledge sharing continuum

Model 2: Compares levels 1 and 2 versus 3-5 on the knowledge sharing continuum

Model 3: Compares levels 1-3 versur 4 and 5 on the knowledge sharing continuum

Model 4: Compares levels 1-4 versus 5 on the knowledge sharing continuum

Theoretical Implications

The empirical model illustrates the complexity of the knowledge sharing phenomena. As it relates to the theoretical proposition H1, it provides theoretical evidence that culture and incentives influence the perceptions employees have of knowledge sharing while technology investments do not make a difference on their perceptions. Following on theoretical proposition H2, the fixed effects model highlights the models sensitivity to culture, which might indicate that cultural orientation of an agency affects knowledge sharing behavior. This assertion is further supported by the aggregate model which shows how an agency's culture level makes it less likely for employees to agree that knowledge is shared within the work unit. Regarding theoretical proposition H3, incentives increase knowledge sharing behavior and their effect are particularly strong when sharing knowledge is a challenge within the agency. Addressing theoretical proposition H4, technology does not appear to be a catalyst for an employee's perception on knowledge sharing behavior.

The empirical model also tells us that beyond the institutional mechanisms of culture, incentives and technology, there are individual factors that influence perceptions of knowledge sharing. Our individual factors included supervisory and minority status, gender, age and tenure. The empirical model points out to the challenges of perceiving that knowledge is shared in the work unit for minorities, people aged 40 or older, and females. This could be the result of inherent characteristics within each demographic, but the pattern might also point out to evidence of continuous prejudice and discrimination in society. In the case of supervisors, it appears that their perceptions that knowledge is

shared in their work unit are cautious since they hesitate to gravitate towards the "Strongly Agree" category.

For knowledge management scholars, knowledge sharing within organizations has been a key proposition to achieve competitive advantage and/or mission accomplishment. This study contributes to the field by highlighting how institutional mechanisms and individual factors affect employee's perceptions of knowledge sharing in their work unit. The federal bureaucracy, as an organizational field, provides an excellent organizational context to test theory. However, the theoretical framework could be used and improved in other institutional context for confirming its validity and generalizability.

In this quantitative study, the aim has been to study U.S. federal agencies from the employees that constitute them. However, Rosenberg (1968, p. 241) states that "there are certain qualities of organizations which cannot be inferred from any cumulation of data about individuals." Indeed, organizations could be path dependent. For this reason, leadership experience is necessary when making decisions in terms of culture, incentives and technology. This study supports such decision-making by adding knowledge obtained from empirical data to the practice of public management. Culture, incentives and technology have long been studied by management scholars and continue to be part of the strategic management tools that leaders use in both public and private organizations.

Research Limitations

Although the large sample size in this study (n = 435,748) provides assurances that the inferential statistical conclusions are sound, the researcher acknowledges that

there are design, measurement and inherent limitations when analyzing survey data quantitatively. Most importantly, it is acknowledged that the data provided in the EVS questionnaire measures the perceptions of reality of federal agency employees, who played the role of informants. Consequently, some of the variables are derived from subjective data. In addition, the survey methodology suffers from sample selection bias (Remler and Van Ryzin, 2011). Since answering the EVS questionnaire is voluntary, nonrespondent views are not represented.

Although it is not arguable that positive employee perceptions of knowledge sharing within the work unit correlates to employee's perceptions of the merit principle being used to reward performance, these agencies might have by law separate pay systems. Knowledge sharing behavior might be influenced by the specific design of a pay system.

Upon consulting with SMEs as part of the qualitative procedures of this study, a number of limitations were identified around the variables and nature of the survey: (1) It is not clear how the employees within the agency interpret the outcome variable, Item 26 of the EVS. The item refers to a "work unit" for which a clear definition is not given. (2) The IT variable, agency's technology spending per employee, might not be an accurate measure for knowledge sharing. A better measure is the agency's technology spending per employee for only collaboration and communication technologies. However, this metric is not currently available. (3) The degree of an employee's engagement might have an impact on the answers to the survey measures. More engaged employees might have a bias for viewing different items in the survey, collectively, in a more positive way.

Since this is a non-experimental study, the aim is not to evaluate hypothesis about causality but limited to the study of associations between variables derived from a review of the literature (Kline, 2009). Even when the hypothesis is drawn from the theory and supported by the survey data, the data does not prove the theory but merely supports it (Rosenberg, 1968). Other research designs such as experiments and qualitative methods could strengthen the theoretical premises in order to arrive at theoretical generalizations of the knowledge sharing phenomena. Although the focus of the next chapter will be on knowledge management as a strategy in these agencies, the qualitative data to be analyzed might enlighten our understanding around how culture, incentives and technology promote the phenomena of knowledge sharing.

The empirical model points out to the complexity of the knowledge sharing phenomena. Although I relied on existing theory within the field and disciplined intuition guided by data to specify the predictor variables, it is possible that the study suffers from omitted variable bias (Remler and Van Ryzin, 2011, Rosenberg, 1968). Furthermore, the more control variables we can specify in the analysis, the more precisely we will be able to narrow down the organizational factors in a regression analysis (Rosenberg, 1968). Finally, regression analysis does not solve the ambiguous temporal precedence problem. There is a possibility of reverse causation between the dependent and independent variables.

The latent variables were conceptually defined using narrow data from an existing survey. Consequently, the scales used for the latent variable could constitute more of a descriptive rather than a theoretical generalization (Rosenberg, 1968). Specifically, the latent variables reflect what the federal government values in terms of culture and

incentives. Although other organizations might look at culture and incentives from a different lens, the large case sample used in the study provides confidence that the descriptive generalization used for culture and incentives is shared among the surveyed employees of the federal agencies.

Finally, we lack technology data at the employee level. Therefore, we are unable to run the model at the individual agency level. Running the model at the individual agency level might provide a unique perspective for the agency's management.

Appendix 4.1: Standardized Culture Scale

Latent Variable: Culture

Questionnaire Items:	**Rotated Factor Loadings**
1. I am given a real opportunity to improve my skills in my organization.	0.732
3. I feel encouraged to come up with new and better ways of doing things.	0.767
20. The people I work with cooperate to get the job done.	0.541
30. Employees have a feeling of personal empowerment with respect to work processes.	0.791
31. Employees are recognized for providing high quality products and services.	0.788
53. In my organization, leaders generate high levels of motivation and commitment in the workforce.	0.843
54. My organization's leaders maintain high standards of honesty and integrity.	0.797
Culture Scale Description:	
Eigenvalue	4.009
Average inter-item covariance	0.730
Reliability coefficient (Cronbach's alpha)	0.901
Scale minimum	-2.410
Scale maximum	1.660

Note: Factor analysis performed using stata principal factor command and varimax rotation. Scale is standardized representing standard deviation units.

Appendix 4.2: Standardized Incentives Scale

Latent Variable: Incentives

Questionnaire Items:	**Rotated Factor Loadings**
22. Promotions in my work unit are based on merit.	0.798
24. In my work unit, differences in performance are recognized in a meaningful way.	0.845
25. Awards in my work unit depend on how well employees perform their jobs.	0.850
32. Creativity and innovation are rewarded.	0.778
33. Pay raises depend on how well employees perform their jobs.	0.716
Incentive Scale Description:	
Eigenvalue	3.190
Average inter-item covariance	0.900
Reliability coefficient (Cronbach's alpha)	0.901
Scale minimum	-1.774
Scale maximum	1.936

Note: Factor analysis performed using stata principal factor command and varimax rotation. Scale is standardized representing standard deviation units.

Appendix 4.3: Descriptive Statistics for Regression Variables

n = 594,579 Variable	Missing Values	Mean	SD	Min.	Max.	Alpha
Dependent						
Knowledge Sharing	4,911	3.763	1.027	1	5	NA
Independent						
Culture Scale	69,025	1.23×10^{-09}	0.953	-2.410	1.660	0.901
Incentives Scale	95,981	-1.91×10^{-09}	0.943	-1.774	1.936	0.901
Information Technology	-	52.198	23.336	20.104	134.761	NA
Control		**Frequency**	**%**			
Supervisor	36,019	116,028	21%	0	1	NA
Female	40,143	234,300	42%	0	1	NA
Minority	53,090	178,785	33%	0	1	NA
Age Group (40 or older)	44,332	426,446	78%	0	1	NA
Tenure (11 or more years)	38,058	298,603	54%	0	1	NA

Note: Scales are standardized to facilitate comparisons of the coefficients based on standard deviation from the mean.

Chapter 5: Qualitative Analysis and Findings

Overview

The qualitative research in this chapter looks at the professional domain of knowledge management in U.S. federal agencies. Given the strong quantitative findings supporting the theoretical model, the qualitative analysis has been scoped to understand: First, institutionalization mechanisms that operate at the regulatory and policy level; second, dimensions of knowledge management in the U.S. federal government; third, discourse of the professional domain within the context of the U.S. federal bureaucracy, and finally, cases illustrating knowledge management practices in the U.S. federal agencies. To accomplish these objectives, I invited the Federal Knowledge Management Community to a best practices meeting on 7/30/2014. The meeting invitation is included in Appendix 5.1. In this meeting, I had official representation from the Department of Defense, the Department of Energy, the Federal Bureau of Investigation, the Federal Transit Authority and the National Aeronautics and Space Administration. In addition, I conducted two unstructured interviews with subject matter experts (SME) from the Federal Transit Authority to gather data for the cases. The unstructured interview protocol is shown in Appendix 5.2. To make the data gathering more robust, I have researched articles written by SMEs within the last three years, as well as, consulted reports issued by consulting firms specifically addressing the U.S. federal government. Finally, I have looked at the strategic plans for the agencies under consideration and using an ontological coding convention have extracted quotes that point towards adoption of knowledge management strategies.

The chapter is structured as follows: I first address how the U.S. law serves as a force in the institutionalization of knowledge management within the U.S. federal bureaucracy. Second, I articulate the dimensions of the knowledge management professional domain based on informed understanding obtained while conducting this research and benchmarking this understanding with the academic literature. Third, using the words provided by SMEs and agencies' strategic plans, I illustrate both the current state and the direction that the knowledge management discourse is taking within U.S. federal agencies. Fourth, I present the Federal Transit Authority (FTA) and the National Aeronautics and Space Administration (NASA) as two cases to illustrate proven successful knowledge management strategies within the U.S. federal government. Then, I summarize knowledge management practices and present a futuristic direction of knowledge management. Following the research hypotheses of this study, I proceed to assess the qualitative evidence gathered against each of the research hypothesis as reiterated below:

> H1: Culture, incentives and technology influence the institutionalization of knowledge sharing behaviors in federal agencies.
>
> H2: Knowledge sharing behaviors are influenced by the cultural orientation of federal agencies.
>
> H3: Knowledge sharing behavior in federal agencies increases with incentives.
>
> H4: Knowledge sharing behavior in federal agencies increases with the adoption of technology.

Finally, I conclude by stating the limitations of the qualitative analysis presented in the chapter.

U.S. Administrative Law and Knowledge Management

As it relates to this study, institutionalization that relies on laws and regulations reflects the impact of coercive isomorphism within the organization (Rainey, 2009). The phrase "knowledge management" is coded within three of 50 United States Code (USC) titles and two of 50 Code of Federal Regulations (CFR) as follows (Georgieff, 2013):

USC titles:

- Title 5: Government Organization and Employees, Civil Service Functions and Responsibilities, Office of Personnel Management (OPM)
- Title 6: Domestic Security, Homeland Security Organization
- Title 42: The Public Health and Welfare, National and Community Service

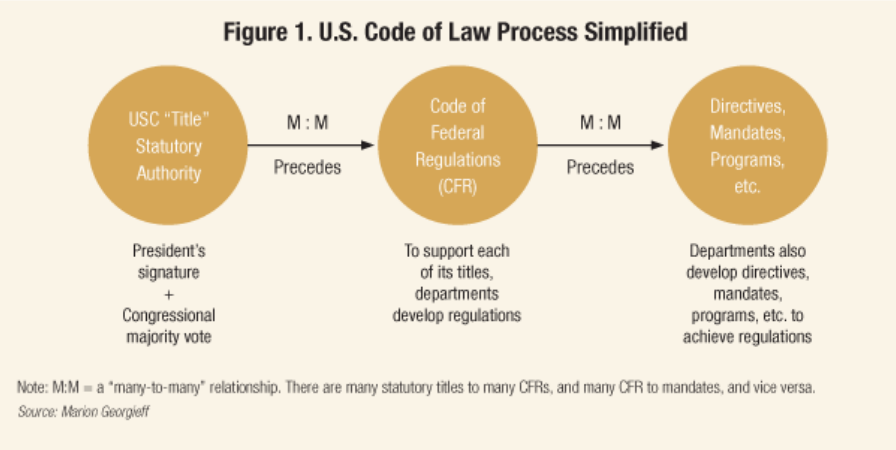
CFR:

- 5 CFR 250.202 - " Office of Personnel Management in Agencies. Office of Personnel Management responsibilities.
- 32 CFR 1701.21 - " Exemption of National Counterterrorism Center (NCTC) systems of record.

The USC is the official compilation and codification of the general and permanent federal laws of the United States. According to the Federal Register, the CFR is a codification (arrangement) of the general and permanent rules published in the Federal Register by the executive departments and agencies of the U.S. federal government.[7] The Code is divided into 50 titles covering Federal regulations and is updated by amendments appearing in the Federal Register. The Code and the Federal Register establish the latest version of administrative law. Figure 5.1 provides a simplified view of the legal precedence.

[7] The CFR is available online through the National Archives at http://www.archives.gov/federal-register/cfr/, accessed 7/10/2014.

Figure 5.1: U.S. Code of Law Process Simplified



According to Georgieff (2013, p. 43) under the rule "USC begets CFR begets agency activity" within the federal government, "OPM has the greatest strength of KM authorized ownership based upon USC, CFR, and agency activity" followed by Homeland Security, Public Health and Welfare, and National Intelligence. In order to fulfill its requirement, OPM has incorporated knowledge management within its Human Capital Assessment and Accountability framework and uses two measurements from the CFR as follows (Georgieff, 2013, p. 43):

- "The agency has developed and implemented a knowledge management process that provides a means to share critical knowledge across the organization."
- "Information technology tools that facilitate gathering and sharing knowledge within and outside the agency are available to employees to improve individual and organizational performance."

Administrative law establishes governance precedents within the federal bureaucracy. Laws and regulations constitute the main institutionalization force when viewing the U.S. federal agencies as an organizational field. Administrative law offers the regulatory, facilitative and constitutive environments for knowledge management

within U.S. federal agencies. Scott (2014, p. 238) articulates these three dimensions of the legal environment in organizational studies as follows:

- "Regulatory" environment consist of a set of "substantive edicts, invoking societal authority over various aspects of organizational life" (Edelman and Suchman, 1997, p. 483).
- "Facilitative" environments occur through the facilitation of tools, procedures and forums that actors can employ to pursue goals, resolve disputes and control deviant behavior.
- "Constitutive" environment "constructs and empowers various classes of organizational actors and delineates the relationships among them" (Edelman and Suchman, 1997, p. 483).

The USC and CFR provide the regulatory environment for the institutionalization of knowledge management. Given OPM's greatest strength of authorized ownership, the agency provides the facilitative environment for knowledge management. Providing a "facilitative" environment, OPM has established centralized training and development resources for knowledge managers in the federal government. One of such resources is the Knowledge Portal, which supports the online education and training requirements of 40+ small agencies via "Cloud-Based" customizable Learning Management and Learning Content Management system support.[8] In addition, OPM wiki has provided a space for the federal training community to collaborate in building a knowledge base (Ndunguru, 2013). Of relevance to the constitutive environment, some federal agencies face legislative, regulatory, or policy limitations on sharing administrative data among federal agencies. As stated in the strategic plan of the Department of Commerce: "Addressing these limitations will drive down costs and reduce the public burden of redundant data collections, resulting in improved government efficiency" (U.S. Department of Commerce, 2013). Showing an example of early efforts of administrative agencies to

[8] See http://www.opm.gov/services-for-agencies/technology-systems/knowledge-portal/, accessed on 9/11/2014.

better share sensitive data, the International Trade Data System (ITDS) is championing potential avenues that will continue the data sharing success of ITDS. The law currently prohibits sharing data among the Census Bureau, Bureau of Economic Analysis, and the Bureau of Labor Statistics. Within the strategic plan, it is proposed that enactment of a simple "legislative amendment to Title 26 allowing more data sharing would reduce cost and enhance data quality without sacrificing the confidentiality of the data" (U.S. Department of Commerce, 2013).

Knowledge Management Dimensions in the U.S. Federal Agencies

Within U.S. federal agencies, knowledge management does not have a single disciplinary dimension. Rather, it constitutes a managerial philosophy of investing in intellectual capital to address organizational performance and knowledge sharing. In practice, the knowledge management profession within the U.S. federal government is moving in the direction of tying two closely linked disciplinary areas: intellectual capital and organizational learning. Since intellectual capital has been the prerogative of knowledge acquisition, it is not surprising that the U.S. government have encapsulated knowledge management within its Human Capital Assessment and Accountability framework. As it relates to organizational learning, its connection to knowledge management has evolved as business needs within agencies are redefined. In the academic literature, the linkage of knowledge management to organizational learning is at its maturity. Easterby-Smith and Lyles (2011) proposed four key terms in the discourse of knowledge management. These terms are knowledge management, organizational knowledge, organizational learning and learning organization. Easterby-Smith and Lyles (2011) offers the following definitions:

- Knowledge management is a technical approach aimed at creating ways of measuring, disseminating, storing and leveraging knowledge in order to enhance organizational performance.
- Organizational knowledge refers to the nature of the knowledge contained within the organization.
- Organizational learning is the learning processes of and within organizations.
- Learning organization is an entity, an ideal type of organization, with the capacity of learning effectively and therefore prospers.

Linking knowledge to the task of developing a learning organization became a practitioner's prerogative after the 1990 publication of Peter Senge's book: The Fifth Discipline - The Art and Practice of the Learning Organization. A review of this book by a public administration scholar stated that "Apart from technical training in larger, better organized agencies, most learning is disconnected from the living organization and extremely difficult to transfer" (van Wart, 1994, p. 577). This chapter features two cases of U.S. federal agencies that, contrary to the prevailing state of the 1990s, have been successful in becoming a learning organization through the integration of contextual learning activities as a prerogative to promote successful mission accomplishment within the organization.

Contextual learning occurs in a facilitated environment that is able to integrate the chain of learning depicted in Figure 5.2.

Figure 5.2: The Chain of Learning

Source: Adapted from Jensen (2005)

Knowledge management practitioners in federal agencies are successful in developing a learning organization when their programs and activities are able to produce new

knowledge. Jensen (2005) displays a process in which there are two transformations: (1) Data is transformed into information by being organized in a certain formula. (2) Information is transformed into knowledge by being related to, or being used for, a productive purpose in a certain context. In addition, the process relies on the recognition of each hierarchical level (Jensen, 2005):

- Data exists when one can see or recognize differences between two states of a system.
- Information is the situation where this difference makes a difference.
- Knowledge can be defined as the situation where insight is achieved in a context by pointing out information from data as the difference that makes a difference.
- New knowledge is achieved when testing this insight according to different situations.

Although knowledge is commonly seen as a possession, it is in reality contextual, asserting to the difficulty of transferring knowledge among organizational members for developing the learning organization. As the cases will illustrate, agencies have been successful in connecting their living organizations to the learning of the employees, mainly through contextual learning activities and programs.

Knowledge Management Discourse within the U.S. Federal Government

The institutionalization of knowledge management in the federal government creates isomorphic forces in the administration, technological adoptions and resource structure for knowledge sharing within the agency and among different agencies. The effects are time bound and occur through the shared understanding developed through the social relational and network activities that the field engages in. Within the professional domain in U.S. federal agencies, we can find a discourse with institutionalized patterns of knowledge. As part of the qualitative analysis, I have performed three activities:

- Engaged in a two-hour best practices meeting in which contextual inquiry took place.
- Performed a general search and reviewed articles written by SMEs in the last three years.
- Performed an ontological coding analysis of the Executive Branch agencies' strategic plans.

The meeting took place on 7/30/2014 and I moderated a naturally occurring interaction among SMEs from five federal agencies centered on the discussion of the theoretical model and best practices in the professional domain. Some of the SMEs represented agencies that did not have a dedicated knowledge management department. The format of this meeting closely followed the standard quarterly meetings conducted by the Federal Knowledge Management Community. These meetings encourage storytelling and promote "show and tell" demonstrations. SMEs have also been active in writing about knowledge management efforts within the federal community. Finally, the strategic plans presented an opportunity to assess the strength of the discourse at the agency's level and provide guidance on the direction of the professional domain. Since I rely on both talk and text, an appropriate methodology for the qualitative findings is discourse analysis. According to Nikander (2007, p. 415), "discourse analysis interrogates the nature of social action by dealing with how actions and/or meanings are constructed in and through text and talk." Through analysis of text and talk, we can assess the themes and features that SMEs and U.S. federal agencies clearly orient to within the professional domain.

Knowledge management practitioners recognize that it is not easy to find a singular definition for what they do. The definition itself could be a challenge for the discipline. In one of my interviews, the knowledge manager stated: "I will tell people

what knowledge management is because … often times you see people arguing over the definition." Furthermore, the practice of knowledge management continues to redefine itself as U.S. federal agencies adopt new technologies and leaner operational structures. Recognizing that technology tools alone could not diffuse the knowledge agencies need to accomplish their mission, SMEs attested to the need of "a champion" for diffusing new knowledge within the agencies. Knowledge managers take this role, often bridging people and business processes by helping articulate the knowledge requirements. Two of the agencies represented in the meeting have appointed chief knowledge officers (CKOs) as part of the formalization of the knowledge management program. Addressing this role an SME stated that, "You have to have a catalyst to get [knowledge sharing] going through the agency." Emphasizing the importance of the role, it was further stated that CKOs are viewed as the technical experts that make sure knowledge sharing tools are available in the practice. However, not all U.S. federal agencies have a high profile leadership position addressing knowledge management issues within their organizations.

An important development for the knowledge management efforts among SMEs in U.S. federal government agencies was the launch in 2011 of the Federal Knowledge Management Community. The community of practice has quarterly meetings and brings together employees responsible for knowledge management within different federal agencies to share best practices and strategies for addressing agencies' challenges (Welcome, 2014). "Sharing knowledge" is a meme among knowledge management practitioners in the federal government. Their professional interest is driven by the desire of finding tools and methods to capture, retain and transfer more of the collective knowledge existing within the agency.

To focus the discourse analysis, I have developed a series of themes based on the theoretical model, the unstructured interview protocol, and recommendations received by SMEs during the best practices meeting. In addition, I reviewed a knowledge management forum published during Fall 2013 in The Public Manager, a well-regarded practitioner journal indexed and abstracted in library databases.[9] The forum solidifies the view of knowledge management as a profession with defined boundaries of activities that are relevant to organizational development. Contributions from practitioners, of both public and private sectors and academics highlighted current knowledge management themes not different from the research-based sources I used to arrive to the discourse themes. Figure 5.3 illustrates the themes for the qualitative analysis.

Figure 5.3: Knowledge Management Discourse in U.S. Federal Agencies

The data for the discourse analysis consist of excerpts from the SMEs meetings, SMEs articles, and consulting industry reports, as well as, quotes from the Executive Branch agencies' strategic plans. A strategic plan documents the environmental context in which organizations "exist and operate, and explore factors and trends that affect the way they do business and carry out their roles" (Bryson and Alston, 2011, p. 4). In contrast to SMEs meetings, SMEs articles, and consulting reports, the strategic plans do

[9] See the ASTD publication: The Public Manager, Fall 2013, Volume 42, Number 3.

not reflect the discourse of SMEs but the discourse of the agency's leadership. The purpose of examining strategic plans as a data source is to augment the analysis by using the agency's leadership discourse, which might provide a current long-term view of the direction of the knowledge management field. In order to isolate quotes from the strategic plans, I applied a coding scheme leveraging the search function in the electronic files provided by the agencies and posted on the website address www.performance.gov. The coding was derived from existing theory and guidance from SMEs. Table 5.1 is a tally display that illustrates the frequency of directed language in the agency's strategic plan.

Table 5.1: Knowledge Management Language Coding Matrix

	Treas	Comm	Edu	DOE	HHS	HUD	VA	DOT	DHS	DOL	USDA	DOI	State	DOJ	DoD	Total
Predictor Variables																
Culture	15	2	6	0	4	2	4	5	1	6	1	1	2	1	4	54
Incentives	1	1	5	0	8	4	1	2	1	4	1	1	1	1	2	33
Technology	12	41	38	49	29	7	12	46	5	16	13	15	22	18	36	359
Dependent Variable																
Knowledge Management	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	4
Knowledge Sharing	0	0	0	0	0	0	1	6	0	0	0	0	0	1	0	8
Knowledge	3	12	29	6	31	3	3	12	3	32	9	7	6	3	4	163
Information sharing	3	0	0	1	4	1	2	2	8	3	1	0	0	10	5	40
Sharing	8	14	4	4	12	4	11	14	10	7	1	1	0	22	10	122
Organizational learning	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Learning organization	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	3
Learning	2	5	143	0	8	0	1	4	0	6	3	2	3	1	0	178

The criterion of selection is the researcher's ontological view of the meaning that might be convened, in practical discourse, by the dependent and independent variables. As shown at the top of the table, the independent variables are assessed using actual terms. To represent the dependent variable, I added latent language to ontologically relate the meaning of the knowledge sharing concept. Inclusion of the text is positive when the language aligns with the symbolism underlying knowledge management. Although the theoretical framework presented in this dissertation cannot be validated through a coding

analysis, the coding scheme itself can be validated through replication (Berg and Lune, 2012). Using coding analysis, I systematically isolate text from the strategic plans that might reflect the adoption of knowledge management practices.

The strategic plans are owned by the agency's leadership and represent their views. The purpose of the excerpts and quotes to be extracted is to assess the strategic direction of the knowledge management field within the U.S. federal bureaucracy. The excerpts and quotes isolated could sometimes fit more than one discourse category, but they are presented to illustrate the category under consideration.

From Table 5.1, we could appreciate that agency's leadership discourse indiscriminately use "data", "information" or "knowledge" to reflect equivalent meaning. Instances of "information sharing" are more prevalent than "knowledge sharing." In addition, "knowledge", "learning" and "sharing" are common in the vocabulary used by the agencies to reflect organizational development efforts. Interestingly, "knowledge management" appears only in four instances and all within the Department of Education; while "organizational learning" and "learning organization" appear also four times in total and all within the Department of Commerce. "Technology" is the most prevalent word used in the agencies' strategic plans. The prevalence of the word in the strategic plans might illustrate managerial preferences for viewing technology as essential to the long-term viability of the agency.

Knowledge Sharing through Culture

According to the SMEs, culture is the most often used mechanism to promote knowledge sharing within federal agencies. Despite information presented in Table 5.1, SMEs agreed that cultural orientations are different not only among agencies but also

within bureaus of the same federal agency. In knowledge management, the goal is not necessarily to change the modus operandi of the agency or the bureau but to acknowledge its existence through an appropriate set of knowledge transfer tools. To institutionalize knowledge sharing within an agency requires a cultural change. A knowledge manager at the Department of Energy states: "It's time for federal agencies to change the culture of their organizations to embrace corporate knowledge sharing for the purpose of collective learning and continuous improvement."[10] This is because knowledge sharing is an unusual experience since it presupposes trust (Dupuy, 2004). The notion of trust could be antithetical to the concept of bureaucracy. Cultures built under bureaucratic structures tend to distinguish hierarchically who are the owners of specific knowledge within the organization. Bureaucratic structures are more interested in coordination than cooperation. A knowledge sharing culture might be a solution to address the blind spot of bureaucratic structures and promote the ideal of an organization that is more responsive to its external environment (Dupuy, 2004). Knowledge managers in public organizations strive for the cultural adoption of knowledge sharing practices. Their work might seem as a lever given the notion of public organizations being extreme cases of bureaucracies. Furthermore, during a telephone conversation with an SME from the U.S. Forest Services, it was stated that a knowledge sharing culture could be used as a mechanism to promote engagement and inclusion among the workforce within the agency. This effort is important given that the federal government promotes the values of a diverse workforce through a varied set of mechanisms that not only targets hiring and promotion practices, but also inclusive management practices within the federal

[10] See Deadra Welcome blog entry, *Demystifying Knowledge Management in the Federal Government*, at http://www.govloop.com/community/blog/demystifying-knowledge-management-in-the-federal-government/, accessed 9/21/2014.

workforce. The quotes below from the agency's strategic plans highlight how culture is used as a mechanism in knowledge management:

> *"Recognizing that senior leaders play a critical role in leading the cultural transformation needed to become a learning organization, the Department will focus first on designing a framework of knowledge and skills that are essential for all members of the Department's Senior Executive Service (SES). The goal is to develop proactive leaders, who are able to drive strong workforce engagement, maximizing the impact of each individual's talents and increasing collaboration among staff." Department of Commerce, 2014-2018 Strategic Plan*
>
> *"HHS has identified five guiding principles to help us better leverage the creativity of the Department's employees and maximize the use of HHS data. These include: 1) deployment of tools and platforms that enable collaboration and enhance peer support, build networks and enable effective knowledge transfer;"*
> *"HHS has initiated a number of collaborative learning consortia, collaborative databases, and tools for information sharing to enhance the public, as well as internal capacities, to share information and knowledge." Department of Health and Human Services, 2014-2018 Draft Strategic Plan*
>
> *"VA will need to develop a culture of partnership that encourages collaboration." "We must develop a partnership culture that entails trust, transparency, mutual benefit, responsibility, productivity, and accountability. Increased public-private partnership opportunities empower staff with effective tools and resources for collaborations, and allow for building open innovation platforms." Department of Veteran Affairs, 2014-2020 Strategic Plan*
>
> *"While the Department's mission, especially in the areas of criminal law enforcement and national security investigations, often requires confidentiality, DOJ's leadership has fully committed to changing the culture of DOJ to one of disclosure whenever possible and to re-evaluating whether information long withheld can now be released." Department of Justice, 2014-2018 Strategic Plan*

Knowledge Sharing through Technology

Practitioners of knowledge management in the federal government are technology vanguards willing to experiment with capabilities offered through both open-source and commercially available options. As illustrated in Table 5.1, "technology" is by far the most frequently used word in the strategic plans. Agencies are not immune to the

obsession for technology in management. However, as demonstrated in the quantitative analysis in Chapter 4, technology is not a determinant of whether employees perceive that knowledge is shared. Within their agencies, SMEs work on how to strategically enable information and collaboration technology for sharing knowledge. The U.S. federal government has adopted an enterprise architecture strategy in which agencies "must establish common network platforms for e-mail, and all information and knowledge management systems" (McNabb, 2006, p. 7). Enterprise architecture answers to the strategic need for information technology management to align systems across the federal government (McNabb, 2006). The initiative is important for knowledge sharing since it reduces technological complexity and promotes shared access. An example of the enterprise push within knowledge management is the increasing use of collaborative and data integration technologies under a common platform. A report by Deloitte's Public Leadership Institute and the National Academy of Public Administration addresses how Web 2.0 will ensure the future of collaborative government. Web 2.0 is a series of technologies that "foster interactive, collaborative spaces that allow users to participate more actively in the process of creating and sharing content" (Deloitte Research, 2008, p. 6). According to the report, a number of obstacles stand in order to make government more collaborative as follows:

- Poor incentive structures to promote collaboration
- A hierarchical culture that does not fit well with organizational flattening and empowerment
- Lack of familiarity and comfort with Web 2.0 technologies
- Stepping out of the legal bounds mindset that requires filtering by intermediaries

Knowledge management units in U.S. federal agencies assess the realities of these barriers in order to improve collaboration within their organizations. The quotes below

from the agency's strategic plans highlight how technology is used as a mechanism in knowledge management:

> *"We will also take full advantage of information technology to maximize the use and sharing of data to enhance sound decision-making." Department of the Treasury, 2014-2017 Strategic Plan*
>
> *"The Department will drive advancements in Big Data standards by forming communities of interest from industry, academia, government, and other standard bodies, with the goal of developing consensus definitions, taxonomies, secure reference architectures, and a technology roadmap." Department of Commerce, 2014-2018 Strategic Plan*
>
> *"To improve employee collaboration, for example, the Department will leverage the engagED platform, which is an internal initiative that allows employees to suggest innovations, collaborate to develop those ideas, and elevate them to leaders for decisions and implementation. Similarly, key programs will be used strategically, such as Idea Engine and SharePoint, which both encourage online knowledge management and collaboration. Other key collaborative tools are document sharing and management tools that help develop and support communities of practice among internal offices and colleagues." Department of Education, 2014-2018 Strategic Plan*
>
> *"Implement cutting-edge information technology solutions that support rapid, secure, and accurate information exchange; of diverse types of information; and linking of information among local, state, tribal and urban Indian, federal public health agencies, healthcare facilities, and laboratories, as well as with international regulatory counterparts, where appropriate;" Department of Health and Human Services, 2014-2018 Draft Strategic Plan*
>
> *"To that end, efforts are underway to improve technology capacity to link administrative data, standardize data systems, collaborate and share data across programs, develop ongoing longitudinal data system, and establish common identifier coding mechanisms to facilitate data linking and data analysis." Department of Labor, 2014-2018 Strategic Plan*
>
> *"The Department must evolve its approach to information technology to create an environment that enables mission command." Department of Defense, Quadrennial Defense Review Report*
>
> *"VA will support and enhance enterprise-wide information sharing through the implementation of a Customer Data Integration (CDI) environment to identify, develop, designate and enforce authoritative information sources and services." Department of Veteran Affairs, 2014-2020 Strategic Plan*

Knowledge Sharing through Incentives

Incentives do not appear to be prevalent in promoting knowledge sharing in federal agencies. None of the quotes reviewed from the strategic plans provide evidence for the use of incentives in promoting knowledge sharing in an intra-agency basis. Both throughout my meetings and articles reviewed, SMEs referred to culture driven and technology adoption practices rather than practices that promote knowledge sharing using merit-based incentives. However, SMEs recognize incentives as a viable practice to promote knowledge sharing: "Identifying KM incentives is one way to overcome resistance as well as create strategies to change the culture."[11] In some agencies, public recognition tied to knowledge sharing behavior is viewed as an incentive but in practice recognition and incentives are not equivalent management tools. Recognition is an intangible management tool that is often used to elicit a desired behavior while an incentive relies on a tangible or meaningful way to reward performance. Recognition is often awarded for displaying a specific behavior, such as knowledge sharing, but not necessarily tied to a performance goal.

Driving Mission Focus

Knowledge requirements in the federal agencies are tied to the need for the agency to accomplish its congressionally mandated mission. During my interview, a knowledge manager representing FTA emphasized that "People at FTA care deeply about the transit mission." Another example of mission being the driver for knowledge sharing practices is NASA: "Knowledge at NASA means many things, but the driving incentive is to achieve mission success" (Hoffman and Boyle, 2013, p. 23). Therefore, barriers to

[11] See Deadra Welcome blog entry, *Demystifying Knowledge Management in the Federal Government*, at http://www.govloop.com/community/blog/demystifying-knowledge-management-in-the-federal-government/, accessed 9/21/2014.

knowledge sharing could influence a federal agency's ability to deliver on its mission.

The following quotes from the agency's strategic plans illustrate this point:

> *"Second, mission success during a time of rapidly-evolving technology is achieved only when employees have the right technology, tools, and information to do their job effectively."*
> *"As a part of this strategy, a staff development framework will be designed to drive excellence in all aspects of mission delivery: systems thinking, customer service, personal mastery, and teamwork. Recognizing that senior leaders play a critical role in leading the cultural transformation needed to become a learning organization, the Department will focus first on designing a framework of knowledge and skills that are essential for all members of the Department's Senior Executive Service (SES). The goal is to develop proactive leaders, who are able to drive strong workforce engagement, maximizing the impact of each individual's talents and increasing collaboration among staff." Department of Commerce, 2014-2018 Strategic Plan*

> *"The Department is creating an interactive internal communications system that spans across all its principal office components and business units. The goal is to provide accurate information about the Department's priorities to employees, as well as forums and feedback opportunities for them to share ideas and lessons learned to improve execution on those priorities. Productivity and performance will be enhanced because employees will receive the relevant content knowledge they need to be effective ambassadors for and partners in delivering on and achieving the mission of the Department." Department of Education, 2014-2018 Strategic Plan*

> *"To accomplish our mission in the years ahead, we must capture the wisdom and knowledge of our current and departing technical experts and leaders and transmit it to their successors." Department of Housing and Urban Development, 2014-2018 Strategic Plan*

> *"The Geospatial Platform offers an Internet-based tool for sharing trusted geospatial data. It provides services and applications for use by the public, government agencies, and partners to meet their mission needs." Department of the Interior, 2014-2018 Strategic Plan*

> *"To conduct its mission with competence, USAID is dedicated to expanding the knowledge and expertise of its technical experts and development professionals. This expanded commitment to talent management is strengthening our ability to deliver sustainable, decisive results." Department of State and USAID, 2014-2017 Strategic Plan*

Driving Organizational Learning

As stated by an SME, "Knowing what and whom you need to know to be successful may be the crux of learning" (Camarena, 2014). For knowledge managers in the federal government, the learning to be achieved focuses on business/policy processes and people. Since the main driving concern is lost knowledge, there is an urgency of retaining knowledge to counteract the effects of retirement and employee transfers within and among agencies.[12]

The increasing amount of project type work in federal agencies shows that the majority of federal employees today are knowledge workers. Good work for a knowledge worker depends on how well he/she can learn about the organization and its external environment. The penalty of not learning well is the "outsourcing" of the knowledge work altogether. However, "outsourcing" does not always prove to be effective for fulfilling congressionally mandated missions. Therefore, public organizations must continue to be learning organizations. The agencies' missions are dependent upon their ability of executing policy work, which often is knowledge intensive. In this environment of project work, there is "nested" knowledge (Newell, Robertson, Scarbrough, Swan, 2009). The knowledge manager role in agencies is to release "nested" knowledge to the whole entity when it proves to have potential for increasing efficiency and effectiveness. In this way, they expand the learning boundaries of the agency itself. The quotes below from the agency's strategic plans highlight how learning becomes an important prerogative to managing knowledge:

[12] See PricewaterhouseCoopers report, http://www.pwc.com/en_US/us/public-sector/assets/pwc-federal-human-capital-management.pdf, accessed 9/5/2014.

"Treasury will inspire excellence by supporting individual and organizational growth through continuous learning and improvement." Department of the Treasury, 2014-2017 Strategic Plan

"Developing the right skills and knowledge is critical for accomplishing the Department's mission, improving employee satisfaction, and growing the next generation of leaders. The Department is committed to transforming itself into a learning organization that excels in serving customers and delivering results by valuing learning as an ongoing creative process; continually developing, adapting, and transforming itself in response to changing conditions; and improving the core capabilities of its people at all levels, both individually and collectively." Department of Commerce, 2014-2018 Strategic Plan

"The Department must continue to prioritize and support the learning and development of its leaders." Department of Education, 2014-2018 Strategic Plan

"Accelerate diffusion of best practices and successful models by using multiple vehicles to spread knowledge, encouraging model participants to actively participate in dynamic learning networks, sharing early insights and feedback with stakeholders, and developing the operational infrastructure needed to scale models rapidly and efficiently;" Department of Health and Human Services, 2014-2018 Draft Strategic Plan

"We will promote learning agendas, and share lessons learned and best practices. And through interagency collaboration, policy development, enhanced professional training, and evaluation, we will institutionalize a gender-sensitive approach to our diplomatic and development activities in conflict-affected environments."
"The Department and USAID will also leverage learning from each other to advance efficiency and effectiveness in our contributions to the achievement of Federal Cross-Agency Priority Goals." Department of State and USAID, 2014-2017 Strategic Plan

Driving Partnerships

Managing knowledge in partnerships has become an important skill for knowledge managers in U.S. federal agencies. Partnerships could occur among different agencies and externally with the private and academic sector. Knowledge managers can ensure the success of the partnerships by:

- Creating stakeholders directories to connect with people and entities with the right skills

- Creating the standards for the information to be shared among stakeholders
- Diffusing best practices for such partnerships

These practices ensure the legitimacy of the partnership between the government agency, and the private or academic sector. The quotes below from the agency's strategic plans highlight the importance of partnerships in managing knowledge:

> *"Strengthen public-private information-sharing programs with the financial sector."*
> *"Create mechanisms for more effective information sharing within Treasury and with its inter-agency partners, including creating standards and ensuring the quality of corporate data." Department of the Treasury, 2014-2017 Strategic Plan*
>
> *"Improve data-based services, decision making, and data sharing within the Department and with other parts of the federal government (BIS, ESA, ITA)."*
> *"Making better use of existing data will require the ability to combine different data from different agencies to create new, more useful data products, and enable sharing data across agencies." Department of Commerce, 2014-2018 Strategic Plan*
>
> *"Increase access to and sharing of data, and support for epidemiology programs at the state, local, and tribal government levels and by urban Indian organizations and other partners;" Department of Health and Human Services, 2014-2018 Draft Strategic Plan*
>
> *"Improve data collection and information sharing across and by federal, state, and local entities to bolster disaster preparedness and response and recovery efforts."*
> *"HUD participates in several interagency place based initiatives that focus existing funding more effectively and create incentives for collaboration across organizational, jurisdictional, and sectoral lines. Such initiatives support communities in improving their growth potential and the quality of life and opportunities for their residents." Department of Housing and Urban Development, 2014-2018 Strategic Plan*
>
> *"Coordinate with FEMA, the U.S. State Department, Department of Defense (DOD), and other federal agencies to provide security and emergency management training, including technical assistance and information sharing to transit agencies;" Department of Transportation, 2014-2018 Draft Strategic Plan*
>
> *"Enhance Department-wide support for state and major urban fusion centers to serve as the focal point within the state and local environment for the receipt,*

> *analysis, gathering, and sharing of threat-related information between the Federal Government and state, local, tribal, territorial (SLTT) and private sector partners." Department of Homeland Security, 2012-2016 Strategic Plan*
>
> *"ETA also contributes to the Department's efforts to detect and deter misclassification by promoting information and data sharing activities among State UI agencies, the Internal Revenue Service (IRS), and Wage and Hour Division." Department of Labor, 2014-2018 Strategic Plan*
>
> *"By also forging state, local, and tribal partnerships among police, prosecutors, victim advocates, health care providers, and others, the Department's grant and knowledge-sharing programs provide victims with the protection and services they need to pursue safe and healthy lives, while simultaneously empowering communities and local law enforcement to hold offenders accountable and implement effective crime prevention strategies." Department of Justice, 2014-2018 Strategic Plan*

Legislative, Regulatory and Policy Environment

Knowledge managers within agencies also address issues related to legislative, regulatory, or policy limitations on knowledge or information sharing. This begs the question of to what extent could knowledge be regulated either using law or policy. Knowledge as opposed to information is an esoteric entity. Consequently, knowledge should be viewed as an entity that is internally autonomous, self-organizing and self-regulating (Henry, 1975). A knowledge management policy must be meta-systematic in design in order to bring a degree of social stability (Henry, 1975). Therefore, the application of knowledge policies within agencies should focus on the design of a public social system of inquiry well supported by an analytical bureaucracy legitimized by the expertise to carry out its duties (Carroll, 1975). The quotes below from the agency's strategic plans highlight the extent to which agencies consider the regulation of knowledge and information relevant within the knowledge management discourse:

> *"Many federal agencies face legislative, regulatory, or policy limitations on sharing administrative record data with others. Addressing these limitations will*

drive down costs and reduce the public burden of redundant data collections, resulting in improved government efficiency. The International Trade Data System (ITDS) is an example of early government efforts to better share data. The Department will identify and champion other potential avenues that will continue the data sharing success of ITDS. However, current law prohibits sharing data among the Census Bureau, BEA, and the Bureau of Labor Statistics (BLS). Enactment of a simple, proposed legislative amendment to Title 26 allowing more data sharing would reduce cost and enhance data quality without sacrificing the confidentiality of the data."
"Yet this opportunity also presents a variety of challenges, including: How can the data be shared in a manner that is consistent with national values? Are there legal impediments to sharing? Can the Department provide the desired data transparency? And what is the impact or burden associated with providing the information? Recognizing that this is an evolving strategy, the Department will explore, research, and test the extent to which government and private data can be shared and the economic potential such sharing represents." Department of Commerce, 2014-2018 Strategic Plan

"Increasing no cost public access to Departmental research, especially journal literature and scientific data, to accelerate discovery through the sharing of scientific knowledge." Department of Energy, 2014-2018 Strategic Plan

"VA will develop and implement an Insider Threat program in accordance with Executive Order 13587 - Structural Reforms to Improve the Security of Classified Networks and the Responsible Sharing and Safeguarding of Classified Information in order to protect classified material in the VA." Department of Veteran Affairs, 2014-2020 Strategic Plan

"Implement information safeguarding capabilities within the DHS Information Sharing Environment (ISE) that allow for proactive oversight of our classified networks and information." Department of Homeland Security, 2012-2016 Strategic Plan

A View on the Discourse Dynamics

The discourse of knowledge management in the U.S. federal government is mainly driven by the policy and business needs of the agencies. Among the SME community, there is a strong interest in sharing best practices among U.S. federal agencies. Although SMEs emphasize culture as the most important tool to drive knowledge sharing, technology issues continue to be prevalent in the strategic plans. Incentives are not a key knowledge transfer tool for knowledge managers. Learning has

become a critical part of knowledge management considerations within agencies. Although the agencies in general address the issue of learning as it relates to developing skills within the workforce, only the Department of Commerce has included within its long term strategic plan a vision of becoming a learning organization. Mission success and collaboration are concepts often used when addressing the need to share information. The review of the strategic plans offered in this session begs the question of the extent to which knowledge management should be included in the long term planning of the U.S. federal agencies. If knowledge management proves to help agencies accomplish its congressionally mandated missions, one can argue that it should be of strategic importance to the long term planning of the agencies.

To illustrate the practical dynamics in agencies with formal knowledge management efforts, I present FTA and NASA cases illustrating best practices in knowledge management among U.S. federal agencies. These agencies were selected as cases given their participation in the best practices meeting and their leadership sponsored commitment to knowledge management efforts within the organization. From the cases, one could appreciate the maturity progression in knowledge management efforts.

Case 1: Improving Business Processes through Knowledge Management at the Federal Transit Administration

As described by the U.S. Government Manual, the Federal Transit Authority (FTA) was established as an operating administration of the U.S. Department of Transportation (DOT) by section 1 of Reorganization Plan No. 2 of 1968 (5 U.S.C. app. 1), effective July 1, 1968 (National Archives and Records Administration, 2012). The

FTA is one of the ten divisions within the DOT and led by an administrator who is appointed by the President of the U.S. Its headquarter offices are located in Washington D.C. and supported by regional offices which assist transit agencies around the United States and its territories. FTA's mission is to improve public transportation for America's communities by assisting in developing improved public transportation and providing financial assistance to state and local governments to finance public transportation systems and carry out national transit goals and policy (National Archives and Records Administration, 2012). Currently, FTA employs more than 500 employees spread between Washington D.C. and the ten regional offices that support local transportation programs. The central office functions as the strategic and operational hub for the tactical regional offices. The need to improve business processes within the decentralize operation motivated senior leadership to add a knowledge management structure within the organization. Today, a career public servant within the Administration arm at FTA oversees the Learning and Knowledge Management unit. Further from being perceived as collateral duty, the Chief Knowledge Officer position has equal division standing as the Director of Human Resources and the Director of Information Technology.

Senior leadership at FTA was not doing a good job at capitalizing on knowledge and experience within the bureau and decided to create a chief knowledge officer role to improve knowledge management in the organization. In October 2007, Susan Camarena was selected for this role given her successful military career and her experience leading the Knowledge for Development (KfD) program at the U.S. Agency for International Development (USAID). Being an army of one, she presented to the senior leadership

within a month in the job to ensure that they understood what knowledge management was and what she was there to do. After obtaining the buy-in from the senior leadership, she recruited 19 knowledge coordinators from the central and regional offices, as well as, facilitated sessions in order to make knowledge management inroads within the bureau. The goal was to design a formal program for the knowledge management activities done on an ad-hoc basis within the bureau. Viewing knowledge as an asset that is complex, scarce, costly and strategic, a knowledge audit focused on identifying capabilities, capacities, and perceived problems rather than stores of knowledge itself. Based on this audit, Camarena developed the unit's strategic focus on culture, business process, decision-making and strategic planning. Since knowledge management happened around the people at FTA, the unit viewed itself as a consultancy and a resource to support knowledge sharing for the purposes of accomplishing the agency's mandated mission. In 2009, the unit's progress could be assessed by reviewing the Knowledge Management Strategy Overview as seen in Appendix 5.3. As of January 2009, according to an OPM research project questionnaire, FTA had a knowledge management strategy document, incorporated knowledge management goals in its Annual Performance Plan, and placed an After-Action Reviews (AARs) management process.

As a leadership priority, the next step was to provide the content for a knowledge portal that employees could effectively use to share methods and best practices within FTA. Although used enterprise-wide at the DOT, the portal had mixed success at FTA, as it appeared to lack content sustainability. Therefore, the focus of the knowledge management unit temporarily shifted towards working on promoting a knowledge sharing culture with the ability to innovate. To this end, communities of practice have flourished

around FTA. Communities of practice are natural networks of experts committed to generate new knowledge, enhance skills and sustain the values of a specific professional domain. Today, knowledge management champions within communities of practice at FTA view TransPort, a knowledge portal built using Microsoft SharePoint, as a successful tool to promote a knowledge sharing culture.

The unit also avails from the ideation platform movement within the federal government (Lee, 2013). Currently, the unit is responsible for managing IdeaHub within FTA. IdeaHub is an online community in which employees within the DOT collaborate to build innovative ideas that make the agency better. Employees are crowd sourced within IdeaHub for providing a social community to generate ideas, post questions and challenges and further develop the ideas that others have submitted. According to FTA, the ideation platform has agency-wide support since it has been successful at generating innovation and new knowledge.

Another enterprise wide agency initiative is the Adobe Connect communication platform. Adobe® Connect™ is a web conferencing platform for web meetings, eLearning, and webinars. It powers mission critical web conferencing solutions end-to-end, on virtually any device, and enables organizations from leading corporations to the U.S. Department of Defense to improve productivity.[13] Given the decentralized nature of FTA operations, the platform has been successfully used for conferencing and providing cost efficient training through webinars.

Two key practices successfully introduced to promote the effectiveness of knowledge retention within the division are the legacy capture interview and After-

[13] As described in its official page http://www.adobe.com/products/adobeconnect.html accessed 9/5/2014.

Action Reviews (AARs). In a legacy capture, the unit interviews an employee that is leaving having a conversation with his or her peers about their job, or a moderated interview with a manager sharing aspects of his leadership role within FTA. Often, these interviews are necessary because employees might have technical program specific expertise that is not necessarily available to the department since he/she might have been the sole owner of the program. The interviews are videotaped and transcripts are produced of the conversation to share with new employees who will have not had access to the learning opportunity through mentoring or shadowing. In after-action reviews (AARs), Camarena's expertise has been honed in the military. She has contributed a publicly available technical manual on AARs published by USAID.[14] AARs are a management practice developed by the U.S. Army for the purpose of training soldiers to meet task and mission standards. Everyone that participated in the project or event contributes to the exercise. The goal is to be able to take away the emotions from the participants and look at the facts and data of the project or event to generate actionable recommendations for improving future performance in a similar situation. At FTA, this exercise can last for as long as one and half hours and is driven by a set of four standard questions:

- What was expected to happen?
- What actually occurred?
- What went well, and why?
- What can be improved, and how?

The discussion generates new knowledge or learning of the project or event that participants can use to respond effectively under similar circumstances encountered in the

[14] The After-Action Review Technical Guidance manual is available at http://pdf.usaid.gov/pdf_docs/pnadf360.pdf accessed 9/5/2014.

future. The exercise also generates recognition and appreciation for others' perspectives regarding the project or event providing for a venue to enhance collaboration among members. A report is then prepared and available to be shared among members of the team and senior management. The focus is on improving performance. By the end of the AAR, "participants must clearly understand what worked well and why, what did not go well, and where improvements can take place" (Camarena, 2006, p. 17).

An example of a best practices repository at FTA is the Grants A-Z database, which FTA has maintained prior to the inception of the knowledge management initiative. However, the knowledge management unit has also developed templates, online people directories, effective meeting practices, and formal and informal recognition programs that enhance FTA's organizational effectiveness at accomplishing its congressionally mandated mission.

Camarena, through an opportunity to serve as an acting learning and development lead, encountered synergies among resources offered by the two separate units. The teams started to work seamlessly which provided the opportunity to consolidate the units into one unit, now the Learning and Knowledge Management unit. Viewing training as a tool to influence the knowledge sharing culture at FTA, the merged team created the Knowledge and Experience Exchange Program. Beyond traditional training activities, components of the program include mentoring, knowledge cafes, brown bag sessions, shadowing and book reviews (Welcome, 2014). Following a strategy of localize training within the bureau allows employees to build social networks, bridge knowledge gaps and assures management a faster response to pressing problems (DeLong, 2004).

At FTA, developing a knowledge sharing culture plays a larger role in the knowledge management strategy than incentivizing the behavior through compensation. The only knowledge sharing incentive is public recognition, which is informal, but the strategic plan currently includes the implementation of a non-monetary award for sharing knowledge. However, incentivizing knowledge sharing is made possible in the bureau because of the existence of a hub for the activity.

Barriers to knowledge sharing at FTA were deemed critical when reviewing the 2013 results to Item 26 within the EVS survey. The percentage of positive responses ("Strongly Agree" and "Agree") decrease between 2012 and 2013. The unit engaged consultants to conduct focus groups within the organization. Employees voiced concerns over increasing workloads resulting from the Hurricane Sandy disaster and lack of supervisory availability. This information is shared with the division leadership in an effort to address employee's viewpoints.

Case 2: Becoming a Learning Organization through Contextual Learning at NASA

As described by the U.S. Government Manual, the National Aeronautics and Space Administration (NASA) was established by the National Aeronautics and Space Act of 1958 (National Archives and Records Administration, 2012). According to its strategic plan, NASA's mission is to "Drive advances in science, technology, aeronautics, and space exploration to enhance knowledge, education, innovation, economic vitality, and stewardship of Earth."[15] As further stated in the strategic plan, the organization keeps a robust knowledge management program for capturing and integrating lessons learned into future missions. A systematic approach to knowledge management at NASA

[15] NASA's strategic plan at http://www.nasa.gov/sites/default/files/files/FY2014_NASA_SP_508c.pdf, accessed 9/9/2014

took hold in 2011 with the appointment, under the Chief Engineer, of an agency level Chief Knowledge Officer (CKO), supported by the appointment of knowledge officers at each center and mission directorate (Hoffman and Boyle, 2014). Following a federated structure, the CKO and deputy CKOs became the facilitators and champions for the knowledge services offered at the agency (Hoffman and Boyle, 2014). Today, the permeating efforts in knowledge management are represented by the agency's recent development of a knowledge map shown in Appendix 5.4. In addition, Table 5.2 below provides an overview of the key knowledge management programs at NASA.

Table 5.2: NASA's Knowledge Management Programs

Program	Description
Lessons Learned Information System (LLIS)	Principal mechanism for collecting and sharing lessons learned from Agency programs and projects. It is an automated online database. The information in LLIS is drawn from individuals, directorates, programs, projects, and any supporting organizations and personnel accross NASA, including engineering, technical, science, operations, administrative, procurement, management, safety, maintenance, training, flight and ground-based systems, facilities, medical, and other activities. First established as a paper system in 1992 and operating as an automated web-based system since 1994.
NASA Engineering Network (NEN)	Provides NASA personnel a portal to access, create, and share lessons learned, interact with SME and practitioners, search many NASA repositories of interest, and find tools and information resources. NEN's suite of information retrieval and knowledge sharing tools has the capability of searching for lessons learned accross the Agency's multiple repositories, inlcuding LLIS. The system was put in place in 2005.
Academy of Program/Project and Engineering Leadership (APPEL)	Provides training to meet the learning and development objectives of the NASA program and project management and engineering communities.
ASK Magazine	Designed for program project managers and engineers to share expertise and lessons learned with fellow practitioners.
Master Forum	Participants share best practices and lessons learned with NASA employees and contractors.
Project Management Challenge	Annual conference that examines current management trends and provides a forum for sharing lessons learned. In February 2012, the office of the Chief Engineer announced that the Project Management Challenge conference would be discontinued in favor of virtual seminars.
Road to Mission Success (RTMS)	A Goddard in-house workshop series of six full days (spread over a month) to look at how the Center actually works through in depth discussions with senior leaders and the study of Goddard case studies.

Source: Office of Inspector General, 2012 and NASA website

Attesting to innovation in management practices, two leading business schools wrote cases on NASA's knowledge management initiatives in the early 2000s (Leonard and Kiron, 2002; Yemen and Clawson, 2004). At NASA, knowledge management has been a mandated initiative since January 2000. Tragic accidents of the space vehicles, the Challenger in 1986 followed by Columbia in 2003, and a set of Mars mission failures gave rise to the importance of learning from mistakes through a disciplined approach.

Furthermore, an aging workforce attenuated the need to capture oral histories of "one of a kind projects".

At NASA, knowledge management represents the ability to bring the "right information to the right people at the right time." According to NASA Policy Directive 7120.6 knowledge management is "the policies, processes, and practices that allow the Agency to identify and manage knowledge gained by its workforce in varied forms. Knowledge management specifically addresses how knowledge is created, retained, shared, and transferred throughout NASA and with its partners and contractors. It involves dynamic contextual learning that supports the effective transfer and utilization of knowledge throughout the Agency."

In December 2000, the Chief Engineer reported on the need to improve communication across the Agency by using knowledge management tools and practices (Office of the Inspector General, 2012). The report identified an improved lessons learned strategy as the primary mechanism. This direction of capturing lessons learned could be contrasted with the experience that Rob Manning, Chief Engineer of Pathfinder, had on the date the spacecraft landed in Mars on July 4, 1997. The team "had been inventing and designing and building and coding so fast that they didn't even have time to properly document most of what they had accomplished. There was no time or money for documentation" (Pyle, 2014, p. 17).

NASA might well be one of the earliest U.S. government institutions that dedicated resources to knowledge management research. NASA's Ames Research Center (ARC) has been active in knowledge management related research at least since the late 1980s (Keller, 2002). Although ARC focused on artificial intelligence, there are

many overlapping areas. In artificial intelligence, the computer plays a central role in knowledge transfer; while in knowledge management, technology may or may not be part of the knowledge transfer process. Scientist at ARC identified knowledge transfer and machine learning as research areas of interest for both artificial intelligence and knowledge management. At ARC, knowledge transfer capabilities were tracked using five broad categories: Capture, preservation, augmentation, dissemination, and infrastructure. In 2002, an inventory of systems at ARC revealed that preservation, augmentation and infrastructure were the focus of the systems. However, capture and dissemination were the categories with less systems presence. Consequently, NASA came to the realization that information technology alone could not address its knowledge challenges.

In 2002, GAO identified weaknesses in NASA's lessons learned and knowledge management process. Specifically, it found that "NASA did not routinely identify, collect, or share lessons learned by its programs and project managers" (Office of the Inspector General, 2012). In 2005, NASA published Procedural Requirement (NPR) 7120.6 "Lessons Learned" with the purpose of facilitating knowledge capture from individuals, projects and programs. The requirement established Lessons Learned Committees at the center level and described the multiple-step process to publish information in the Lessons Learned Information System (LLIS). Specifically, it asks center level committees to identify lessons learned and validate them for Headquarters review. It is the responsibility of center managers to coordinate export control, patent, legal and public affairs clearance of the information. Upon approval of the Headquarter Steering Committee, the curator uploads the lessons learned into LLIS. The curator has

access to utilization metrics and provides quality assurance. In February 2009, the Chief Engineer and Chief of Safety and Mission Assurance, via an Agency letter, encouraged active participation by NASA senior leaders in institutionalizing and sharing lessons learned across the agency (Office of the Inspector General, 2012). Appendix 5.5 shows the flowchart of the Goddard Space Flight Center (GSFC) approval process for including lessons learned within the existing system platforms. Within the flowchart, one can appreciate two separate approval processes. First, lessons learned need to be approved for inclusion in the Goddard Knowledge Exchange (GKE) system. According to a presentation provided by GSFC, GKE is an application/system to create, organize, share and search program and project lessons learned in a secure repository. If applicable to other centers, lessons learned are also submitted for external review to the agency wide LLIS system.

NASA could have been perhaps the first agency in the federal government to link the management of knowledge with organizational learning. At NASA, a learning organization is one with the ability to apply collective knowledge to problem solving. The goal of knowledge management at NASA is to promote mission success through fostering a learning culture (Yemen and Clawson, 2003). As Pyle (2014, p. 180) notes, "preserving a mission that has gone well beyond all expectations of achievements…and budget" could be quite a challenge at NASA and without doubt much harder to accomplish without relying on achievements from contextual learning within the organization.

In 2010, only four facilities out of eleven submitted lessons learned. According to the Office of the Inspector General (2012), the only consistent contributor to the LLIS

program was JPL. Project managers were more willing to endorse the benefits of knowledge sharing through the Project Management Challenge, the Road to Mission Success and the Master Forum. The majority of project managers were unaware of NASA's policy requirements to contribute lessons learned. According to the project managers, the situation was further heightened by the policy of having contributions reviewed by the external review boards, inadequate resources, low priority within the project and time-consuming endeavor.

NASA Policy Directive 7120.6 Knowledge Policy on Program and Projects was renewed effective November 26, 2013. The responsible office for ensuring compliance is the Office of the Chief Engineer. Its purpose is to "effectively manage the Agency's knowledge to cultivate, identify, retain, and share knowledge in order to continuously improve the performance of NASA in implementing its mission…" It applies to Headquarters, NASA Centers, Mission Directorates, contractors and grant recipients. It identifies organizational culture as key to enhancing the knowledge management effort. In addition, it is mandated that the NASA's Chief Knowledge Officer "Facilitate the dissemination and promote utilization and implementation of lessons learned and best practices." The Centers and Mission Directorates are required to develop a knowledge strategy.

Beyond capturing lessons learned, in an evolving and more dynamic model for transferring and utilizing knowledge throughout the agency, NASA now is focusing on activities that promote contextual learning (Hoffman and Boyle, 2014). In an environment where team members are rewarded from learning how to accomplish complex activities (Pyle, 2014), promoting contextual learning becomes a key knowledge

management strategy. There is emphasis on activities that get people together so they can share their oral stories and learn from context. Taking responsibility and learning from mistakes is promoted by encouraging the sharing of failures to prevent future occurrences (Pyle, 2014). Beyond codified knowledge and "know-how", knowledge management at NASA also looks into capturing and disseminating nontraditional knowledge sources such as that derived from social and cultural experience (Hoffman and Boyle, 2014).

Designing incentives for knowledge sharing continue to be a balancing act at NASA. As experienced managers understand, incentives designed to benefit organizational performance could have unintended effects. NASA agencies compete for projects and funding of programs. Competition among centers can spur creativity but also have the adverse effect of promoting situations where knowledge appears to be privatized (Leonard and Kiron, 2002). Consequently, knowledge management efforts must be able to identify barriers to knowledge sharing that could hinder the organization's ability to accomplish mission success.

At NASA today, project responsibilities have expanded beyond purely focusing on mission success. A wider variety of functional activities, include "business management, commercialization, new technology identification and development, strategy development, and more" (Hoffman and Boyle, 2013, p. 24). Consequently, knowledge management efforts at NASA are responding to rapid changes in the environment. In its latest efforts, NASA is creating video dashboards, access libraries, process flows, project case studies, and knowledge maps to ensure capture of the top five to ten percent of critical knowledge for future projects (Welcome, 2014).

The Renaissance of Knowledge Management

As seen in the cases, U.S. government agencies have been successful in using knowledge management practices to ensure knowledge retention within their organization. Table 5.3 below summarizes the most commonly used knowledge management practices for transferring explicit and tacit knowledge:

Table 5.3: Most Commonly Used Knowledge Management Practices

Explicit Knowledge	Tacit Knowledge
• Legacy capture interviews: Transferring knowledge between a veteran employee and his or her successors. • Documents and Templates: Documenting key activities and facts in paper files or some kind of electronic database. • Training: Packaging captured knowledge into formal training materials and offered to a broader set of employees.	• Storytelling: Communicating knowledge that can't be represented as propositions or rules. • Mentoring and Coaching: Sharing of the broadest range of knowledge, from detailed technical skills and tacit cultural values to career development advice, in a relationship that ideally allows the expert to monitor the degree to which knowledge is actually being absorbed. • After-Action Reviews: Transferring expertise in a larger group. • Communities of Practice: Improving knowledge sharing and problem solving across organizational boundaries.

Source: Adapted from DeLong (2004)

In times of austerity within the federal government, practitioners of knowledge management have become increasingly interested in developing winning models to generate a return on investment from knowledge management practices. Knowledge management is promising to do just that. It recognizes that organizations can benefit from a better understanding of how to represent and reason their current policy and business processes in order to improve them. As technology becomes ubiquitous, organizations that are able to provide accurate knowledge representations of their

processes will be the only ones to avail from the benefits of timely automation. In the case of government, this will prevent mishaps and delays in the implementation of policy aimed at delivering products and services to the constituency.

Knowledge management brings into play the importance of developing a practice in which knowledge models are built to make explicit policy and business processes for enhancing decision-making. The public management profession could experiment with knowledge models to enhance agencies abilities to simplify, target and automate decision-making. These knowledge models will then be subjected to modification when the policy or market environment changes. Having these models readily available makes operational and decision-making processes within the organization "flexible and resilient to change" (Voskuil, 2012). In this knowledge management renaissance, knowledge models become as important as physical and financial assets currently are for organizations in general.

According to Voskuil (2012) "a knowledge model expresses the rules and concepts that drive a business, and describes regular cases as well as "exceptions" – which then become normal." He also provides an example of how the Dutch government has successfully used semantic technology to improve immigration services. Using a website, the immigrant answers questions that trigger a profile that provides the engine to a series of rules determining which topics will be relevant to the immigrant. This topic list encompasses a series of information assets that are put together from different government offices such as the immigration office, the tax department, benefits payment, vehicle registration, etc. Each government agency manages its own information assets, which include metadata associations and taxonomies. This way of modeling business

processes within technology-aided platforms provides for collaboration among government agencies and a citizen centric approach to services. In this example, the knowledge intensive task of providing immigration services to the country's visitors has relied on ontology and taxonomy tools to automate business processes rules from a group of ministries or agencies. Ontologies and taxonomies are mapping tools that help develop knowledge models for business process improvements.

In the renaissance of knowledge management, public managers will need to think beyond old paradigms in order to improve the delivery of product and services to the citizenship. Knowledge models that are documented could help enhance the ability of the federal agency to implement changes in policy and business processes that promote responsiveness to citizens and policy makers. Potential questions for improving government performance, resulting from the production of these knowledge models, could be:

- How agencies could enhance services to citizens by embedding more skills into information and intelligence systems?
- How can knowledge models be used to improve contextual learning activities within the employee-training offering of federal agencies?
- What knowledge models could be built that will help enhance the policymaking and delivery process at the federal government level?

Theoretical Implications

As it relates to theoretical proposition H1, SME informed that knowledge management in practice rely more on tasks and activities addressing culture and technology. Although content analysis is ineffective for testing causal relationships (Berg and Lune, 2012), we can state that none of the quotes identified as part of the coding analysis within the strategic plans provided an indication of the use of incentives

to promote intra-agency knowledge sharing. Other than public recognition, incentives for promoting knowledge management outcomes, such as knowledge sharing, are not currently used within the representative agencies that responded to the meeting invitation. In addition, there was no evidence that an assessment of how performance is incentivized within the agency influenced knowledge sharing considerations.

Regarding theoretical proposition H2, evidence of cultural orientation was not obtained for qualitative purposes due to the difficulty of having a representative sample of agencies and a tested instrument for cultural orientation research in the U.S. federal government. However, the FTA acknowledged that prior to the formalization of the knowledge management program within the bureau; the culture of the organization was welcoming to knowledge sharing outcomes.

Regarding theoretical proposition H3, obtaining a qualitative understanding on incentives is not possible since they are not part of the mechanisms currently used by knowledge management practitioners that participated in the SMEs meetings. In the future, knowledge management practitioners in the federal agencies might be willing to experiment with incentives, whether via establishing specific incentives for knowledge sharing outcomes or, indirectly, by assessing the effects of performance incentives (such as merit-based) on promoting a knowledge sharing culture.

Finally, as it relates to theoretical proposition H4, there was no indication from SMEs that agencies that invest more in technology are better at knowledge sharing. It was emphasized during the meeting that it is consequential to have a "champion" within the agency to promote knowledge sharing behaviors through enabling technology focused tasks and activities within knowledge management.

Research Limitations

Samples used in qualitative research are often not inclusive. I was only able to gather evidence from the few agencies that accepted the invitation to attend the best practices meeting. In addition, the qualitative evidence gathered by SME meetings, articles and the agencies' strategic plans does not include the views of agency employees as stakeholders of the knowledge management process. Employees' views might have highlighted patterns not necessarily observed by SMEs. In addition, the SMEs views are limited to the representative agencies that attended the Federal Knowledge Management Community gathering on 7/30/2014. This might have influenced the direction of the report.

At this moment, the researcher is limited in obtaining an understanding of cultural orientation of the agencies. In order to further the analysis, an instrument needs to be developed and tested in a representative sample of U.S. federal agencies.

As articulated below, there are inherent limitations in qualitative research (Creswell, 2013). Rather than validating, qualitative research tries to understand the phenomena under consideration. In addition, reliability is limited to establishing a degree of dependability and authenticity around the methods and findings. To address dependability, meetings conducted at a site were recorded for further analysis. Furthermore, the coding analysis could be replicated since the documents are publicly available. To address authenticity, the researcher triangulated among data sources and methods. Finally, the researcher solicited SMEs views on the authenticity of the findings and interpretations.

Despite these limitations, the study concludes by advancing potential solutions for the knowledge sharing dilemma in organizations and offering direction for future research.

Appendix 5.1: Invitation Letter for Meeting on 7/30/2014

July 21, 2014

Federal Knowledge Management Community
Washington, D.C.

Dear community member,

My name is Lourdes N. Alers-Tealdi. I am a doctoral candidate in the School of Public Affairs and Administration (SPAA) at Rutgers University - Newark. As part of the requirements to complete a doctor of philosophy (PhD) degree, I am conducting a research project in the field of public management on the practice of Knowledge Management within the Federal government. This letter is an invitation for subject matter experts in Knowledge Management within the Federal government to participate in the research study.

I started this project with the goal of providing a parsimonious and pragmatic theoretical model that, from a managerial standpoint, advances our understanding of how leaders can institutionalize knowledge sharing within the Federal government. The Federal agencies, as an organizational field, provide an excellent organizational context to test theory. In the U.S. federal government, Knowledge Management has been a core strategic effort since at least the 1990s. Using the 2012 Employee Viewpoint Survey (687,687 respondents), a theoretical model was developed to statistically test the institutionalization of knowledge sharing through the use of culture, incentives and technology in Federal government agencies. The qualitative research part of this study will corroborate with subject matter experts how agencies are currently using the tools and mechanisms of culture, incentives and technology to promote knowledge sharing in federal agencies.

I will be conducting a best practices meeting on Wednesday, July 30 at the Conference Center of the Federal Transit Administration (FTA) located at 1200 New Jersey Avenue South East. The meeting will be conducted from 10am - 12pm and, if your schedule allows, please also join us for lunch from 12pm – 1pm. The meeting will be driven by open contributions or presentations from the participant members. Please be prepared to contribute (via presentation or informal discussion) information on your agency's Knowledge Management efforts. Although my primary interest is in practices around the research themes of culture, incentive and technology, if applicable to your agency and role, focusing on one best practice that has been particularly successful in your agency is an alternative value added contribution to the meeting and the study. In addition, sharing documents that explain the Knowledge Management strategy within your agency is highly valuable. Based on the interest generated during this meeting, I will schedule phone conversations to narrow the best practices to be highlighted in the research study. The meeting will be recorded, but you will remain anonymous within the research report.

Your participation is voluntary. However, your participation will benefit the advancement of public management as a field of study. Specifically, it will contribute to a dissertation that will be published at Rutgers University – Newark.

If you have any questions regarding the research project or any other part of this letter, please feel free to contact me via email at lourdes.alers@rutgers.edu , or my advisor, Dr. Norma Riccucci, at riccucci@rutgers.edu. I look forward to your participation and meeting with you as part of this initiative.

Sincerely,

Lourdes N. Alers-Tealdi
PhD Candidate
Rutgers University - Newark

Appendix 5.2: SMEs Unstructured Interview Protocol

- Culture
    - Has culture been used as a tool to promote knowledge sharing at FTA?
    - Have culture influenced the implementation of knowledge management strategies between the central FTA operations and the regional offices?
    - How has knowledge sharing improve innovation at FTA?

- Incentives
    - What role do incentives play in FTA's knowledge management efforts? (i.e. job description, employee's evaluation, awards, time, remuneration).
    - Have a commitment to knowledge sharing at FTA been accompanied to a merit reward system? If yes, please explain in what ways.

- Technology
    - How has ICT influence knowledge sharing at FTA?
    - How has investments in ICT provided a platform for knowledge management at FTA?
    - Has the enterprise wide services initiative at the federal level affected the practice of knowledge management at FTA?

- ROI – justifying knowledge management investments at FTA
    - Given the state of the economy, why an agency will invest not only in knowledge management, but any information-handling technology?
    - What issues at FTA does the leadership feel knowledge management should address to ensure mission accomplishment?
    - How did the knowledge audit help justify the investment at FTA?
    - In a complex task as managing knowledge, has the FTA been able to identify metrics to justify investments?

- Knowledge and leadership
    - What is the role of senior leadership in influencing knowledge sharing at FTA?
    - Is an agency Chief Knowledge Officer necessary?
    - What skills should a knowledge management leader exhibit?
    - What level of authority does a knowledge management leader needs within the agency in order to be effective?

- Beyond the four walls – Sharing knowledge in an intra-agency and inter-agency environment

- What processes and practices are in place to ensure (1) intra-agency and (2) inter-agency collaboration? (i.e. at the DOT level)

- Legislative, regulatory or policy limitations in knowledge sharing at FTA

  - How are legislative, regulatory or policy limitations in knowledge sharing handled at FTA?

Note: Interview protocol relies on the "Institutionalization of Knowledge Sharing" theoretical model as presented in Chapter 3. In addition, it borrows from Frappaolo (2002) and the direction of Dr. Marco Ferreira, Outside Faculty Advisor.

Appendix 5.3: FTA Knowledge Management Strategy Overview

FTA Knowledge Management Strategy Overview

FTA Knowledge Management Vision

FTA knows what it knows; it is continuously filling the gaps of what it does not know. We have, therefore, increased the use of innovative approaches for accomplishing both our long-range planning and our day-to-day activities.

FTA Knowledge Management Mission

Implement the procedures and tools required to easily find and share the experience, knowledge and information that support proactive and responsive decision-making at all levels for FTA.

FTA Knowledge Management Strategic Goals

Goal 1: FTA Encourages a Culture of Knowledge and Experience Sharing

- FTA has a common understanding of KM and its goals.
- FTA Staff knows of, and uses, KM tools and procedures.
- FTA provides incentives for sharing knowledge and experience.

Goal 2: FTA Employs Efficient and Effective Business Processes

- KM tools and procedures are integrated into FTA's daily business process.
- FTA uses KM tools to document its business procedures.
- FTA harnesses its knowledge and experience.
- FTA Staff can easily access knowledge, experience and information to conduct the Transit Mission.

Goal 3: FTA Leverages its Knowledge and Experience for Decision Making and Strategic Planning

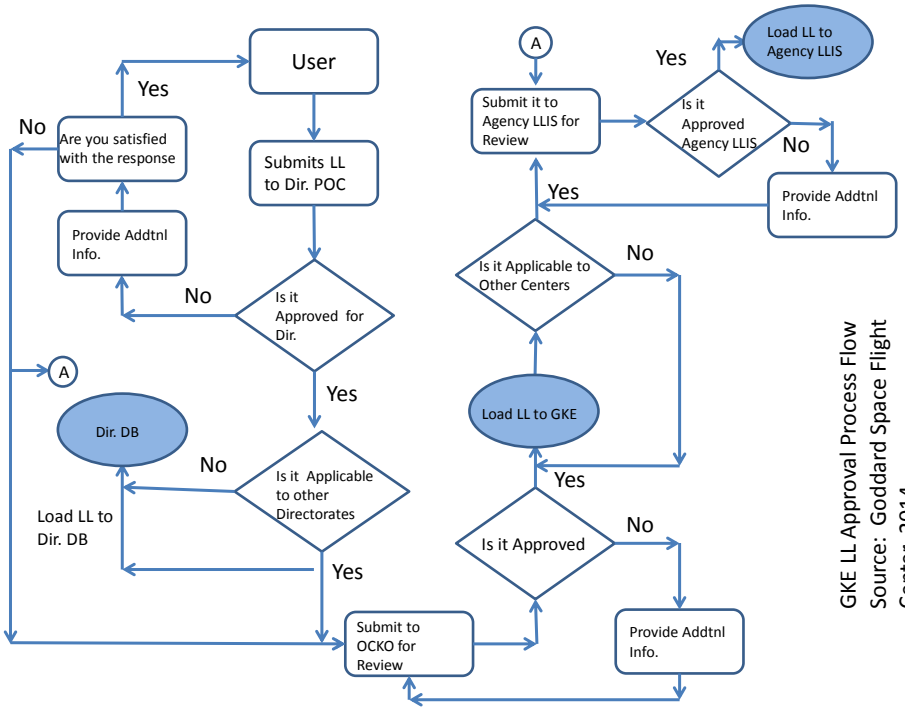
- Decision Making and Strategic Planning is augmented by enhanced business processes resulting from implementation of KM procedures and tools.
- Data and knowledge formulate foundation for comprehensive decision making,

Source: Federal Transit Authority (2012)

Appendix 5.4: NASA Knowledge Management Map

Source: NASA's Website, http://km.nasa.gov/knowledge-map/, accessed 9/9/2014.

Appendix 5.5: LLIS Approval Process for Goddard Space Flight Center



GKE LL Approval Process Flow
Source: Goddard Space Flight Center, 2014

Chapter 6: Conclusion - Summary of Findings, Practical Implications, and Limitations to Address in Future Research

Overview

Using an institutional theory framework, this study provided an overview of the practice of knowledge management in the U.S. federal government. This conceptual framework and research tradition has been used by scholars since the mid-19th century (Scott, 2014). The work of Alexis De Toqueville exemplifies early scholarly interest in understanding American institutions in a period of rapid institutional build up. This scholarly interest has permeated public management reform practices which have been a subject of interest for institutional scholars (Tolbert and Zucker, 1983). The institutionalization of knowledge management in the federal government answers to a management need to lower the risk for information failures and improve business process performance. Although institutional theory today has an interdisciplinary base, this empirical study has followed on the tradition of the founders of the institutional school in that it simplifies assumptions to develop theoretical principles with the potential of wide applicability (Scott, 2014).

Since we can only call upon knowledge when shared, only knowledge that is shared is subject to management within the organization. However, a key prerogative within the professional field calls for the need to promote a knowledge sharing culture within the organization. It is on this premise that the practice of managing knowledge is founded. Knowledge management has enjoyed the endorsement of both intellectuals and professional consultants giving the administrative practice legitimacy within management circles. In the case of the U.S. federal bureaucracy, the State can avail from the force of

law to introduce administrative practice. Consequently, the legitimacy of knowledge management as a practice within U.S. federal agencies is driven by both the profession and the coercive power of the State.

Summary of Findings

Since few empirical studies with a focus on variability have been produced on "factors affecting the nature of institutional frameworks" at the organizational field level (Scott, 1994a, p. 86), this study offers a contribution to institutional theory within the field of public administration. Given the current interest in collecting and analyzing large data sets, more institutional studies at the organizational field level should be expected in the future. The study presented the U.S. federal agencies as constituting an organizational field (Scott, 1994b; 2014) fertile for studying isomorphic institutionalization of knowledge sharing. As evidenced by the ability of U.S. federal employees to commonly relate to the annual EVS questionnaire, isomorphic forces are also apparent in the field's acceptance of similar practices around culture, incentive and technology. These variables were presented in the study as the three available mechanisms for leaders within U.S. federal agencies to institutionalize knowledge sharing.

The complex phenomena of organizational knowledge sharing became subject to examination by statistical inference and qualitative inquiry within a specific organizational field, the U.S. federal bureaucracy. A mixed methods design provided the opportunity to capture evidence from a large survey set and corroborate findings with experts whose job is to promote organizational knowledge sharing. By triangulating

evidence, certain patterns of the state of knowledge management within U.S. federal agencies were captured.

The study statistically showed that culture and incentive mechanisms could both be effective in addressing knowledge sharing perceptions in an agency. Although no prior study uses similar measurements for the dimensions presented in this study, Kim and Lee's (2006) statistical model also included dimensions of culture, incentives and technology. Within the cultural dimensions, they find that trust and access to social networks have a significant influence in knowledge sharing. As it relates to incentives, their study is of particular interest as it measures how perceptions of performance based reward systems influence knowledge sharing. Similar to this study, Kim and Lee find that employees with strong perceptions of performance-based reward systems are more likely to share knowledge. Taking the Executive Branch agencies within the U.S. federal government, this study showed that an agencies' culture is more sensitive to knowledge sharing perceptions than incentives. Therefore, the statistical evidence supports prioritizing knowledge management efforts at producing a culture amenable to knowledge sharing.

As presented in Chapter 5, SMEs meetings also attested to the importance of culture in this process. This preference is not different from those found in a study conducted by Sveiby and Simons (2002) in which 8,277 managers surveyed agreed that culture is where the best opportunities will be found in the next five years. As a mechanism to promote organizational knowledge sharing, culture has found a following among knowledge management practitioners.

Within the statistical model presented in Chapter 4, one can also appreciate the interplay between culture and incentives. We have inferred from this study that culture perceptions have the strongest influence at the "Disagree" level or above; however, we find that in "Strongly Disagree" instances incentives rather than culture have stronger influences in knowledge sharing perceptions. This finding is relevant since SMEs are currently not relying heavily on incentives to promote knowledge sharing behaviors among employees within the agency. This aligns with prior research by Willem and Buelens (2007) that finds low use of incentives in the public sector despite incentives having a significant empirical effect on knowledge sharing. However, as stated by Newell et. al. (2009), "If the leader of a knowledge-intensive firm wished to emphasize the importance of knowledge sharing – as might be expected in knowledge-intensive firms – then mechanisms that directly or indirectly rewarded knowledge sharing would need to be introduced."

This study focused on merit-based incentives as measured by the EVS 2012 questionnaire. The U.S. federal government has a long tradition of implementing a merit-based civil service. The statistical results of this study support the use of merit-based compensation and rewards systems within U.S. federal agencies for the purpose of promoting knowledge sharing. This is an important finding given the challenging history of pay-for-performance reform in the U.S. federal service system (Perry, Engbers and Jun, 2009; Rainey and Kellough, 2000).

Statistically, the study also showed that technology investments in an agency do not influence knowledge sharing perceptions among employees. This corroborates findings by Connelly and Kelloway (2003) which demonstrated that presence of

knowledge sharing technology in an organization do not predict a positive knowledge sharing culture. Taking both the quantitative and qualitative research together, there is interplay between the relevance of technology in knowledge sharing and a management's prerogative for technology. Strategic preferences for technology among management might bias considerations of culture and incentives to promote knowledge sharing within the organization. SMEs play a crucial role in this interplay since they remind management of the need for a catalyzer to ensure technologies are fully leveraged for knowledge sharing. Much of the institutionalization power of technologies derives from human agency since "users shape the way technologies are actually used in everyday practice because most technologies can be used in multiple ways" (Newell, Robertson, Scarbrough and Swan, 2009). This is even more real for the collaborative technologies that are currently used by the U.S. federal government. As discussed within the qualitative research, consultants and academics in the public sector consider Web 2.0 technologies as having the capability of creating an environment of collaborative government. The Deloitte report, written in conjunction with the National Academy of Public Administration, concluded with two important questions: "Do you give people the tools they need to create a collaborative atmosphere? Or do you start by creating that atmosphere, so that when the tools arrive, people actually will use them?" (Deloitte Research, 2008). The report concluded that there is a need for managers to work on both efforts.

The findings on the effects demographics have on knowledge sharing perceptions should be of interest to academics and practitioners working with diversity issues. Females, minorities and people aged 40 or older are less likely to agree that knowledge is

shared in their work unit. Connelly and Kelloway (2003) studied the variables of gender and age in relation to a social interaction culture. Although no significant findings were reported for age, gender did have an effect on social interaction culture. Empirical work reviewed in this study attest to the social side of knowledge sharing by providing statistical evidence of its positive association to social networks, informal and lateral coordination (Kim and Lee, 2006; Willem and Buelens, 2007).

Practical Implications

Among practitioners, an emphasis on culture has successfully propelled the use of symbols to promote knowledge sharing behavior in organizations. (Connelly and Kelloway, 2003; Newell, Robertson, Scarbrough and Swan, 2009). A case study by Girard and McIntyre (2010) shows how the Canadian federal government, after the horrific events of September 2001, relied on the use of a cultural symbol to promote knowledge sharing within federal agencies. Senior leadership recognized the value of knowledge management but was uncertain about how to implement the culture within the bureaucracy. Representing the importance of artifacts in communication, the team selected the Inuit Inukshuk as an icon for the knowledge management model. The Inukshuk is a human-shaped figure built by piling stones on one another by the Inuit in the northern part of Canada for the purpose of navigational assistance (Dalkir, 2011). The selection of the symbol reflected its cultural affinity in Canada, the central part played by people in knowledge sharing and the diversity reflected by the fact that each Inukshuk is unique (Dalkir, 2011).

According to Cabrera and Cabrera (2002), organizational knowledge sharing is a social dilemma that requires managerial actions that either lower the perceived cost or

increase the perceived benefits of the behavior. Among actions proposed are: incentives for cooperation and contribution rate, feedback on contribution mechanisms, training programs that teach employees how to make knowledge contributions and the establishment of communities of practice. Furthermore, an important aspect of the knowledge sharing program is "promoting group identity and personal responsibility."

To produce organizational commitment to these efforts, the FTA and NASA demonstrated the importance of designing consistent activities that facilitate knowledge sharing within the agency. Consistency of activities within the knowledge management program in the agency generates a cultural tradition and expectation of knowledge sharing. Ultimately, the goal for these types of activities is to create an open climate and signal a desire to promote a knowledge sharing culture within the agency.

It is often not clear how knowledge sharing produces the desired performance outcomes. A great degree of uncertainty regarding when and how knowledge shared will be used might deter the behavior from being a priority in managerial circles. Therefore, incentives tied solely to results for specific knowledge sharing behaviors might limit the flow of potential knowledge within the organization. Managers should also design incentives that reward employees for the process of sharing knowledge within their team or work unit. Performance evaluations can be designed to include knowledge sharing skills and/or goals for the group of employees within the work unit.

Both FTA and NASA have linked their knowledge management efforts to organizational learning. A strong organizational commitment to employee training and education can promote a learning culture where sharing knowledge becomes an expectation. Contextual learning activities within the agency can promote knowledge

sharing among employees. Organizations need to create the right contextual learning activities in order to engage employees. These contextual learning activities promote open communication where knowledge is shared through metaphors, analogies, symbols and concepts (Jensen, 2005; Nonaka, 1991). With the proper activities, contextual learning can provide the right environment to leverage the knowledge of all individuals involved for the purpose of creating new knowledge.

Knowledge managers need to address diversity considerations in how knowledge is shared within organizations. It is important to understand if minority, females and people aged 40 or older are getting access to social networks within organizations. As stated in an SME meeting, inclusion and engagement should be part of the efforts of a knowledge management program. Programming for the flourishing of affinity groups within agencies might help address the knowledge sharing needs of women and minorities.

The future of knowledge management relies on the ability to capture and automate highly customized knowledge models of business processes. The skills needed to address this challenge are the ability to organize the existing knowledge base of the organization and develop tools to communicate this knowledge succinctly to technologist with the ability to capture this reality in automated form. However, automation will need to be responsive to the rapid changes of highly customized knowledge models. Therefore, it is not technology that is driving this future but rather human intelligence, which through existing communication and information technologies can increasingly process and analyze large amounts of information for the purpose of generating new knowledge.

Limitations to Address in Future Research

The implementation of knowledge management research in the public sector will present its research challenges to public administration scholars since theories change more slowly than the values, attitudes and beliefs been experience in the digital State (Caldwell, 1975). However, I provide open questions that at this moment in time could be further explored by researchers interested in contributing to the knowledge management practice in the U.S. federal government.

A conceptual model with potential for being operationalized is the one presented by social dilemma theorists (Cabrera and Cabrera, 2002). One of the variables of most interest to these theorists is trust and its effects on knowledge sharing. Within organizational studies, the trust variable belongs to the cultural dimension. Although the culture scale included perceptions around whether agency leaders maintain high standards of honesty and integrity, this measure might not fully represent dimensions of organizational trust. Also, experimental research methods might be able to better capture trust outcomes that will otherwise be missed through statistical survey analysis.

As it relates to organizational field studies, the theoretical model is only tested using data from U.S. federal government agencies. Results with data from other organizational fields might differ resulting from different definitions of the culture and incentives construct, as well as, different competitive dynamics within the particular field under consideration. Therefore, future researchers could apply a similar methodology to a different organizational field in order to corroborate whether or not the findings of this study are generalizable.

The theoretical model presented has quantitatively highlighted existing variances in cultural and incentive perceptions across the U.S. federal government agencies. We also know that cultural orientation is most sensitive to knowledge sharing perceptions. However, it is not possible in this study to articulate the differences in culture and incentives among the diverse agencies of the U.S. federal government. Obtaining a qualitative understanding of these effects can improve the design of knowledge sharing activities within the agency. Future research should look at designing a research tool that better assesses the cultural orientations and the impact that incentives have on knowledge sharing within U.S. federal agencies.

This study also highlights the effects of merit-based incentives on knowledge sharing. However, we can not necessarily generalize findings from the specific organizational field of the U.S. federal government to other industry clusters. Future research could further explore how perceptions of merit-based rewards and compensation influence the degree of knowledge sharing among team and work units.

The technology variable captured in this study represents the technology investment of the agency divided by the number of agency's employees. My meetings with SMEs highlighted that a better measure will be to include only collaborative technologies. However, this figure is not currently available from the agencies. It is not clear if this will have an effect on findings but future research could improve the measurement by narrowing the technology definition to investments in those technologies that employees use to actually share organizational knowledge.

Findings around how demographics influence knowledge sharing are important for future research. This study showed that females, minorities and people aged 40 and

older are less likely to agree that knowledge is shared in their work unit. Future research should investigate to what extend these findings relate to inherent ways of perceiving organizational knowledge sharing and to what extend there might be social prejudice issues driving the relationship. This type of research will better help managers in the design of organizational engagement and inclusion programs that will mediate any potential negative effects.

Finally, although it is widely believed that knowledge sharing improves organizational effectiveness and mission accomplishment, this study did not address the implications of such outcome. Future research can extend the theoretical model of this study to address organizational performance issues. Understanding in which situations and processes knowledge sharing makes an organizational performance difference could improve the management practice.

The Path for Knowledge Management

In the 1970s, public administration scholars alluded to the changes resulting from knowledge management efforts (See Public Administration Review (PAR) in November/December 1975 with the symposium on Knowledge Management). Among the important changes given was the growth in the amount of information and the means of its dissemination (Caldwell, 1975). A major point raised was that similar to bureaucracy, technology is constituted by an empirical nature and antithetical to democratic values. Also, given that knowledge has the capacity of being self-organizing and self-regulating, a knowledge management policy needs to be meta-systematic in design to ensure its social stability (Henry, 1975). It was recognized that in a similar way to achieving political equality, we must contend with issues around achieving technical

equality. This leads to the increasing importance of the politics, law and administration of both knowledge and technology (Carroll, 1975). These overarching issues addressed by researchers in the 1970s continue to be relevant today. Institutions should continue to dedicate research resources to understand the social impact of knowledge in society and how best to leverage technology as a tool to disseminate such knowledge.

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