

2016

Tacit Knowledge Capture and the Brain-Drain at Electrical Utilities

Nicholas Steven Perjanik
Walden University

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Walden University

College of Management and Technology

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Nicholas Perjanik

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Walden University
2016

Abstract

Tacit Knowledge Capture and the Brain-Drain at Electrical Utilities

by

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MBA, California State University, Sacramento, 1994

BA, California State University, Sacramento, 1991

Dissertation Submitted in Partial Fulfillment

of the Requirements for the Degree of

Doctor of Philosophy

Management

Walden University

May 2016

Abstract

As a consequence of an aging workforce, electric utilities are at risk of losing their most experienced and knowledgeable electrical engineers. In this research, the problem was a lack of understanding of what electric utilities were doing to capture the tacit knowledge or know-how of these engineers. The purpose of this qualitative research study was to explore the tacit knowledge capture strategies currently used in the industry by conducting a case study of 7 U.S. electrical utilities that have demonstrated an industry commitment to improving operational standards. The research question addressed the implemented strategies to capture the tacit knowledge of retiring electrical engineers and technical personnel. The research methodology involved a qualitative embedded case study. The theories used in this study included knowledge creation theory, resource-based theory, and organizational learning theory. Data were collected through one time interviews of a senior electrical engineer or technician within each utility and a workforce planning or training professional within 2 of the 7 utilities. The analysis included the use of triangulation and content analysis strategies. Ten tacit knowledge capture strategies were identified: (a) formal and informal on-boarding mentorship and apprenticeship programs, (b) formal and informal off-boarding mentorship programs, (c) formal and informal training programs, (d) using lessons learned during training sessions, (e) communities of practice, (f) technology enabled tools, (g) storytelling, (h) exit interviews, (i) rehiring of retirees as consultants, and (j) knowledge risk assessments. This research contributes to social change by offering strategies to capture the know-how needed to ensure operational continuity in the delivery of safe, reliable, and sustainable power.

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Dedication

Completing my dissertation as a parent, husband, community volunteer, and full-time professional would not have been possible without the patience and support of my family. To my wife and children that understood the commitment and family-time sacrifices to complete this journey, I dedicate this to you.

Acknowledgements

I thank my dissertation committee, Dr. David Bouvin (chairperson), Dr. Godwin Igein (committee member), and Dr. Walter McCollum (university research reviewer) for guiding me through the process. I would also like to professionally and personally share my appreciation to the senior leadership at Weidmann Electrical Technology for investing in my continuing education and professional development. Allowing me to be a scholar practitioner is a privilege.

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Chapter 1: Introduction to the Study

Introduction

The electrical utility industry operates in an environment that is facing an ever increasing demand for the delivery of reliable energy, more stringent financial and regulatory constraints, a maturing asset inventory, and an aging workforce. Macomber (2013) stated that internationally, the number of people living in cities is expected to nearly double in the next 40 years to six billion and “many cities lack sufficient clean water, electricity, reliable public transit, and other basic resources needed to support their exploding populations and strengthen their economies” (p. 43). This expected increase in demand combined with the challenges facing utilities pose significant challenges to electrical utility organizations. This is especially challenging considering the current state of the aging equipment, the impending retirement of a significant portion of the workforce, and the managing of the knowledge required to sustain the reliable delivery of energy.

Estimates by power equipment manufacturers suggest that the average age of installed large power transformers in the United States is 40 years, with 70% of them being more than a quarter century old (U.S. Department of Energy, 2011). In comparison, there is a lack of research on the average age of the electrical engineers responsible for this aging system, or the potential issues associated with replacing them or maintaining their knowledge upon retirement. The literature on organizational knowledge held by senior engineers approaching retirement has not been widely studied. To increase the

organizational understanding of this intellectual asset, including the different types of knowledge held by personnel, a study of the knowledge management (KM) practices used to capture, store, and transfer this valuable resource provides a unique opportunity to explore the phenomena in the context of a sustainable knowledge-dependent environment.

The electrical utility industry is similar to other large and mature industries, such as telecommunications, manufacturing, and the medical field in terms of the employment longevity and expertise held by their personnel. In exploring processes that reduce the loss of knowledge in the electrical utility industry specifically, Bishop (2005) stated that once the types of knowledge at risk of being lost are determined, utilities need to develop improved methods for sustaining and passing on the knowledge held by its employees. For this study, focus was placed on the strategies used by electrical utilities in capturing the tacit knowledge of retiring engineers.

This paper is structured as follows: In the first chapter, I introduced and discussed the background to the study, including: key terms and knowledge typologies; the sharing, transferring, and innovation dimensions of knowledge; the conceptual framework for the study; and I finish with the assumptions, limitations, significance of the study, and implications for social change. In the second chapter, I provided the results of the literature review with a specific focus on knowledge capture strategies. Chapter three included a description of the qualitative inquiry approach and embedded case study methodology. Finally, I collected evidence on the programs, processes, and systems used

by electrical utilities to understand how the industry captures the tacit knowledge of retiring personnel.

Background of the Study

The issue of knowledge loss and the capturing the experience-based knowledge has been widely examined. Although research has previously looked at knowledge loss from Small Multinational Enterprises (Bhanumathi & Rathb, 2014; Carmel, Yoong, & Patel, 2013) to international market enterprises (Mladkova, 2012; Mundra, Gulati, & Vashisth, 2011; Salim & Sulaiman, 2011; Sheng, Hartmann, Qimei, & Chen, 2015) little empirical research is available on the topic at larger publicly held electric utilities. This study sought to address this gap.

In their research, Carmel et al. (2013) identified five types of knowledge loss. These included “subject matter expertise; knowledge about business relationships and social networks; organisational knowledge and institutional memory; knowledge of business systems, processes and value chains; and knowledge of governance” (p. 913). Carmel et al. presented knowledge in terms of how it is shared by experts, the interactions between people on a social basis, the history of why organizations operate and continue the way they do, the daily level of knowledge embedded within organizational operations, and its contribution to a larger organizational environment. Potential sources of knowledge loss that involved both people and the processes within the organizations were identified. They provided the following knowledge taxonomy to begin the discussion:

- Declarative or explicit knowledge = Know about.
- Procedural to tacit knowledge = Know how.
- Causal knowledge = Know why.
- Conditional knowledge = Know when.
- Relational knowledge = Know with (p. 916).

This study was interested in the Carmel et al.'s (2013) second knowledge type identified as knowledge as “Know how”.

Brain-Drain

In determining the current and predicted future state of electrical engineers and electronic engineers, both U.S. government predications and trends in new job creations and employment retirements were identified. According to the United States Department of Labor's Bureau of Labor Statistics (2015), there was a projected 4% employment growth for these professions from 2012 to 2022. With the U. S. Department of Labor identifying 16,750 electric power generation, transmission, and distribution industry engineers accounting for 4.32% of the engineering workforce, the expected growth in this industry was slower than the average growth rate of 11% for all occupations. Although the numbers did represent employment opportunities for new engineers, the predictions for future employment did not address the skill-set or experience variation between those entering the market and those being replaced.

Various researchers, in various industries, and in various countries, have studied the skills and the number of replacement workers. For example, although Neumark,

Johnson, and Mejia (2013) determined that there was not an expected shortage of skills in the near term, they did note an increased risk of skill shortages following 2018.

Specifically, they stated that as a result of baby-boomer retirements, the majority of replacement workers will bring to their positions a level of skill and education lower than previous replacements. This trend had been demonstrated in other countries like Australia, where organizations prepared for the perceived threat of an inexperienced and insufficient number of replacement workers (Dumay & Rooney, 2011). Dumay and Rooney (2011) took the position that organizations have had sufficient time to better understand what knowledge “needed to be retained, transferred and discarded, while at the same time developing the new knowledge that will be the cornerstone of the future” (p. 193). This study illustrated that there have been different organizational responses to the perceived and potential employment threat across industries.

In considering the employment status of retirement in the electrical utility industry, quantitative estimations are available to clarify the retirement risks. Jennex and Durcikova (2013) stated that as of 2010, more than a quarter of the workforce had reached retirement age. In a similar industry to electric utilities, Grant (2013) referenced the Society for Petroleum Engineers’ (SPE) estimate that more than “231,000 years of cumulative experience and knowledge” would be lost with retirements in that industry alone (p. 94). Grant added that organizations like Exxon Mobil have been actively invested in managing their risks of retirement brain-drain. In this climate, identified organizational risks included losing credibility with clients, overcoming training

challenges, hiring replacement workers, potential decreases in revenue, and the long term risks that result from not being fully aware of the value of knowledge that was lost (Carmel et al., 2013). Beyond understanding the potential number of employees leaving an industry, organizations are becoming more aware of the related issues that accompany employee loss.

A related area of interest in the literature revolves around the social aspects of knowledge sharing. Much of the existing baby-boomer research has focused on intergenerational knowledge transfer and the topics of approaches to work, perceptions or employment and teamwork, the use of technology, and the motivational differences considering age on both a chronological and subjective age identity basis (Huang, McDowell, & Vargas, 2015). In related research, Short (2014) recognized that generations are influenced by their life experiences and bring to their workplace long lived views of the workplace. Kuyken's (2012) research considered the *baby-boomers*, *generation X* or simply *GenX*, and *generation Y* or *GenY* typology and their shared challenges involving "cultural, socio-professional and individual factors" (p. 365). With a baby-boomer generally defined as a person born between 1946 and 1964, a GenXer defined as someone born between 1965 and 1978, and a GenYer as someone born between 1978 and 1994, Kuyken (2012) characterized these age groups as groups or unique entities. Kuyken noted that baby-boomers were the group that replaced the term "old" with "senior" and prolonged the ideas of retirement, the GenX group were individualists more capable of adapting to their work environments; and the GenY group

were those raised on the internet and “born into a knowledge society” (p. 371). The topics of intergenerational learning and knowledge sharing have provided multiple typologies and a perspective for evaluating the effectiveness of knowledge transfer programs.

Although Kuyken’s (2012) study focused on assuring continuity while accounting for generational differences, it addressed an issue often overlooked in knowledge based research. By recognizing that generations learn, share, and think differently, Kuyken presented a *communities of knowledge* approach to consider how learning occurred within each group. Wang, Zuo, and Bo (2014) posited that the perceptions of the pre-retiree towards the younger groups would influence their intention to transfer knowledge. Citing Social Identity Theory (SIT) and Communication Accommodation Theory (CAT), Wang et al. approached their research on the combined premise that people organize individuals into categories or social groups and then modify their communications based on these defined identities. The research application of this view of communication in the electric utility has yet to be explored and is beyond the scope of this study. In line with Kuyken’s study on learning and environmental considerations and Wang et al.’s research on perceptions, intentions, and attitudes of pre-retirees in the intergenerational transfer, additional age-based research to mitigate retirement knowledge loss has been based on technology use and the dangers and risks of not considering intergenerational transfer of knowledge in strategic management planning (Harvey, 2012). With an increased understanding of the differences on a social, motivational, and technological basis,

intergenerational considerations can be leveraged to capture, transfer, and maintain experience-based organizational knowledge.

Leveraging KM Programs

There are many aspects or components involved in the leveraging of organizational knowledge. Although KM has been focused on topics ranging from leveraging knowledge sharing and transferring through appropriate processes and technologies (Kannabirna & Pandyan, 2010), to the dissemination of a shared KM objectives and strategies throughout the organization (Taylor, 2013) there was a further need to understand: (a) the organizational value of knowledge, (b) the contributions of leadership and culture, and (c) the methods to combat the phenomenon of knowledge hoarding. The value of organizational knowledge ultimately rests with the ability of the organization to develop and implement KM practices so users can access and leverage the knowledge when and where it is needed.

Knowledge management practices. In first understanding organizational KM, a few generally accepted definitions for knowledge have been presented. Mladkova (2012) defined knowledge as consisting of “interactions among experience, skills, facts, relations, values, thinking processes and meanings” (p. 105). Whyte and Classen (2012) stated that knowledge is “the product of interpreting information based on a person’s understanding and is influenced by the moral fibre of its holder, since it is based on judgment and intuition” (p. 951). This is a definition highlighting how one’s understanding is an individual phenomenon. Agbim, Owutuamor, and Oriarewo (2013)

stated that knowledge is the “awareness, identification and applied know-how that we all possess” and “is created in the minds of people and increases when people are involved in its acquisition and dissemination” (p. 113). Knowledge has generally been considered an abstract concept and its definition has taken many forms. These forms included Dzekashu and McCollum’s (2014) reference to “an assembly of components connected in an organized manner” (p. 55), or Davenport and Prusak’s (as cited in Connell, Schechtman, & Hasty, 2012) statement that while data is converted to information, and that information is converted to knowledge, knowledge is the result of an individual’s experiences and values. Hariharan (2015) added that knowledge is part of the wisdom hierarchy, noting that “Wisdom represents a deeper understanding of the knowledge and the fundamental principles behind the knowledge” (p. 37). O’Dell and Hubert (2011, p. 22) stated that in its simplest and most practical form, knowledge is “information in action”. The large number of definitions of the term and the variations or context from which each can be taken presented challenges in studying the topic. For this study, understanding a definition of knowledge in a pragmatic and simple to comprehend form helps to conceptualize knowledge-based terminology.

Concepts such as KM and knowledge-based tools are referenced in much of the literature. Two of the simplest and broadest definitions of KM were provided by Dzekashu and McCollum (2014) and Chandra, Iyer, and Raman (2015). Dzekashu and McCollum summarized that KM is “about people, processes, and technology” (p. 60). This is a popular perspective shared within the KM research community. Chandra et al.

stated that KM is “the process of getting the right information to the right person at the right time. It involves knowledge creation and sharing” (p. 95). Combining KM programs and KM initiatives with the tools and systems needed to effectively implement them poses challenges to users (Taylor, 2013). One approach to improving this involves viewing, managing, and understanding knowledge as something that exists along a continuum. Fetterhoff, Nila, and McNamee (2011) stated that KM can be viewed as two opposite ends of a continuum with *archiving/retension* at one end and *learning/innovation* at the other. For Chatterjee (2014), KM “may be simply redefined as ‘management of learned information as knowledge’, aimed at systemizing the process of knowledge management so that the knowledge processes can be organized into a structural framework” (p. 24). Operationally viewed, Mundra, Gulatti, and Vashisth (2011) referred to KM as those organizational practices used “to identify, create, represent, and distribute knowledge for awareness, learning and reuse across organizations” (p. 7). The definitions for knowledge management has been presented in terms of aligning it with the right person when they need it; as something that existed along a continuum; and as something that could be stored, maintained, and then leveraged to add value to an organization. As a management tool, KM programs can expand the usefulness or utility of the knowledge to maximize the benefits for the organization.

For instance, this can include the spreading of knowledge through technological means. A recognized objective of KM involves connecting those who need the

knowledge with the sources of knowledge, and through the right processes and use of technologies (Kannabirna & Pandyan, 2010). According to Grant (2013), this occurs only when the knowledge has “become embedded in the work practices of organizational members” (p. 116). With one of the primary goals of KM being the development, capture, and future use of organizational knowledge, Bhanumathi and Rathb (2014) viewed KM programs as essential and effective tools for managing knowledge loss. As a KM program, technology-based programs offer organizations a systematic means for leveraging knowledge. In addition to technology, KM has also become an integral part of organizational strategy discussions.

The establishment of KM programs and organizational readiness has been well documented in the literature. This has included Mladkova’s (2012) recognition of the importance of including KM in an organizations’ strategic process from a human resource perspective. Mladkova suggested that organizations should consider four “important structural prerequisites” before implementing KM (p.107). These included a knowledge strategy, an organizational structure, organizational cooperation, and the appropriate level of trust within the organization. Taylor (2013) noted that to implement an effective KM program, organizations needed: (a) a shared organizational KM goal and objective; (b) an organizational buy-in on the use, contribution, and value of the knowledge initiative across the organization; and (c) an understanding of how the efforts and initiatives will contribute to the overall organizational strategy. The use and integration of KM programs

into strategic decision making processes is not a new idea. The use of KM programs has extensively been studied in terms of the maturity of the organization and its leadership.

The idea of assessing the maturity level of an organization has been an active research topic over the past two decades. In evaluating the organizational readiness or KM maturity level, Dalkir (2011) referenced five readiness models including Paulk, Weber, Curtis, and Chrissis' 1995 capability maturity model (CMM) and their 1997 adaptability maturity model integration (CMMI), Kochikar's 2000 Infosys model, Paulzen and Perc's 2002 knowledge process quality model (KPQM), and the 1997 Forrester Group KM model. With all of these models, Dalkir emphasized the need of the organization to determine its readiness level, the enablers needed to support a KM program, the obstacles to overcome, and the potential worker related issues that may exist. The effectiveness of knowledge sharing has been shown to ultimately be tied to the organizational stakeholders and more specifically, the employees, leaders, and managers (Suppiah & Manjit, 2011). Although the array of models presented illustrated different approaches to aligning KM programs to an organization's maturity level, a few challenges should be noted here.

The infrastructures of organizations have been shown to be both support and constrain the sharing and transferring of knowledge. Perez-Nordtvedt, Kedia, Datta, and Rasheed (2008), in stating that the four dimensions to knowledge transfer were comprehension, usefulness, speed, and economy, identified the level of the recipient's intent to want to accept the knowledge, the strategic importance of the knowledge to the

recipient, and the organizational channels that have been established for the transfer to occur as being important factors to knowledge sharing success. Additionally, management's support and the users "perceived usefulness" of the knowledge were shown to be key to successful transference (Lin & Fan, 2011).

The most widely agreed-upon method for evaluating an organization's KM system is through the use of *knowledge audits* and *knowledge mapping*. Knowledge maps can illustrate where different forms of knowledge exist within an organization (Burnett, Williams, & Grinnall, 2013). Through processes involving a *Knowledge Process Audit* (KPA), a *Knowledge Inventory and Map*, or a *Knowledge Needs Analysis*, Burnett, Williams, and Grinnall (2013) suggested that knowledge transfer may be carried out by unexpected or alternative means that are based on similar interests, shared experiences, and cross-department collaborative means. In the process of understanding where the knowledge rests, who possesses it, and how it can be transferred to others, organizations are better equipped to use it for operational and strategic purposes.

One area that has been shown to benefit from these analytical processes is in strategic management implementation. Ramanigopal, Palaniappan, and Mani (2012) stated that the alignment of one's KM strategy to one's business strategy comes after identifying the required key components of the KM system. From a knowledge strategy formulation perspective, the process begins with the organization's business vision and mission and the aligning of the KM strategy to that business strategy (Kannabirna & Pandyan, 2010). According to De Toni, Nonino, and Pivetta (2011), an organization's

KM program should align with the “current competitive environment, organizational context, and business strategy” (p. 327). Wiig (as cited in Kannabirna & Pandyan, 2010, p. 336) offered two fundamental objectives of a KM strategy implementation including adding stakeholder value and reducing the risk to its successful implementation. When KM programs properly address all forms of knowledge, their effectiveness increases (Mayfield, 2010). As a strategic contribution, KM programs offer organizations a strategic alignment tool and a means to leverage knowledge assets to support an overall business strategy.

Knowledge management, leadership, and culture. Much research has been conducted on successfully developed and implemented KM programs. KM programs have been shown to contribute to organizational gains with advancements in business processes, customer service levels, and customer satisfaction metrics in the private sector (Kalid & Mahmud, 2008). Technical organizations have increased their levels of innovation through KM programs (Fetterhoff, Nila, & McNamee, 2011; Hu & Randel, 2014; Lin, Che, & Ting, 2012; Mundra et al., 2011). Organizations have benefitted financially and strategically from their properly aligned KM programs (Bautista-Frias, Romero-Gonzalez, & Morgan-Beltran, 2012). And KM programs have expanded core values such as “reliability, commitment to enable excellence, service to the employees, and respect for the individual and his/her knowledge” (Kannabirna & Pandyan, 2010, p. 341). From a business perspective, KM programs offer organizations a wide range of financial, strategic, operational, and specifically leadership related benefits.

The role of leadership and organizational structure in supporting KM programs has been well documented in the literature. On the topic of organizational structure, research has shown that a strong governance or structured hierarchy can be a driver to KM program success (Kannabirna & Pandyan, 2010). Conversely, Suppiah and Manjit (2011) concluded that such dominant hierarchy cultures have challenges to overcome and stated that “structures, systems and processes, fixation on order and control, and all the other trappings of this culture type make encouraging tacit knowledge sharing behaviour among employees an enormous task” (p. 473). In these types of structures, Suppiah and Manjit recommended developing internal teams and socially-based groups that would allow for more organic and personalized knowledge sharing to occur. Although much of the research supports the value of hierarchical structures, there is a significant position taken in the literature that reinforces the need for more natural structures that encourage face-to-face interactions at all levels. A common thread in the research is the role of leadership in these environments.

Research on KM has covered many related topics and has offered much insight into the value and role of leadership with KM programs. Research has shown that flat organizational structures empower employees to share, experiment, and develop knowledge (Mundra et al., 2011). Research has identified that the importance of leadership to expert knowledge retention has often been underestimated (Carmel et al., 2013). Research has also demonstrated that leadership does influence knowledge sharing and the gaining of experience and advancing of learning in organizations (Whisnant &

Khasawneh, 2014). In some organizations, the targeting of rewards by leadership has been shown to be an effective tool for motivating and shaping an organization's sharing of knowledge (Mayfield, 2010). Advancements in the implementation of KM programs support a culture of change and have resulted in changed behaviors and international operational gains (Fetterhoff et al., 2011). In the case of shared leadership, team-based knowledge capture practices, tools, and systems can support organizational change, increase collaboration, and contribute to building the right culture within an organizational framework (Taylor, 2013). The role of leadership has included supporting the development of environments and cultures that empowers employees, encourages knowledge sharing, improves and expands collaboration, and has contributed to organizational recognition of the value of knowledge.

One aspect of KM programs warranting further discussion is the role that culture plays in contributing to organizational success. Given that the knowledge sharing that occurs in an organization is closely tied to its cultural traits (Zarzu & Scarlat, 2015), Taylor's (2013) research conclusions were similar to the perspective originally proposed by Mladkova (2012). Mladkova suggested that for KM to be fully exploited, it would need to account for different types of knowledge and relate to the "strategic objectives, culture, principles and habits" of the organization (p. 105). Noting that the KM literature has highlighted that social and cultural issues were the main obstacles to the success of KM practices, Mladkova's study supported Ibrahim and Reid's (2009) position that KM practices impact organizational culture and that employees are more driven to follow

leadership when their efforts are recognized, valued, and contribute to the organization's success. This research focused on the need to leverage and integrate knowledge into all aspects of an organization and determined that cultures, may both positively and negatively contribute to organizational success, may influence and motivate employee's to improve performance, and that it is a component affected by the level of formality and formed groups within the organization.

An interesting and related view presented by Suppiah and Manjit (2011) was based on the idea and formaton of *clan cultures* within an organization. This was premised on the idea that employees and organizations may create an environment where co-workers interact on a highly personal level where teamwork and a high level of employee or oganizational commitment exists. They added that in such a clan culture, the sharing of personalized and internalized knowledge sharing increases and the organizational culture becomes more positive. This idea of positively contributing to an organization raises several issues referenced in the literature. These related to first, quantifying or determining the value obtained from such knowledge sharing practices, and second, the use of technology to enhance the knowledge sharing practices.

In regard to the first topic, this concept of contributing value is referenced throughout the literature as a "value added" idea and has been related to the need for strong leadership in a KM environment. This was specifically studied in the context of evaluating the effectiveness of teamwork and knowledge sharing. Van Genderen (2014) stated that ultimately, cultures based on this value-added perspective "can be reduced to

representing a contribution based on knowledge” (p. 7). By considering Taylor’s (2013) view that the role of human capital and teamwork was significant, they defined a knowledge sharing culture as one that has demonstrated competency in their knowledge management processes and supports the attainment of goals and objectives. In the end, Taylor asserted that it is the culture of the organization, evaluated through a process known as a *team cultural process assessment* that would heavily influence the success of a KM program. Although team-based activities and cultures were shown to add value, the knowledge management processes developed often became obstacles in meeting those goals and objectives.

The second aspect considered in evaluating the leadership and culture of an organization and its KM success is its use, leverage, and reliance on technology. Experience with supporting KM implementations through technology alone has demonstrated limited success. Charles (2002) illustrated this fact with a discussion of the doomed Kalliope project at Hewlett-Packard (HP).

In the case study, Charles (2002) demonstrated the importance of upper level support in a “bottom’s-up” approach to implementing a KM project. At HP, issues of undefined timeframes and a lack of dedicated resources, project description, and organization-wide goals by leadership undermined the success of the technology before it started. Additionally, Grant (2013) referenced a 2002 report from KPMG Consulting of 161 companies and the problems most often encountered in using a KM programs. These problems included: (a) no time to share knowledge, (b) not using technology to share

knowledge effectively, (c) difficulty capturing tacit knowledge, and (d) reinventing the wheel. As illustrated in Grant's (2013) study, the effective use of technology was identified as a major obstacle in implementing KM programs. While not included in the list, yet identified in much of the research literature reviewed, there is a general acceptance that one's willingness to voluntarily share knowledge is tied to social, political, or cultural conditions within the organization.

Knowledge hoarding. Up to this point, the discussion has revolved around organizational and leadership influences in creating a culture that supports managing knowledge. What requires special attention in this dynamic environment are the challenges related to the phenomena of *knowledge hoarding* (Perjanik, 2015). Determined to be a common thread in the literature, there are multiple reasons cited for how and why this occurs and the methods available for addressing it within an organizational context. This section of this study explored the issue of knowledge hoarding by understanding the power, ownership, social, and incentive or motivational perspectives of this issue.

A high level review of the literature set the framework and the root cause of knowledge hoarding. The general theme accompanying the topic of knowledge hoarding was the concept that "knowledge and power are intrinsically related" (Law, 2014, p. 361). Van Genderen (2014) extended this concept on an international basis and concluded that four common themes were universally observed. These included individual perspectives that: (a) knowledge is valued and can represent power, (b)

knowledge is generated and accessed by the privileged, (c) sharing of knowledge occurs within influential and stratified layers, and (d) trust plays a role in whom one will share the knowledge with. This idea of knowledge as power was an underlying basis for much of the following issues associated with hoarding of knowledge.

One view of this paradigm involved conflicting ideas of whether the knowledge was property of an organization or whether it was property of the worker that possessed it. For some knowledge workers, or what Dekas, Bauer, Welle, Kurkoski, and Sullivan (2013) defined as those whose main capital or product is knowledge, the real question rested with *who* owns the knowledge. Redlitz (2013) referred to a scenario where *Office Gurus* possess and protect knowledge that is critical to the organization and their colleagues and seek to protect it for themselves. Ollila, Styhre, and Werr (2015) studied this phenomena from the perspective of management's role in "mobilizing the expertise of professional workers" while still maintaining managerial oversight. Under the *knowledge is power* paradigm, Dzekashu and McCollum (2014) pointed to the owner's perceived value of the knowledge they possess. Grant (2013) recognized that there may be reluctance by employees to share their expertise, especially when job changes and new employees are involved. This conflicting perspective offers workers validation for not sharing knowledge that they perceive is theirs. It may also provide workers with something of value on an intrinsic basis while concurrently increasing their value to the organization. This view of how the organization values that knowledge could provide the employee with extrinsic value. This view may relate to the belief by the employee that he

or she personally owns the knowledge as a form of personal job security (Bautista-Frias et al., 2012). With the willingness of knowledge sharing is contingent on the owner of the knowledge, Law (2014) added that psychological tensions may be created with this dilemma. Panahi, Watson, and Partridge (2013) stated that there is a link between sharing personal knowledge and organizational knowledge and the potential risk to one's organizational position. The perception may also be held that "the more valuable the knowledge, the higher people construct barriers to free sharing valuable information with others" (Van Genderen, 2014, p. 8). The perception that hoarded knowledge makes an employee indispensable is a strong motivator for not readily sharing it. Given this, job security, employee turnover, and retirement increases may create an environment where knowledge hoarding for job security moves from a perceived issue to a real threat.

The severity of this issue is exacerbated when one considers the large number of retiring knowledge workers in various industries and other psychological issues involved. In the aerospace industry alone, estimates identified that more than 50% of the workforce over 50 years of age were at risk of "walking away" (Khuzadi, 2011). As a recognized major industry consideration, Khuzadi added that this issue was a direct result of the worker's philosophical view of their perceived job security and making themselves indispensable to their co-workers, technical teams, and organization. As an industry facing a large number of retirements, it was expected that the electric utility would encounter some of these same psychological issues.

Additional research in the literature has demonstrated that in supplementing individual psychological issues, there are societal components associated with the knowledge hoarding phenomena. On the individual side, studies have covered topics ranging from the contested role of emotional intelligence in learning and team-based environments (Ghosh, Shuck, & Petrosko, 2012) to considering the differences in attitudes and behaviors based on chronological age versus one's subjective self-view age identity (Yung-Kuei et al., 2015). Research has approached this issue by looking at how workers see themselves and their role within the social context of their organization.

On this social basis, research has extended this topic to include worker roles within an international context where issues of trust, teamwork, and recognition are factors. It has been demonstrated that issues of protecting knowledge existed globally in both team-based environments and in competitive-based societies (Van Genderen, 2014). In looking at both U.S and German organizations for example, Van Genderen (2014) concluded that although Americans may not be inclined to share their perceived high-value knowledge as a result of working in a competitive society, the phenomena of hoarding knowledge may be an international phenomena as "our professional, organizational, and national cultures socialize employees to hoard their most valuable knowledge – rather than freely share it within their organizations" (p. 7). Within this context, trust, teamwork, and individual recognition all play a part in organizational knowledge sharing. Grant (2013) stated that effective KM programs succeed when knowledge sharing activities occur in environments identified as having high levels of

trust and motivation. Although challenges exist to overcome some of these noted considerations, the research on addressing knowledge hoarding is heavily focused on the creation of environments that positively incentivize the sharing of knowledge and discourage the hoarding of knowledge.

The literature on creating incentives, rewards, or recognition systems provides ample support for the need and value for addressing the knowledge hoarding challenge. For example, research supports that when managers provide workers with the power and responsibility for sharing knowledge with higher levels of leadership, sharing knowledge willingness increases (Whisnant & Khasawneh, 2014). Additionally, it has been shown that: (a) rewards-based system incentivizes workers to share valuable information (Redlitz, 2013), (b) increasing the number of reward-system based communities increases knowledge sharing capabilities and improves the organizational culture (Dzekashu & McCollum, 2014), and (c) embedding knowledge sharing activities into annual performance evaluations positively increases knowledge sharing activity (Grant, 2013; Dalkir, 2011). While fully motivating workers to share knowledge is still a challenge (Grant, 2013), research has demonstrated that recognizing and rewarding knowledge sharing effectively increases general knowledge across the layers of workers and throughout the organization (Bautista-Frias et al., 2012). And, when properly targeted and supported by management, internal and external rewards can shape tacit and explicit knowledge sharing behavior (Mayfield, 2010). This research illustrated that knowledge sharing increases when workers are personally vested in their organizations, share

responsibility for their knowledge, participate and contribute to their work related communities, and have a vested and recognized interest in sharing knowledge. The idea of being vested, recognized, and rewarded for sharing knowledge has become a major component of the organizational strategies for addressing knowledge hoarding.

The options available to organizations in the literature include providing non-monetary and monetary rewards. For example, those organizations that have provided monetary rewards including bonuses, raises, and work-related benefits as well as non-monetary rewards such as organizational recognition, increased training, improved work environments, and the opportunity to take on additional projects have benefitted from these programs (Sajeva, 2014). When considering the types of rewards an organization offers, the reward systems need to address the universal question of “What’s in it for me?” (O’Dell & Hubert, 2011, p. 25). Sajeva (2014) stated that effective reward-based programs should be designed to: (a) encourage employees to share experiential experiences, (b) consider the type of knowledge to be shared, and (c) align with both the KM and business strategies. Although much of the literature suggests an increase in knowledge sharing as a result of implementing these reward-based programs, these strategies have not received complete support in the literature.

The research on the positive value of reward systems has been met with some conflicting views. For instance, research by Hung, Durcikova, Lai, and Lin (2011) concluded that motivation and sharing were not definitively related. They determined that different modes of rewards could generate different outcomes, and that those outcomes

could be either positive or negative. Their research supported O'Dell and Hubert's (2011) conclusion that both intrinsic and extrinsic motivators affect knowledge sharing and must be considered on an individual basis. Considering these conflicting views for this study, Hu and Randel's (2014) research demonstrating that the types of extrinsic and intrinsic incentives positively relate to the sharing of various types of organizational knowledge was an accepted assumption. The topic of reward or incentive-based systems within the context of knowledge hoarding and knowledge sharing activities are included in this study.

Explicit and Tacit Knowledge Types

An understanding of knowledge begins with the recognition of the major knowledge typology accepted in the literature. When organizations seek to capture knowledge, much of what is collected and stored in databases are large volumes of explicit knowledge, or what Mladkova (2012) defined as being able to be "expressed in formal and systematic language and can be shared in the form of data, scientific formulae, specifications, manuals, etc." (p. 108). It is the type of knowledge that Mladkova summarized as being formal and a systematic language. While research has focused on how large organizations generally collect, store, and access their internal knowledge (Fetterhoff et al., 2011), what has not been robustly researched involved a focus on what type of knowledge was most critical to the organization's future success. (Pereira, Ferreira, & Alves, 2012).

In 1995, Nonaka and Takeuchi extended upon Polanyi's idea and offered the most often cited *explicit* and *tacit* knowledge classification. Al-Qdah and Salim (2013) stated that this taxonomy is the most widely accepted knowledge taxonomy in knowledge-based research. While not the only recognized typology for classifying knowledge, the extensive research utilizing this perspective supported its continued use in this study. A thorough review of each knowledge type and specifically the research conducted on the tacit dimension was warranted for this study. This research will use Nonaka and Takeuchi's generally accepted knowledge typology introduced in the late 1950s.

Defining explicit knowledge. The first of the two knowledge dimensions is commonly referred to as explicit knowledge. Xu, Hsieh, and He (2014) cited Nonaka, Toyama, and Konno's 2000 definition and stated that "explicit knowledge refers to objective knowledge that can be articulated, codified, and expressed in formal and systematic language, such as in documents, reports, and models" (p. 817). Van Genderen (2014) added that explicit knowledge is characterized as being easily replicated, process oriented, and easily explainable to others. From an end-product perspective, Guang-Bin, Yi-jun, and Liang (2010) stated that explicit knowledge "can be encoded to pass through certain media, including paper-based document, electronic database file, and enterprises' operating procedures, etc." (p. 1). For many in technical fields, the definition of explicit knowledge is readily understood as that knowledge that can be captured in reference documents, industry developed consensus guides, and organizational standard operating practices.

Since explicit knowledge can be codified, documented, and made readily available for others to use, a brief literature review and discussion of the methods of storing explicit knowledge was warranted. Much of the research referenced the storing of knowledge in knowledge repositories and recognized the accumulating, managing, maintaining, and re-using of the knowledge (Burnett et al., 2013; Dalkir, 2011; Davenport & Prusak, 1998; Gopal & Joy, 2011). As a component of an overall KM program, Davenport and Prusak (1998) stated that knowledge repositories can benefit an organization by recording and reinforcing cultural rituals and traditions. This view of collecting and storing explicit knowledge had become central to the idea of treating both something that is intangible and something that is tangible as having value. With this, organizations have faced additional challenges in storing and determining the value of this captured knowledge.

In addition to repositories, there were other methods available for storing explicit knowledge identified. In essence, any process, method, or technology that codifies knowledge to a reusable format could be used. Stressing the value of accessible knowledge, Grant (2013) emphasized that stored knowledge may lose value when it can not be easily located. Accordingly, there has been an increased use of *people locators* or *expert directories* to assist in locating those with the knowledge. Although Grant considered these directories to be an effective tool when used correctly, he noted that the research community has not fully agreed upon their applied value. There has continued to be issues associated with organizations accessing and maximizing stored

knowledge. Ensuring that the knowledge is not only codified, but then updated, accessible, and used by those that need it when they need it and where they need it continues to challenge organizations.

Defining tacit knowledge. The second of the two knowledge dimensions is commonly referred to as tacit knowledge. As the other dimension of Nonaka and Takeuchi's (1995) knowledge taxonomy, it was based on the earlier "we know more than we can tell" statement of Polanyi (1966, p. 4). This seven-word-reference has been cited in nearly every study addressing tacit knowledge. More modern definitions of tacit knowledge have central dimensions in common. A few tacit knowledge definitions have included: "the stock of expertise and knowledge within an organization—primarily located within the brains of employees—that can not be easily expressed or identified, but may nevertheless be essential to its effective operation" (Grant, 2013, p. 97); "more dependent on its holder, attached to a person's mind, difficult to communicate easily, and deeply grounded in an individual's action and experience" (Panahi, Watson, & Partridge, 2013, p. 380); "subjective knowledge that is difficult to formalize, articulate, and communicate to others, such as personal experiences, professional insights, and know-how in a specific area" (Xu, Hsieh, & He, 2014, p. 817); and "that knowledge that is created in people's mind...[that] resides in individual know-how or individual skills, previous experiences of collaborations and their social context" (Agbim, Owutuamor, & Oriarewo, 2013, p. 113). Hvorecky, Simuth, and Lipovska (2015) stated that tacit knowledge was what guides the application of explicit knowledge. These definitions have

approached tacit knowledge from the perspective of the individual and the internalization of knowledge. Other definitions have approached the topic with broader and more general perspective, yet still relate to a degree to the personalization of knowledge.

Additional contextual definitions included Thoene and Buszko's (2014) coined "practical intelligence" reference and the application of "knowledge of how to do something" (p.42). According to Pereira et al.'s (2012) technical perspective, tacit knowledge is "made up of the collective minds of the individuals involved and represents a unique set of beliefs and assumptions, values, principles, and *ways of doing things*" (p. 177). From a decision making perspective, tacit knowledge is considered difficult to express, involved with problem solving, and a component of team-based interactions (Goffin and Koners, 2011). McIver, Lengnick-Hall, Lengnick-Hall, and Ramachandran (2012) stated that it "often involves many intangible factors embedded in personal beliefs, experiences, and values or judgements" (p. 92). And finally back to the personalization perspective, it is that embedded knowledge that one learns, and then personalizes based on their own experiences and interpretations (Fetterhoff et al., 2011). With these wide range of perspectives for defining tacit knowledge, Pereira et al.'s (2012) technical view of the ways of doing things or know-how and Fetterhoff et al.'s (2011) personalization perspective were the dominant definitive characteristics of tacit knowledge for this study. To better understand the concept of tacit knowledge, an understanding of other classifications of knowledge is appropriate here.

The explicit and tacit dimensions are not the only recognized way to categorize or classify knowledge. Although Nonaka and Takeuchi's (1995) knowledge taxonomy provided a popular classification of knowledge types, other tacit knowledge sub categories have been introduced since then. For example, Agbim et al. (2013) referenced Nonaka and Konno's two technical and cognitive dimensions of tacit knowledge from 1998 to classify tacit knowledge as either one's "know-how" or one's "beliefs, ideas and values which we often take for granted" respectively (p. 119). In recognizing that tacit knowledge was a component of expertise, and that "expertise is a demonstration of the application of knowledge" (Dalkir, 2011, p. 113), Coopmans and Button's (2014) research illustrated that tacit knowledge was a requirement of the activities of experts and cited Dinur's (2011) nine types of tacit knowledge taxonomy in their approach. With tacit knowledge open to continued and new classifications and typologies, Chatterjee (2014) stated that this soft or intrinsic knowledge was dominating much of the organizational research still being conducted. While the explicit and tacit typology is the most accepted classification recognized in the literature, new research has sought to expand upon them to overcome some of the limitations of using only two types.

When all researchers have not accepted this premise that knowledge is either explicit or tacit, they were provided with a clear and systematic framework from which to categorize the types of knowledge. Simply stated, if the knowledge can be codified, it is explicit; and if it can not be codified, it is tacit. Even though tacit knowledge has been defined within the contexts of science, emotions, society, experience, know-how, and by

its degree of transferability (Perjanik, 2015), it has been referenced as residing as a “cognitive learning” attribute, a “mental model”, or in the human mind adding to the challenges for transferring it to others (Guang-Bin, Yi-jun, & Liang, 2010). According to Goffin and Koners (2011), the internalization of tacit knowledge is what ultimately makes it unique and difficult to share with others. It is the many facets or attributes of tacit knowledge that also contribute to the challenges in uniformly defining it (Agbim et al., 2013).

In addition to simply defining tacit knowledge, there are inherent challenges in codifying it. What makes tacit knowledge unique and valuable (i.e., what makes it personal and of value to the owner), is also what makes it a challenge to transfer or share (Perjanik, 2015). Although some researchers like Zaim, Gurcan, Tarim, Zaim, and Alpkın (2015) have further broken down the typology to include individual/personal knowledge, managerial knowledge, expertise knowledge, and collective knowledge as forms of tacit knowledge, the explicit-tacit typology offers researchers with a starting point, and an easier to understand classification based on high level understandings associated with codification and transferability.

The same issues that make tacit knowledge hard to define are also the same issues that make it hard to transfer. With this, determining the value, contribution, and competitive advantages of managing this type of knowledge becomes even more challenging. Although Conger and Lawler (2015, p. 28) stated that the estimated value of intangible assets in the U.S. economy was \$14.5 trillion in 2012 and that intangible

human and intellectual capital were a large components of it, the literature supports that tacit knowledge has and will continue to become more valuable to organizations. The capturing and transferring of knowledge continues to be seen as an important and essential factor in KM programs (Mayfield, 2010; Joia & Lemos, 2010).

Research on organizational continuity in high tech industries has demonstrated that science, technology, R&D, or engineering-based industries are highly dependent on tacit knowledge sharing and capturing systems (Coopmans & Button, 2014; Fetterhoff et al., 2011, Ibrahim & Reid, 2009; Pitrowsky, de Sá Affonso da Costa, & Ribeiro Salles, 2014). In electrical utilities specifically, few studies have been conducted to investigate knowledge sharing practices in the profession (Bishop, 2005; Zhen, Jiang, & Song, 2011). Bishop (2005) stated that while explicit knowledge is abundantly made available in documents, manuals, and utility policies, there is an increased need to capture and understand the transfer of worker's tacit knowledge to new workers. Zhen, Jiang, and Song (2011, p. 2959) added that engineers represent a group type that operate within the domain of *personal knowledge repositories* and additional work is needed to understand how to effectively and proactively improve knowledge sharing and collaborative activities. The electrical utility industry is recognized as one industry where capturing explicit knowledge is a key to reliability, operations, and safety (Gallo, 2013). This has been generally approached by establishing operating procedures, safety guides, and technical manuals where the costs of not having them is often expressed in lost income, power delivery downtime, and lives lost.

An aspect of tacit knowledge that is typically provided as a footnote in the literature is the need for more research aimed at defining the organizational value or financial contribution of tacit knowledge. Advancements in quantifying it include the financial modeling of a high-tech acquisition by Thoene and Buszko (2014), the development of a conceptual framework that focused on financial value, operational benefits, and business process and cultural improvements by Ibrahim and Reid (2009), and the research analysis of “proxies” such as patents, intellectual property, and new product or process introductions by Fahey and Prusak (1998) and Bhanumathi and Rathb (2014). The challenges with defining tacit knowledge, and quantifying its value when shared throughout the organization were recognized by Yoshida, Teramoto, Tabata, Han, and Hashimoto (2011) when they stated that those that possess it are often unaware of the value others place on it. In processes like the sharing best practices, Ibrahim and Reid (2009) stated that the transferring and sharing of efficient and effective programs, systems, or processes have a direct impact on the operations, production, culture, and motivation of the organization and the benefits may only be measurable in terms of production metrics. They added that certain aspects such as motivation cannot be easily quantified. As discussed with the ideas of knowledge management and knowledge mapping, understanding what knowledge an organization possesses, where and with whom it resides, and how to retrieve or access it requires an organization to first acknowledge that the knowledge exists and that managing it will provide future value.

On a final note on the value of knowledge, the value of knowledge has also been described in terms of its usefulness in daily activities and its contribution to the organizational operations. Given that organizations with recognized KM programs treat both forms of knowledge as tangible assets, Chatterjee (2014) stated that embedding learning and sharing throughout the organization leverages its value for everyone and may best be used when it is implemented in systematic processes. Mayfield (2010) viewed the management and sharing of tacit knowledge as an essential aspect of maintaining innovation, competitiveness, and in meeting environmental trends as part of an overall KM strategy. Whether tacit or explicit, a high level summary of the literature supported the need and strategic value for capturing, embedding, sharing, and leveraging both coded explicit knowledge and the less tangible tacit knowledge throughout the organization.

Converting tacit knowledge to explicit knowledge. A general approach taken by organizations to maximize their organizational knowledge includes the attempted conversions of tacit knowledge to explicit knowledge in a process referred to as codification. Chatterjee (2014) took the position that the role of KM is the codification of tacit knowledge to explicit knowledge. It was this sharing of “know-how” that Chatterjee indicated had value and needed to be shared. To have value as explicit knowledge, Ramanigopal et al. (2012) stated that it needed to be available to an organization’s members in a usable form. Through this process of codification, organizations have routinely attempted to gather, store, and codify all of their knowledge for future use.

Codification has been presented in the literature as consisting of two separate processes. Law (2014) recognized codification as a transfer process where the tacit nature of the knowledge is converted to a written, replicable form. Mundra et al. (2011) referred to this as a *codification strategy* that involves first identifying who has knowledge, classifying and extracting it, and then managing its use. Joia and Lemos (2010) viewed codification as a *knowledge strategy* consisting of a standardized and structured process for storing both information and knowledge with the primary goal of “reutilization” throughout the organization. Although these two process classifications share the idea that capturing tacit knowledge into a written and reusable form allows it to be managed and used in the future, it was recognized by both that the tacit nature of the knowledge would pose significant challenges in the codification process.

Once recognized, the method of addressing these challenges involves first determining who had the knowledge and the best means for transferring it. Supporting Mladkova’s (2012) position on the value of social interactions, Law (2014) recognized the knowledge strategy as one involving a face-to-face personal process and “a high degree of richness in interactions between the sender and the receiver” (p. 360). Mundra et al. (2011) had referred to this process as a *personalization strategy* that involved first identifying who has the knowledge, like in the codification strategy, but then classifying and identifying whom to contact to get access to it, and then managing the sender and receiver interactions and connections. This process has resulted in some organizations determining ownership of knowledge within their organizations, and the development of

expert locators or *corporate yellow pages* (Grant, 2013; Yoshida et al., 2011). For Joia and Lemos (2010), personalization involved a lesser focus on the physical conversion of the data to an explicit form, and an increased emphasis on the personal transferring of knowledge, and specifically, the willingness of employees to transfer their tacit knowledge and the organization's structural flexibility for promoting tacit knowledge transfers. In the codification of tacit knowledge, there has been a shift from simply storing it, to the approach of how to first transfer it to another individual through more personalized methods. With this focus, the structure, organic nature, and use of technology have been studied.

With regards to the real world conversion of tacit knowledge to explicit knowledge, research has considered the size and structure of the organization, the real challenges of converting tacit knowledge, and the use of technology to aid in the codification process. The literature suggested that the codification of tacit knowledge to explicit knowledge must overcome significant challenges and that its successful implementation varies with the size of the organization (Bautista-Frias et al., 2012; Bhanumathi & Rathb, 2014). Noting that tacit knowledge really exists along a "continuum" (i.e., from a low amount to a high amount of tacitness), it was recongized that it would be difficult to codify highly tacit knowledge to explicit knowledge (McIver, Lengnick-Hall, Lengnick-Hall, & Ramachandran, 2012; Mladkova, 2012). Although researchers like Yoshida et al. (2011) and Grant (2013) have focused on the use of

technology to enable this conversion, Agbim et al. (2013) proposed that the conversion of tacit knowledge to new tacit knowledge should occur through socialization processes.

Agreeing with Polanyi's 1966 view, Mladkova (2012) stated that the continued challenge of externalizing tacit knowledge rests with the externalization process itself. For Mladkova, the externalization process is what damages the tacit nature of the knowledge. For researchers today, there is one research approach that views codification as something that new methodologies, models, or approaches can somehow be used to overcome the challenge. A second approach has modified the explicit – tacit typology to accommodate new views of the knowledge types. The literature is typically split along the two lines of thought that knowledge is either explicit or tacit and is either capable of being codified or it is not, or that knowledge can lie between the two types and is capable of being codified in either form.

Whether the management of knowledge is guided by treating both knowledge types as distinct ends of the spectrum, or as types that could be converted from one to the other, understanding the explicit and tacit knowledge types and how to effectively leverage these KM programs continues to be a challenge for organizations. Considering the issues involved, further empirical research like this study are needed to further understand how organizations leverage the knowledge they do have for future use.

Problem Statement

The first of the “Baby Boom” generation turned 65 in 2011 and it was noted that nearly 10,000 of this group will retire each day over the next 20 years (Redlitz, 2013).

With close to half of the industry workforce expected to retire in the next five to ten years (Grice, Peer, & Morris, 2011), affective capturing of their tacit knowledge will affect organizations and especially those at a risk of losing their knowledge-based competitive advantage. Dzekashu and McCollum (2014) noted that “knowledge loss resulting from an aging workforce continues to be a management nightmare” (p. 52) and that *operational continuity* poses a threat to organizations not equipped to address the situation.

Previous research aimed at understanding organizational tacit knowledge capture, sharing, and transferring processes has been conducted in a variety of contexts. Extensive research on tacit knowledge has increased the understanding in the areas of classifying tacit knowledge (Dinur, 2011); demonstrating its value in private and governmental contexts (Connell et al., 2012; Kaplan, 2008); improving team performance (Chuang, Jackson, & Jiang, 2013); maximizing human resource planning activities (Gelb & Longacre, 2013; Suppiah & Manjit, 2011); determining capture strategies (Bautista-Frias et al., 2012; Dzekashu and McCollum, 2014; Fetterhoff et al., 2011); and enhancing organizational performance on an international basis (Mladkova, 2012; Park, Vertinsky, & Becerra, 2015).

With this loss of tacit knowledge considered by Pollack (2012) as a challenge for those that employ engineers and scientists (i.e., specifically referencing utilities, nuclear, and health and nursing to name a few), this qualitative inquiry offers an opportunity to study this problem in an environment where there was a much needed (but lack of) applied, consistent, and strategic activity aimed at capturing it from retiring workers.

Recognizing that knowledge loss represented a major challenge to the power industry, Bishop (2005) stated:

Expert utility workers are an extremely valuable asset in maintaining reliable and safe delivery of electric power to consumers. Dealing with the loss of critical knowledge over the next 10 to 15 years is one of the most significant challenges the power industry currently faces (p. 22).

Existing research has predominantly focused on a specific tacit knowledge capture strategy and its application within a specific context. Although Harvey (2012) stated that “there is little empirical work on the design and implementation of strategies for managing organizational memory” (p. 400), there was a need to understand comprehensive tacit knowledge capture strategies used in a higher technology-driven engineering or scientific context. A qualitative inquiry provides an opportunity to explore and obtain a better understanding of what is currently being done to capture the knowledge of retiring knowledge workers to lower the risk to the generation, transmission, and delivery of reliable power.

Purpose of the Study

The purpose of this qualitative research study was to conduct a case study of seven electrical utility organizations to explore and understand the tacit knowledge capture strategies currently used in the industry. For this study, tacit knowledge capture strategies was defined as the processes, practices, and systems used to capture the tacit knowledge of current and retiring engineers. What was needed for management to ensure

operational continuity was a better understanding of what strategies are currently being implemented in the industry to capture this tacit knowledge.

Nature of the Study

The nature of this study was a qualitative approach consisting primarily of a multi-organizational case study involving semi-structured interview of engineers, human resource representatives, and executive leadership personnel at electrical utilities. This approach was appropriate for collecting information on what organizations have uniquely implemented, and for exploring specific cases within an industry to illustrate how tacit knowledge was effectively efficiently captured and transferred in real world situations, and specifically in the engineering and technical departments of large electrical utilities.

Research Question

This study seeks to address one research question within the context of the electrical utility industry. To take advantage of case-based research questions as provided by Maxwell (2013), the main research questions for qualitative inquiries are presented in Maxwell's "case" specific terms, thus avoiding over generalization, addressing diversity within the industry, focusing on specific departments within the organizations, and placing the study within a specific context.

The main research question is:

What strategies are electric utilities implementing to capture the tacit knowledge of retiring electrical engineers and technical personnel?

Conceptual Framework

For this study, the conceptual framework is selected to align with an exploratory qualitative approach and the methodologies presented. Based on an evaluation of existing research and the proposed phenomenon under study, the conceptual base originated from Polanyi's (1966) theory of tacit knowledge and Wernerfelt's resource-based theory (RBT) of the firm introduced in 1984. These two knowledge-based theories contribute to the conceptual foundation for viewing tacit knowledge as something tangible, and capable of being captured, managed, and leveraged by an organization in real world environments. In addition to this framework, organizational learning (OL) theory contributes to the conceptual framework of the study. OL theory provides the link between knowledge management, learning environments, and organizational performance. By combining these three theories into the conceptual framework of the study, the lens from which tacit knowledge is viewed, the view of knowledge as a valuable resource, and the role strategies can play in advancing organizational learning are provided. An overview of these three theories is provided hereto.

Knowledge Creation Theory

The first theory involves a systematic way of looking at the creation and conversion of knowledge through individual and organizational means. In considering Nonaka and Takeuchi's (1995) knowledge creation theory, Dzekashu and McCollum (2014) referenced Polanyi's 1966 concept of emotionally driven knowledge creation resulting from one's "active creation and organization" of their experiences and the

concept that knowledge can be internalized and difficult to articulate. Nonaka and Tekeuchi's (1995) theory of knowledge creation considered knowledge transfer as a process whereby an individual's tacit knowledge is transferred to the organization through a continuous four-mode tacit-to-explicit-to-tacit knowledge conversion process. This process was referred to as Nonaka and Tekeuchi's (1995) socialization, externalization, combination, and internalization (SECI) model. The model involved four modes with a circular relationship.

The SECI model begins with the socialization mode and is identified by the social aspect of sharing tacit knowledge from one individual to another (i.e., tacit to tacit). This type of transfer occurs through face-to-face interactions and involves what Polanyi (1966) stated was both knowledge that "cannot be put into words" (p. 4) and "achieves comprehension by indwelling" (p.55). The next mode is externalization and refers to the conversion of internalized tacit knowledge to explicit individual knowledge (i.e., tacit to explicit). Research on this process has focused on the processes, systems, and technologies that enable this to occur. This mode involves the conversion of the knowledge that Polanyi (1996, p.4) described as not being able to be put into words into a written form. Pitrowsky, de Sa Affonso da Costa, and Ribeiro Salles (2014) added that it is this mode that is the most challenging in the circular process. As earlier discussed, this tacit knowledge conversion to explicit knowledge involves attempts to capture and share individual knowledge while preserving that what makes tacit knowledge valuable. The second mode is followed by the combination mode.

This third mode or stage of the process involves the conversion of the individual explicit knowledge to organizational knowledge that can be organized, grouped, combined, stored, and shared by other individuals, teams, or the organization (i.e., individual explicit knowledge to organizational explicit knowledge). This leads into the final mode involving internalization. This refers to the conversion of the organizational explicit knowledge to new tacit knowledge (i.e., explicit to tacit). It is through this mode that organizational explicit knowledge is transformed to new tacit knowledge and is personalized and internalized by the individual – thus completing the circular knowledge creation process.

The SECI model provided a cyclical view of how knowledge is created and the role of tacit and explicit knowledge in the process. Recognized by Panahi et al. (2013) as a central theme in the literature, they stated that tacit knowledge is actually involved in all modes of the SECI model. Taken in the context of organizations, teamwork, and the role of the individual in the organization, Pitrowsky et al. (2014) added that the knowledge creation process relies on the participation and commitment of both the organization and the individuals. Considering the process of capturing tacit knowledge, Nonaka and Takeuchi's (1995) knowledge creation theory contributed to the conceptual framework by providing a foundation for the role of both knowledge types and their interrelationship in the creation and transferring of knowledge.

Resource Based Theory

The second theory offers a view of knowledge as something tangible and of organizational value. Viewed in the 1990s as a fundamental theory from the field of strategic management, Barney & Clark (2007) related the introduction of the resource based theory (RBT) to four other related theories. These included first, the theory that “distinctive competencies” held by a firm (i.e., those predominantly possessed by management), could provide it opportunities to more efficiently and effectively implement organizational strategies. Second, it was related to Ricardo’s 1817 theory of generating rents. This was originally based on the idea of the inelastic nature of land, and the idea that it be viewed as a resource in the production and generation of value. Third, Barney and Clark recognized the 1959 contribution of Penrose that focused on the role of management in establishing an administrative framework to leverage its productive resources. Lastly, RBT benefitted from the 1970s and new views on antitrust regulations and the idea of sustained market success. From this perspective, long term superior performance could be viewed as originating beyond the limitations of unfair business practices. With these four perspectives described, Barney and Clark provided a foundation for the emergence of RBT in the field strategic management and set the stage for leveraging knowledge for organizational success.

Earlier work leading to RBT was based on the idea of leveraging resources and the resource-based generation of achieving a competitive advantage. Taking Wernerfelt’s 1984 view of leveraging resources in achieving a competitive advantage in terms of

market position, Barney and Clark (2007) recognized that his resource-based view (RBV) of the firm was narrowly defined. They stated that both the predecessor RBV and the latter RBT related to achieving “greater efficiency” and “more economic value”. Keller (2014) added that Wernerfelt’s view included the identifying, bundling, and leveraging of these resources to achieve “supernormal performance”. With a more broadly interpreted perspective, the later defined RBT did not limit itself to only the market position view, but rather applied the idea that strategically managed resources (i.e., the units of analysis) could lead to what economists would describe as the “economic rents” (Barney & Clark, 2007). The RBT therefore offered a broad view for considering knowledge in terms of its potential and utility for contributing to the success of an organization.

Research has approached the definition and use of knowledge as a resource from different perspectives. The most common perspective was provided by Nemati, Bhatti, Maqsal, Mansoor, and Naveed (2010) when they defined resources as those assets that were either tangible or intangible, and were either human or nonhuman that could be leveraged to provide strategic value to the organization. With this perspective, research has investigated an efficiency-based explanation for achieving a competitive advantage (Barney & Clark, 2007), the role of tacit knowledge in strategic decision making (Nemati, Bhatti, Maqsal, Mansoor, & Naveed, 2010), and understanding team-possessioned tacit knowledge and the affect this has on an individual’s market value (Keller, 2014). This view that recognized tangible and intangible resources as something to be leveraged

and as something that could contribute to the success of an organization aligned with both the RBV and RVT.

Additionally, there are other perspectives that support the idea of leveraging intangible resources or assets. For example, in regard to managing intangible resources, Barney and Clark (2007) referenced Itami and his 1987 theory of invisible assets. This theory was based on the idea that those non tangible assets (e.g., trust, image, culture, etc...) are “the real sources of competitive power and adaptability...” (p. 19). Barney and Clark also cited the 1996 view by Grant that knowledge was *the* resource that most needed to be managed by an organization. Keller (2014) referenced a “stream of RBV literature” that has resulted in the study of the competitive advantage resulting from the leveraging of tacit knowledge as a resource. Supported by these theories and the perspectives that tacit knowledge has real world value, the RBT continues to be the focus of research and the concept of achieving a competitive advantage.

This leveraging of assets and achieving a competitive advantage has been a topic covered extensively in the literature. For example, research has demonstrated that intangible knowledge can play multiple strategic roles in contributing to a sustained competitive advantage (Salim & Sulaiman, 2011; Surong & Wenping, 2010). Additionally, It was shown that the leveraging of assets can increase the relationships between clients and the organization in terms of their mutual interdependence, trust, and commitment (Pereira et al., 2012), and that managing these assets well could be a key factor in retaining senior leadership (Child, Duarte, Tanure, & Rodrigues, 2012). This

research appears to go against the idea that the RBT has replaced RBV. As observed in the literature, the two concepts tend to ebb and flow in the most recent research.

The concept of competitive advantage and the shift from RBV to RBT has not always been differentiated in the literature. The use of the RBV of the firm has remained a dominant trend in much of the literature as the focus on how organizations obtain a market leadership position continues. For this study, Nemati et al.'s (2010) position that competitive advantage, and its relationship to how organizations manage their resources within the context of specific industries was extended to consider how tacit knowledge was captured, to then be available to maintain operational continuity in the electric utility industry.

Although Barney and Clark (2007) considered how firms both create and sustain competitive advantages by relying heavily on both the organization's management and the ability to leverage those resources that are valuable, rare, and not easily copied or duplicated, this study took a more comprehensive view of knowledge-based resources as they related to maintaining operational efficiency and sustained effectiveness. This perspective aligned with Van Genderen's (2014) position that difficult to imitate and socially complex resources provide value to the firm and contribute to its long term success. By considering tacit knowledge and something that was complex and difficult to imitate, this study accepted that intangible resources contribute to improving the value of the organization and were capable of being managed to increase their efficient and effective value.

Based on an evaluation of existing literature and the proposed phenomenon under study, this study is founded on the conceptual frameworks including both tacit and explicit knowledge creation theory, and the RBT. As discussed, the literature supports that both tangible and intangible assets could contribute to the value of the organization. RBT offers a unique perspective for viewing both tacit and explicit knowledge as something tangible and capable of being captured, managed, leveraged, and critical to organizations that exist in real world environments.

Organizational Learning Theory

Organizational learning (OL) has been a well studied phenomenon for over 35 years and has been integral to the study of knowledge. It has been the focus of extensive research with efforts directed at understanding and leveraging the cultural and environmental factors needed to improve competitiveness. It can be traced back to the 1976 pioneering research of Argyris and 1978 research of Argyris and Schon (Li & Luo, 2011). Argyris (1976), after characterizing the 1974 research of Cohen and March as individual research with a societal lens, began to focus specifically on organizational conditions, systems, and relationships and concluded that a social and cultural framework could contribute to learning. Argyris defined learning as “the detection and correction of errors, and error as any feature of knowledge or of knowing that makes action ineffective” (p. 365). From looking at learning from the viewpoint of the decision-making process, Argyris recognized a circular or reflective element in the learning process. The decision-making process was the foundation for their learning model.

In understanding the learning process, examples of how a decision was made and then how a future decision was made considering the first decision were used to illustrate the learning process. Argyris (1976) identified two sets of variables in the decision-making process. Argyris noted that the validity of the information provided and the level of “receptivity to corrective feedback” of the participants were considered important to the learning process. Referencing internal rivalries, politics, and other dysfunctional issues that reduce the feedback process in organizations, Argyris stated that one was often limited to what was called “single-loop” learning in these environments. Later, Argyris contributed with Schon on the idea of “double-loop” learning and offered it as a reflective multi-step learning process. It was stated that double-loop learning occurs when previous actions or decisions are reconsidered or reflected upon, and when incorporated in a new action or decision process there is an improved level of effectiveness and the organization benefits from it. Kaplan (2008) provided a different perspective on the double-loop learning process by implementing what was referred to as facilitated or fast-learning processes consisting of “*Learning before doing*”, “*Learning while doing*”, and “*Learning after doing*” (p. 13). These processes related to having the knowledge from outside the organization before starting, learning from the experience while on the job, and having a process in place to review and gain knowledge retrospectively from the experience. This came to be viewed as an organizational circular learning process.

Although the work in the 1970s are credited with providing this circular learning process as the theoretic foundation for OL, researchers have applied the theory in other

organizational contexts. For example, approaches have considered the benefits of double-loop learning-enabled innovation (Dai, 2012; Mundra et al., 2011), the role of experience in the OL process (Agbim et al., 2013), the role of knowledge acquisition, digestion, and absorption in OL (Li & Luo, 2011, p. 1763), the contribution of OL to increased organizational performance (Salim & Sulaiman, 2011), the relationship between OL orientation and the nature of a firm's operational strategy (Li, Chen, Liu, & Peng, 2014, Yeung, Lai, & Yee, 2007), the factors that influence OL around sustainability (Benn, Edwards, & Angus-Leppan, 2013), and the role of OL in decision making, innovation, and R&D processes (Chatterjee, 2014). Additional OL based research and its applicability to this study are provided later in this study.

For this study, the context from which knowledge is generated, captured, and transferred is dependent on the OL processes in place at the utilities. In ensuring that captured tacit knowledge is valued by the organization, or what Li and Luo (2011, p. 1763) stated were defined as a "source of organizational value creation", successful knowledge-sharing activities and learning processes should be assessed and measured in terms of leadership involvement levels, set KM program goals, and the levels that sustainable processes are embedded within the organization (Kaplan, 2008). Based on Salleh's (2015) research of learning organizations and KM programs focused on tacit knowledge, and the conclusion made that the management of tacit knowledge was found to be a highly significant predictor of KM performance, OL is viewed in this study as the

link connecting the knowledge capture strategies with the implemented learning activities needed to ensure operational continuity.

Conceptual Framework Related to Study Approach

This brief summary links the three theories and supports and informs this study for assessing the tacit knowledge capture strategies of retiring engineers at electric utilities. First, Nonaka and Takeuchi's (1995) knowledge creation theory provides the foundation for the sharing and conversion of tacit knowledge to organizational explicit knowledge, and to individual tacit knowledge. Second, when considered as an intangible asset, the resource based theory provides credence to the intangible tacit knowledge asset as a resource capable of being managed and then leveraged to maintain and improve operational continuity. Third, as a valuable asset, organization learning theory provides the foundation for determining how organizations learn, what processes, programs, or systems are embedded in the operations to advance the organization, and how to sustain operations in an industry that relies on perpetual learning.

Definition of Terms

Baby-boomers: This generational typology refers to those in the age group born between 1939 and 1964 (i.e., born during the post World War).

Best practices: Considered as “recipes that detail the best way known by the community to accomplish a task or solve a problem” (Grant, 2013, p. 117), best practices involve “encapsulating knowledge at work and disseminat[ing] such descriptions and results to a wide range of potential internal users” (Fahey & Prusak, 1998, p. 272).

Brain-drain: The cumulative experience and institutional knowledge loss as a result of the retirement and turnover of engineers that “walks out the door” with the engineer’s departure.

Capture strategies: For this study, tacit knowledge capture strategies are defined as the processes, practices, and systems used by organizations to capture and preserve the tacit knowledge of current and retiring engineers.

Codification: A standardized process of making hard to articulate tacit knowledge into a documented or shared form of explicit knowledge.

Combination: The process of combining the explicit knowledge held by individuals into organizational knowledge that can be organized, grouped, combined, stored, and shared by other individuals, teams, or the organization

Community of practice (CoP): A group of people that share an interest and through formal or informal meetings either in person or virtually, share and spread knowledge, address challenges, and learn from each other (Agbim et al., 2013).

Competitive advantage: The ability of an organization to achieve a market position or create “more economic value” through strategic use of its advantages than an average industry competitor (Barney & Clark, 2007). It becomes a sustained competitive advantage as long as that advantage remains to exist.

Electrical engineers: Those defined by the U. S. Department of Labor as employed as electrical and electronics engineers and working in the electric power generation, transmission, and distribution industry.

Expert: Carmel et al. (2013) defined an expert as one that “demonstrates higher levels of efficiency, performs tasks with greater accuracy and cost effectiveness and holds subject specific knowledge, such as on methods and procedures, including knowledge of how to deal with problems and new situations” (p. 915).

Explicit knowledge: That type of knowledge that Nonaka and Takeuchi (1995) defined as being able to be “expressed in formal and systematic language and can be shared in the form of data, scientific formulae, specifications, manuals, etc. It can be processed, transmitted and stored” (p. 108).

Externalization: The process of converting tacit knowledge to explicit knowledge while attempting to preserve that which makes tacit knowledge valuable.

Internalization: The process of converting grouped organizational explicit knowledge to new personalized and internalized tacit knowledge.

Knowledge: The applied “know-how” and essential resource that can be transformed and shared with others. It is the end result of interpreting information and applying it based on judgement and intuition (Whyte & Classen, 2012).

Knowledge management (KM): The organizational practices, systems, and tools used by organizations to identify, capture, store, transfer, and make knowledge available for reuse. It has also been characterized by Dzekashu and McCollum (2014) as being “about people, processes, and technology” (p. 60).

Knowledge transfer: For this study, knowledge transfer will refer to the “process” of sharing the knowledge for the benefit of the receiver or the organization.

Learning organization: Presented here as an organization that has implemented learning processes to improve its performance, understands how it is learning and leveraging what it learns, and has embedded systems in place to share both tacit and explicit knowledge at a personal or organizational level.

Organizational citizenship behaviors (OCB): The discretionary behaviors of an employee that are helpful or beneficial to the organization but are not required of one's position.

Organizational learning: For this study, organizational learning refers to the processes in place to create new knowledge and develop it into an applied form that provides value to the organization.

Personalization: A knowledge rich transfer process where the owner of knowledge transfers it to a receiver through face-to-face conversations and interactions (Law, 2014).

Resources: Those tangible, intangible, human, and nonhuman assets controlled by the firm that are capable of providing organizational value as defined by Nemati et al. (2010).

Socialization: The process of sharing tacit knowledge from one individual to another through face-to-face communications and interactions.

Tacit knowledge: That type of subjective knowledge associated with "know-how" and is hard to articulate and communicate to others. This includes that knowledge obtained over time that is intangible, implicit, and personalized to the user (Xu et al.,

2014), and “represents a unique set of beliefs and assumptions, values, principles, and *ways of doing things*” (Pereira et al., 2012, p. 177).

Tacit knowledge capture: The extraction and transferring of tacit knowledge from those that internally possess to those that need or seek it.

Assumptions

I made four major assumptions in this study. The first and largest assumption was that utilities are actually implementing KM programs consisting of tacit knowledge capture strategies. Based in part on existing research and experience in the industry, it was assumed that utilities will have an understanding of the value of KM and the need to capture tacit knowledge. Identifying the strategies assumed that the phenomena under investigation are in fact being implemented successfully at utilities. The second assumption was that the engineers, leadership, and human resource participants would freely, willingly, and trustingly discuss the power-laden topic of knowledge sharing and overcome the need to protect that which may represent power, authority, or job security (i.e., acknowledging the issue of knowledge hoarding). Although Van Genderen (2014) made a similar assumption and noted that the socialization process for sharing tacit knowledge should not be underestimated, it was assumed that a discussion on the process of knowledge capture strategies would be a less threatening topic than the participants actually sharing their subject matter expertise.

The third assumption was that the participants interviewed from the engineering department, leadership, and human resources would provide a realistic picture of the

practices used at the utility. By interviewing personnel with different perspectives, roles, and involvement in the organization the assumption was made that a multiple or triangular strategy would more accurately illustrate what was actually occurring in the organization. In Appelbaum et al.'s (2012) study of retirees, they used a similar approach to better illustrate a range of views on the phenomena and included in their participant pool both retirees and pre-retirees.

The last assumption relating to the electric utilities and their active capturing of tacit knowledge of their knowledge workers assumed that the evidence collected would address these practices in the right context (i.e., they are doing what they say they do). By following Maxwell's (2013) recommendation, the semi-structured interview questions were developed based on an a prior understanding of their organizational practices. Again, interviewing multiple participants with different perspectives or experience on the activities addressed this assumption.

Limitations

There were multiple limitations expected in this study. One limitation was that only certain strategies would be focused upon based on pre-study assumptions, the literature review, and the interviewing of the participants. The study may not have identified all of the related or embedded strategies currently being implemented and may not have comprehensively illustrated what was currently being done at the utilities. While this study involved multiple organizations, an additional limitation was in the generalizing of the findings to other organizations, industries, or cultural settings. With

internal generalizability relating to the making of conclusions within the cases studied, and external generalizability relating to the generalizing beyond the organizations or cases studied, the limitations of concern were those externalized generalizations (Patton, 2002). The study was limited to seven U.S electrical utilities purposefully chosen to participate.

The topic of causal relationships is also briefly discussed in qualitative research. It was noted by Dinur (2011) that research of this qualitative type does not address the causal relationships between the types of tacit knowledge involved and type-specific approaches to capturing it. Although the definitions for both tacit and explicit knowledge are understood in the scholarly field, and would be provided in general terms to the participants prior to the interviews, a limitation may have revolved around participants' understanding of the subject concepts. With varying understandings of the phenomenon under consideration, participants may have responded without a clearly aligned perspective on the topic.

Another limitation was that although face-to-face interviews provide high levels of rich information, phone and web-based *GoToMeetings* may be used as necessary to capture comprehensive views from the organizations. As noted by Ryan, Gandha, Culbertson, and Carlson (2014), the ability to make "collective sense" of social interactions is diminished when evidence is not collected in a natural setting. The on-line interviews do not allow for gathering additional insight and makes the collecting of what is not said more difficult (Ryan, Gandha, Culbertson, & Carlson, 2014). Due to

limitations in time, resources, and geographical locations of the participants, a web-based application was the sole method used to conduct the interviews.

Lastly, although participants within the study were purposely selected to provide a robust picture of the phenomenon across the organization, they may not have provided the most representative picture of the phenomena. The perspectives provided by the participants within each utility may not have aligned to represent the organization accurately and may not have fully represented the phenomena in a real world setting. Joia and Lemos (2010) recognized this when stating that the perceptions of participants may include “many varied interpretations of reality” when they respond to interview questions. Accordingly, Joia and Lemos suggested that in an unconscious manner, participants may try to place the organization in a better light or to “paint a good picture of the company...” (p. 410). This was a consideration when selecting and interviewing research participants.

Scope and Delimitations

The scope of the study is limited to the tacit knowledge capture strategies used at seven electrical utilities located throughout the continental U.S, and to the information available from those participants with experience, knowledge, and an organizational understanding of the processes and systems used at their organization. Although there are some social similarities in KM perspectives internationally (i.e., views of knowledge and its perceived value), the strategies and recommendation that resulted from this study may

not be universally considered suitable or of value on a larger geographic or international basis (Van Genderen, 2014).

Significance of Study

This research addressed a gap in understanding various tacit knowledge capture strategies by exploring them in the context of electrical utilities and their retiring engineers. With existing research focused on many aspects of tacit knowledge including the issues related to the brain-drain, the utilization of knowledge management programs, and the capture strategies used in a variety of industries, there is a continued need for empirical research that explores efficient and effective strategies that can be shared across the industry and result in sustained knowledge continuity and improved organizational success. In addition to providing management with tools and strategies for capturing tacit knowledge, this study offers a societal benefit by improving the sustained delivery of energy to a growing worldwide population, contributing to the large social impact on the building of communities, and by increasing the quality of life around the world.

The research involved determining what processes, systems, and programs electrical utilities are implementing to capture the tacit knowledge of retiring engineers. In response to increased competition, organizations are learning that maximizing and leveraging their resources to achieve a sustained competitive advantage is no longer simply an added benefit, but rather it is a necessity for long term sustainability and organizational success. Over the past few decades, the understanding and application of KM practices as tools for adapting to an ongoing, changing, and often unpredictable

environment has increased in popularity among local, national, and even organizations operating across international borders. Recognizing that the global financial crisis may have delayed the loss of knowledge workers temporarily, Short (2014) concluded that many organizations are now aware and trying to grasp the processes of sustaining their tacit knowledge assets. Determining what utilities are doing to address the potential knowledge loss offers management with tools to help ensure sustained operational continuity.

In the electrical utility industry, investments in training, knowledge sharing, and knowledge acquisition resources face internally challenging competition for funds as marketing, compliance, operations, research and development, and human resources are vying for financial support. This is in addition to those external open-market competitors that seek to take, service, and retain market share. Establishing operational processes and systems that improve and promote KM programs benefits the entire firm. This is true when those involved leverage what knowledge they gather, maintain, and share to increase the performance of the organization. Benefitting all stakeholders, a KM program that encourages sustained operational continuity is necessary for organizations operating in competitive industries (Suppiah & Manjit, 2011). The electrical utility industry is representative of many industries that have challenges that may affect their long term ability to offer services in competitive markets.

In summary, by increasing the understanding of the planning, organization, and implementation of capture strategies for the knowledge held in the minds of key retiring

engineers utilities will be better equipped to leverage this resource for future sustained reuse. On a larger scale, electrical utilities seek to operate at an optimum state to successfully continue to meet the demands of a growing worldwide population.

Implications for Social Change

The success of sustainable energy delivery has a huge social impact on the building of communities and increasing the quality of life around the world. Along with the needs for sustaining technology-based advancements, providing reliable energy, lowering the costs for consumers, and improving the environment, there is a potential for management to create long term organizational success with significant long term social benefits. In considering the positive social benefits of this study, a look at existing studies and the different perspectives provided by each helps frame this research.

While there is research on KM programs and their value in contributing social benefits, there are few that specifically focus on tacit knowledge. Of those studies that did focus on a social benefit, the researchers have offered different perspectives of them. For example, Sopko (2010) referenced the need to understand “the variables, such as training, documents, computers, and skills used to transfer tacit and know-how knowledge from retiring workers” (p. 76). Noting that organizations have benefitted for 50 years from the “76-million strong Baby Boomer generation”, Sopko took the position that studying these variables and the effects of retiring employees were significant topics and were capable of affecting social institutions such as hospitals, schools, and the general workforce.

Connell (2013) approached the social impact of the study of tacit knowledge from a different perspective. Connell's research was based on the belief that by promoting research based on accepted KM principles, organizations and specifically society would benefit when businesses operate more competently, successfully, and effectively. And from a different perspective, Dzekashu (2009) approached the need to study tacit knowledge in a social context by stating that it could result in better planning and designing of knowledge capturing and sharing programs, improve the use of tacit knowledge in the decision making process, and could contribute to all aspects of society that benefit from improved knowledge quality. This supported Nemati et al.'s (2010) and Bhanumathi and Rathb's (2014) position that managers and all organizations can benefit from a better understanding of the factors supporting the strategic management decision making process. Although these three studies each addressed the role of managing and leveraging tacit knowledge with their defined social benefits, this study contributed by addressing the critical societal challenges associated with the delivery of power worldwide and the aging of an industry workforce. This exploratory research offers electric utility management a better understanding of knowledge capture strategies used to retain intangible, and the hard to share knowledge needed to ensure operational continuity to deliver, safe, affordable, and reliably sustainable power to a growing and demanding population.

Summary and Conclusions

In Chapter One, I introduced the study. It began with a discussion on the study background including the current knowledge loss issue facing the electric utility industry. KM practices available to engineering leadership groups, knowledge types, and related research on knowledge capture strategies were presented. A discussion of the research problem, research purpose, and the nature of study set the context for the stated research questions.

In establishing the conceptual framework, I provided a knowledge, resource, and learning-based theory. These provided the lens to frame and explore the implemented practices, processes, and systems that; (1) recognizes knowledge as existing in different forms; (2) considers intangible knowledge as an asset or resource capable of being managed and leveraged; and (3) manages and embeds the generation, sharing, and reuse of knowledge in learning processes to improve organizational performance. Additional clarification of the terminology, assumptions, limitations, and scope were provided to define the structure and pre-study focus of the study. Lastly, the implications of positive social change were presented to illustrate the value of the study of tacit knowledge capture strategies in the context of electrical utilities. The implications included improving the management of tangible and intangible assets necessary for securing the reliable and sustainable delivery of a high demand yet limited environmental and socially valuable resource. In Chapter 2, I extend upon the conceptual framework underpinning

this study, I review the literature on tacit knowledge capture strategies, and I identify the gap in the literature worthy of exploring.

Chapter 2: Literature Review

Introduction

With the retirement of the baby-boomers, and specifically the senior electrical engineers in the electrical utility industry there is a managerial, organizational, and industrial need to capture their tacit knowledge before it is lost. With the loss of know-how a significant risk to maintaining operational continuity, the problem and purpose of this research relate to understanding the tacit knowledge capture strategies currently used in the industry to retain this valuable asset. A thorough literature review offers a picture of what research has been completed on capture strategies, the different approaches taken to explore this topic, and an opportunity to identify the gap in the research that when addressed empirically could advance the understanding of their effective use. This chapter begins with a description of the literature search strategy used and it is followed with the findings in the literature regarding the conceptual framework underpinning this study, existing capture strategies, and an identified gap.

Literature Search Strategy

In researching literature for this study, I searched major scholarly journals on various concepts and topics. The keyword searches included the following key terms: *tacit knowledge, knowledge capture strategy, knowledge management (KM), retirees and retirement, workforce, utilities, brain-drain, knowledge loss, knowledge based theories, consulting, storytelling, video*, and other derivations of these terms. Due to the wide range use of many of these terms, multiple databases were searched including IEEE

Xplore, ScienceDirect, Business Source Direct, ABI/INFORM Complete, Emerald Management, Proquest, and multi-database search tools including Thoreau and Google Scholar/Books. In addition, research articles and subject matter books were included from relevant KM courses offered at Walden University. I placed emphasis on searches for current peer reviewed and full text scholarly articles. More than 85% of the articles referenced in this study were published within the past five years.

Conceptual Framework Underpinning this Study

I provided three theories in chapter one to support the conceptual foundation for this study. The conceptual foundation underpinning the study provides insight into the categorization of knowledge, its value to an organization as a resource capable of being managed and leveraged, and in understanding how organizations use knowledge, learn, and create learning cultures and environments. The following is a discussion of how knowledge creation theory, resource based theory, and organizational learning theory serve as this study's conceptual framework.

Knowledge Creation Theory

The knowledge creation theory offers a systematic way of looking at the cyclical creation and conversion of knowledge through individual and organizational means. Nonaka and Takeuchi's (1995) knowledge creation theory is more commonly referred to as the socialization, externalization, combination, and internalization (SECI) model. The four modes, as viewed by Hall (2012) and Connell (2013) consist of four interdependent, continuous, and transitional phases. The SECI model is the most popular and widely cited

model referenced in the field of knowledge management (Mihi-Ramirez, Morales, & Rojas, 2011). Of the four modes, the most relevant to this study is the mode focused on clarifying and supporting the socialization process. Research on the underlying concepts and the challenges related to the cultural and environmental aspects of the topics have researchers seeking additional empirical support.

Challenges associated with the socialization mode of the SECI model are identified in this study. Petkovic, Miric, and Cudanov (2014) noted that Nonaka and Takeuchi's (1995) theory does explain how organizational knowledge flows or accumulates within the organization, but falls short in explaining the actual creation process. Their view of the model was based on the importance of combining the roles of knowledge conversion and learning within the knowledge creation process. During the socialization mode, the tacit to tacit conversion from one individual to another involves the most complex aspect of the model. For Easa and Fincham (2012), this conversion is achieved through shared experiences within the context of social and cultural activities that routinely occur within the organization. The SECI model assumes that a level of closeness and trust exists within the social and cultural environments, yet these assumptions are the subject of continued interest in the research community and are open to further validation. Within this study, the organizational context from which the knowledge is being captured is directly related to the closeness, structure, and trust within the organization and is a factor in understanding the phenomena.

In much of the theoretical research exploring the creation and generation of new knowledge, the universality of knowledge creation theory has been a given. Yet, current research is challenging this universal validity and is exploring more empirical evidence. Andreeva and Ikhilchik (2011) stated that management theories are now being criticized and scrutinized and noted that the SECI model, which is inherently a challenge to verify lacks “empirical data that could support or refute its’ ideas” (p. 56). One underlying aspect in the socialization mode is the role that culture and the environment play.

Whether on a large or small scale, the environmental context from which knowledge is created is a factor in any knowledge based research. Easa and Fincham (2012) researched the SECI model, which was originally developed considering Japanese values, and stated that the model should be “successfully applied in different contexts” (p. 103). Glisby and Holden (as cited in Easa & Fincham, 2012, p. 105) stated that the socialization mode involves cultural values. They added that since the micro and macro cultures of organizations and nations vary, the values of employee commitment and identity, along with the culture of the organization are factors both involved with the effectiveness of knowledge-sharing activities across size boundaries. This need to validate the model has extended the theory with an increased focus on the social, cultural, and organizational context as they relate to the sharing of tacit knowledge.

Research considering the social, cultural, and organizational factors for the creation and sharing of tacit knowledge has included the role of both learning and the leveraging of organizational assets. Related studies have focused on tacit knowledge and

its application in the knowledge creation and transfer is both government and private organizations and have illustrated the challenges providing empirical data to support specifically, the socialization mode (Connell, 2013; Dzekashu, 2009; Hall, 2012).

Continued research on knowledge creation theory has expanded the theory to include new models to analyze, test, and clarify the universality of the SECI model.

Related to this study, the knowledge creation theory recognizes the tacit nature of knowledge and the challenges embedded in the transferring process. More recent research on the knowledge creation theory has included attention on the underlying challenges of confirming the socialization process and provided empirical support for the transferring of tacit knowledge from one individual to another. Identified by Mihi-Ramirez, Morales, and Rojas (2011) as an asset that is “difficult to imitate”, additional theoretical research has supported the SECI model by considering it within the context of the resource based theory of the firm. Nonaka and Takeuchi’s (1995) theory offers researchers a foundation to apply to others related topics including organizational learning and related knowledge creation factors (Mihi-Ramirez et al., 2011). The knowledge creation theory underpins this study by framing the cyclical process by which knowledge is created, transferred, and converted for organizational use.

Resource Based Theory

Wernerfelt was credited in 1984 with both the idea of leveraging resources in achieving a competitive advantage and the development of the theories of the resource based view (RBV) and the more comprehensive resource based theory (RBT) of the firm.

Accepted as one of the most referenced theoretical frameworks in strategic management, Wernerfelt's original work has passed the test of time for scholarly research (Ferreira, Reis, Serra, & Costa, 2014). While RBT has limitations in terms of its predictive ability to value resources, it has been shown to provide a framework from which to view the utility of resources (Cawley & Snyder, 2012). There has been more recent theoretical research that has modified, updated, and increased the scope of the theory. A brief discussion of this research and how the theory underpins this study are provided.

In 2013, Wernerfelt expanded upon the theory and added that resources could be further leveraged by combining them to achieve a competitive advantage. Although not significantly a change in the theory, this expansion by its originator attested to the richness of the accepted and supported theoretical foundation of the RBT and offered a larger scope to the concept. With multiple decades of support, the focus of RBV and RBT research has been on clarifying the uniqueness of assets, the imitable nature of knowledge-based assets such as tacit knowledge, and on the true sustainability of resources for future use. Sum and Chorlian (2014) noted that with knowledge-based assets, the people and the processes in place will determine the uniqueness of the asset, and its value for future use. With a knowledge-based asset considered in this study, the theoretical basis for viewing it as a contributor to organizational success is dependent on understanding and validating it in terms of its potential utility.

One line of research has approached theory validation by increasing its scope and testing it in different environments. For example, Glavas and Mish (2015) extended the

theory by evaluating resources in terms of their ability to contribute on a collaborative basis, instead of a competitive advantage. Glavas and Mish took the position that Wernerfelt's 1984 theory needed "alternative conceptual frameworks" that could be empirically tested. This was similar to the continued research identified for validating Nonaka and Takeuchi's (1995) knowledge creation theory. Like the tacit knowledge defined by Mihi-Ramirez, Morales, and Rojas (2011) in the socialization mode, Glavas and Mish (2015) recognized that the literature on RBT either added to the concept of achieving a competitive advantage by managing resources, or adhered to the line of thought that "resources by themselves form no real value to a firm; instead it is the context and the processes through which resources are used, which allow firms to create competitive advantage" (p. 626). This second line of thought is the accepted focus of this study. Determining the mechanisms by which organizations capture their knowledge to ensure operational continuity is based on the need to explore the knowledge capture processes within the context of an electrical engineering environment. Underpinning this study is the value placed on the information as a rare and nonimitable resource that can be leveraged to bring a competitive value to the organization.

Although the RBT provides a means to evaluate resources in terms of their contribution to the organization, it is the leveraging of the resources and their future use that determines their real value. Researchers are evaluating the leveraging of resources by multiple means and are determining new views on expanding its scope. For example, Lin and Lin (2013) combined resource-based theory and organizational learning theory to

expand the future use of the resources. Bell and Dyck (2011) expanded upon RBT and developed what they called radical resource-based theory (RBT). Conceptually, this theory changed the idea of achieving a competitive advantage in terms of profit maximization, and restated it in terms of the multiple dimensions associated with individual, group, and organizational “well-being” benefits. As a valuable resource, the tacit knowledge held in the minds of retiring electrical engineers represents a non-imitable asset identified in the socialization mode of the SECI model. It is a resource which can be captured and leveraged by management to contribute to the operational continuity of the organization, and is a topic that should be explored and verified within the unique context of real world environments.

Organizational Learning Theory

Organizational learning (OL) theory has been the focus of extensive managerial and human resource research for nearly four decades. It has been linked to Nonaka and Takeuchi’s (1995) knowledge creation theory and the SECI model and to the separate resource based theory (RBT) of the firm. Learning is an integral component of the knowledge generation, transferring, and utilization process. The SECI conversion processes involves the transferring, sharing, and learning characteristics (Dzekashu, 2009), and the RBT involves the leveraging of resources and the “learnability” of organizations (Lin & Lin, 2013). Although there has been significant research conducted to understand how learning occurs in organizations, there is a theoretical need to explore real world practices and activities that enable learning to occur (Hilden & Tikkamäki,

2013). This study addresses this by considering OL theory to better understand the organizational behaviors, practices, and processes that electrical engineers use while the sharing of tacit knowledge and learning occurs.

In determining this final theory underpinning this study, a brief review of OL theory and its application in exploring organizations will aid in understanding its relevance. Researchers have considered OL to better understand the factors that enable firms to become learning organizations and pursue sustainability (Iarossi, Miller, O'Connor, & Keil, 2013), to design learning structures (Petković, Mirić, & Čudanov, 2014), and to manage the activity, routines, and member behavior that is collected by organizations (Vidal-Salazar, Córdón-Pozo, & Ferrón-Vilchez, 2012). OL has been described as being either exploratory (i.e., the development of new products or skills) or as exploitive (i.e., the learning of skills and knowledge that are core to how one completes a task in an effective or efficient manner) and involving learning of skills that allow for challenging applications, self reflection, and even job satisfaction (Hilden & Tikkamaki, 2013; Li, Chen, Liu, & Peng, 2014). And OL theory has been applied to studies of organizations including municipalities (Ahmadi, Daryani, & Bevrani, 2014) to evaluate how organizations learn in a real world context. For this study, OL theory contributes to the conceptual foundation for understanding how utility organizations establish capture strategies, how they learn during the capture and transfer process, and how organizations create organizational memories for sustaining knowledge for future use.

Literature Review of Capture Strategies

In a review of the literature on tacit knowledge capture strategies, two patterns of approaching the subject material emerged. One line of literature approached the topic by focusing on research aimed at exploring the use of one specific strategy on a standalone basis. These included articles focused on one strategy such as organizational mentoring, storytelling, or videotaping programs. The second line included the determination of what strategies are applicable or used within a general organization or industry. These studies explored all of the strategies being used within the context of an identified market or industry. A thorough understanding of the research conducted on specific strategies, combined with the research on what strategies have been used in specific organizations or industries provides this study both a micro and macro perspective of the phenomenon.

Tacit Knowledge Capture Strategies

Whether it is the use of apprenticeships, training courses and conferences, or storytelling these individual strategies provide a starting point for understanding strategies suitability within the context of an electrical utility. Research that has provided a more comprehensive description of what strategies have been used in other industries offers insight into what might be effectively used in this industry. With this study designed to understand what strategies electric utilities are implementing, this literature review will discuss what strategies have been observed in organizations and similar industries, and will then be followed by a more in-depth look at those more popular

strategies used across the literature. It will conclude with a discussion on relevant research conducted on the specific electric utility industry.

An understanding of knowledge capture strategies first requires an idea of the context from which tacit knowledge will be defined, and an idea of what a strategy will consist of for capturing it. For this study, tacit knowledge will be considered as that knowledge that is experienced based, difficult to articulate, hard to replicate, and due its complexity is difficult to transfer, document, and store. Much of the literature on what Mladkova (2012) has called tools, Al-Qdah and Salim (2013) has called mechanisms, Dalkir (2011) has called techniques, or Whyte and Classen (2012) has called knowledge elicitation techniques will be referred to in this study as tacit knowledge capture strategies. Although Joia and Lemos (2010) have used other terms or process titles to describe the overall organizational construct of capturing tacit knowledge such as relevant factors, strategies is the term used in this study to emphasis a deliberate and applied KM approach to capturing tacit knowledge in an organizational context. The use of the term strategy is preferred for this study as it infers a deliberate approach to meeting some objective.

It should be noted that strategies for capturing tacit knowledge have inherent challenges. To address this, this study relied on definitions used in previous studies. While it has been suggested in the literature that tacit knowledge may be difficult or incapable of being captured (Bautista-Frias et al., 2012; Dzekashu & McCollum, 2014; Fetterhoff et al., 2011), this study adhered to Dzekashu and McCollum's (2014)

definition of tacit knowledge capture as “the extraction of knowledge or experiential matter from individuals, groups, or organizations for the benefit of the same. The process includes identifying, acquiring, refining, and storing the knowledge for dissemination to practitioners or researchers (p. 54). As defined in this study, the capturing of tacit knowledge through implemented tools, processes, or strategies included all of those explicitly defined or embedded processes that result in not only the capture of the knowledge, but include mechanisms to make it available for reuse.

Widmer’s (2012) statement that “knowledge capture is not rocket science, but it takes planning” (p. 17) provides a good introduction into the options available for the various strategies an organization may choose. According to Fetterhoff et al. (2011), a diverse range of practices are available to organizations to capture knowledge. Recent approaches to studying strategies have revolved around establishing sharing organizational cultures, and establishing horizontal organizational structures, communication modes, and technologies. The results from this research has offered more insight into capture mechanisms and industry specific strategies.

Research on this topic has addressed many aspects of the phenomena. For starters, it has shown that successful implementation of knowledge capture systems requires collaboration between leadership and workers, and should consider the different degrees of tacit knowledge within the strategies chosen (Khuzadi, 2011). Additionally, it has been shown that the effectiveness of capture strategies is improved when efforts are properly focused on those considered experts in their field that have the “intuitive know-how”

(McIver et al., 2012). It was also shown that tacit knowledge is involved in both tacit knowledge and explicit knowledge capture strategies (Fahey & Prusak, 1998). The literature on the range of applied tacit knowledge capture strategies illustrates that their use can vary across different industries. What all of the studies do show is the universal need to have a system in place to maximize possessed knowledge.

Of the strategies noted in the literature, the following researchers and the strategies explored cover the majority of those anticipated in the electrical utility industry. As shown in Table 1, an extensive list of research has been on conducted on various tacit knowledge capture strategies:

Table 1

Studies of Tacit Knowledge Capture Strategies

Researcher	Knowledge Capture Strategies
Honeycutt (2008)	Documented procedures and job aids, diagrams, maps, models, patents, document retention standards, business continuity/disaster recovery plans, team document storage sites, searchable web sites, customer account management tools, equipment maintenance logs, case management tools, blogs/Wikis, interview guides, training and apprenticeship, storytelling, succession planning, having a deep bench of experts who can guide others, and having the expert transition relationships to the new employee
Dalkir (2011)	Stories, ad-hoc sessions, road maps, learning histories, action learning, e-learning, learning from others through business guest speakers, and benchmarking against best practices

(table continues)

Researcher	Knowledge Capture Strategies
Mladkova (2012)	Apprenticeships, communities of practice, and storytelling.
Appelbaum, et al. (2012)	Mentoring, succession planning with phased retirements, and Wikis.
Connell, Schechtman, & Hasty (2012)	Communities of practice, training schools, and conferences
Whyte & Classen (2012)	Interviewing experts, data analysis, cognitive modeling, and knowledge audits
Al-Qdah & Salim (2013)	Communities of practice, observations, apprenticeships, monitoring, metaphors, analogies, storytelling, expert interviews, best practices, lessons learned, learning by doing, concept (cognitive) maps, and brainstorming
Redlitz (2013)	Managerial coaching, and mentoring
Jennex & Durcikova (2013)	Communities of practice, knowledge repositories, mentoring, and intern programs
Panahi, Watson, & Partridge (2013)	Face-to-face interaction, observations, mentoring, and personal experience sharing
Bhanumathi & Rathb (2014)	Informal interviews, mind mapping, blogs, wikis, socializing, and externalizing

In addition to the above identified strategies, there are other considerations for increasing the sharing of tacit knowledge. While not identified as techniques or strategies, as many as 13 factors associated with transferring or influencing the transfer of tacit knowledge have been offered by Joia and Lemos (2010). These were identified by Joia

and Lemos as; time to share knowledge, sharing of a common language to share knowledge, a level of mutual trust, a relationship-based network to share knowledge, an organizational hierarchy conducive of sharing knowledge, rewards offered to incentivise sharing, the availability of work and personal training, extended face-to-face contact, modes available for storing knowledge, the view of “knowledge as power”, the openness or level of questioning when sharing new or novel ideas, the level of openness of others to accept new or novel ideas, and the use of technology and media to enable tacit knowledge sharing. Although not direct strategies, these factors were considered during the interviewing process and offered insight into unforeseen organizational practices of value.

Additional industry-specific qualitative research on tacit knowledge capture strategies has demonstrated the universal nature of knowledge loss as a result of the retiring of the baby-boomers. In a governmental context, Kaplan (2008) stated that governmental agencies had similar challenges and encouraged the use of a multistep process. In summary, Kaplan’s steps included establishing a common approach, identifying the critical knowledge, establishing a mentorship and internship program, keeping retiring professionals involved in the process, demonstrating successes through pilot programs, and establishing a more agency-based approach to capturing, adapting, and reusing knowledge. In a more formal capturing process, Bhanumathi and Rathb (2014) offered a seven-step program that originated by identifying the potential user of the knowledge and concluded by storing, managing, and publishing the captured

knowledge. Throughout private and government entities, the issue of knowledge loss has forced organizations to respond with systematic forms or processes of knowledge capture strategies.

While research has identified multiple strategies for dealing with retirement knowledge loss, a wide array of industries are responding differently to this dilemma. Widmer (2012) recognized that organizations have typically followed one of three approaches. They either proceed with a “brain dump” where no action is taken until the worker is about to leave, they implement some form of “knowledge-sharing systems” to capture knowledge over time, or they simply hire back retirees as consultants to preserve the existing knowledge. For many firms, there has been a more reactive approach to this the situation (Daghfous, Belkhodja, & Angell, 2013). As noted by Dalkir (2011), this issue is one of ensuring knowledge continuity. As industries address the issues of an aging workforce, the universal nature of this issue is becoming more widely recognized.

Industries like government or municipal utilities are not alone in their challenges. Bishop (2005), in recognizing the potential risks to the electric industry, offered six recommendations to address this knowledge loss. Bishop’s recommendations were identified as: (a) opening the lines of communication for employee knowledge sharing, (b) investing and leveraging available technology, (c) building learning relationships with other utilities, (d) encouraging participation in continuing education programs, (e) creating a 10-year employment plan that addresses retirement and vacancy risks, and (f) partnering with universities to bring in new workers. Major utilities in particular are

currently experiencing the effects of the large number of retirements yet the topic has not been extensively studied in this industry. The research relating to the electric utility industry, and what strategies have already been implemented is very limited and comes from the human resource needs identified in the atomic energy sector.

Originating in an industry with limited future growth potential, long term employment tenures, and a declining interest on the part of new workforce engineers, the nuclear power sector illustrates organizations where maintaining the knowledge of its experienced personnel was critical to continued reliable, efficient, and safe operations. Two specific qualitative studies offer models to the electrical utility industry and the pending loss of tacit knowledge of utility engineers. These were conducted by Jennex and Durcikova (2013) and Honeycutt (2008). Jennex and Durcikova's study focused on International Atomic Energy Agency (IAEA) methods to mitigate knowledge loss and the efforts at the Tennessee Valley Authority (TVA) public authority. Honeycutt's (2008) study involved a *Knowledge Loss Assessment* at Duke Energy. Through a process referred to as *Workforce Planning*, Honeycutt identified the knowledge risk status at Duke Energy and used a similar process to what was conducted at TVA. The result was a list of processes implemented to retain and transfer employee's knowledge including: documented procedures and job aids; diagrams, maps, models, and patents; document retention standards; business continuity/disaster recovery plans; team document storage sites; searchable web sites; customer account management tools; equipment maintenance logs; case management tools; blogs/Wikis, interview guides; training and apprenticeship;

storytelling, succession planning; having a deep bench of experts who can guide others; and having the expert transition relationships to the new employee (Honeycutt, 2008, slide 8). In both studies, the impetus was the need to maintain knowledge continuity in an industry that had little turnover expected and forecasted minimal opportunities for new sites to be built. In recognizing that knowledge loss represented a risk to the industry, Jennex and Durcikova (2013) stated that losing their valuable knowledge could have grave consequences and focused more on the retainable knowledge required of a position versus the knowledge held by the individual. For electrical utility engineers and this study, these identified processes provided a starting point of available capture strategy options.

In reviewing the literature, the strategies available to organizations across industries have ranged from Al-Qdah and Salim's (2013) position that the capture and communication strategy should align the tacitness level of the knowledge with an appropriate communication media type, to Jennex and Durcikova's (2013) position that retention strategies should focus beyond just an employee's independent knowledge, and should consider the potential impact that the knowledge loss could have on the social network within the organization. The literature demonstrated that while it is not common to see organizations with standardized or strategically established capture systems in place, those that do have them often have a general lack of understanding as to the frequency of their use (Fetterhoff et al., 2011). The literature supports the need for pragmatic approaches to managing tacit knowledge.

The wide range of strategies employed by organizations studied in the literature did illustrate a few common trends and challenges with capturing tacit knowledge. Recent qualitative research has focused on the capturing and converting of tacit knowledge to explicit knowledge, and much of the research has focused on several key strategies for capturing and transferring tacit knowledge to others. More recent approaches include advanced techniques like the novel approach of Rosario, Kipper, Frozza, and Mariani (2015). Their research included the use of a systemography approach referred to as *methodology for acquisition of collective tacit knowledge (MACTAK)*. What were common in this study and related literature are attempts to either improve the methods for capturing tacit knowledge from one individual to another, or they were creatively improving the conversion of tacit knowledge into an explicit form. This second approach has met with conflicting support since it can be seen as a codification process that changes the tacit nature of the knowledge. It may not be viewed as a capture process, but rather it may be viewed as an improved codification process. Considering these approaches, this study sought to explore those capture strategies that maintain the integrity and essence of what makes the tacit knowledge tacit. Those systems, processes, and programs that capture tacit knowledge to then codify it as explicit knowledge were not included in this study.

The following literature discussion addresses the use of the literature-dominant strategies in the context of specific organizations or industries. This research has sought to address the question *What strategies are organizations implementing to capture tacit*

knowledge? Based on my experience as an active member of electrical utility industry and the research provided in Table 1, the rehiring of retirees as consultants, mentoring and apprenticeships, communities of practice, video recording and electronic capture systems, and storytelling strategies will be discussed in more detail here. Additionally, the 13 factors provided by Joia and Lemos (2010) and some of the more embedded programs that support a knowledge sharing culture and environment were included in the research.

Rehiring Retirees as Consultants

It is not uncommon to see organizations do little in the planning and knowledge retention practices of impending retirements. Although shown to inadequately address the long term needs of the organization, many organizations delay action until just before an employee leaves (Widmer, 2012), or take the ad-hoc approach of hiring back their retirees as consultants. The practice of rehiring back retirees as consultants has been standard practice in many fields. For example, it has been the relied upon and valuable practice in Explosive Ordnance Disposal (EOD) divisions of the military (Connell et al., 2012). In this case, the strategy preserves the knowledge of those with life saving knowledge and experience in the military, and has been appropriate based on the funding constraints placed on the military. As an incentive to retirees used since 2007, the EOD had been providing reenlistment bonuses and offering special duty pay to support this strategy. For many organizations, the consequences of not doing anything are felt after the employee leaves. To address this, some organizations are considering ways to keep

employees beyond retirement and to retain their knowledge by simply retaining their employees longer.

To seek the right mutually beneficial relationship, organizations have sought creative use of incentive programs to keep people on the job beyond a planned retirement and to rehire them once they leave. Gelb and Longacre (2013) illustrated this approach by discussing an HR-based program introduced to allow a soon-to-be-retired employee or rehired consultant to stay on and leave a legacy. The goal of this program was to incentivize the person to be involved with picking a successor, training them, and therefore carrying-on the retiree's organizationally valuable work. This approach placed weight in the employee's willingness and desire to contribute to the organization for personal reasons.

The decision of employees to participate in these types of programs has been studied extensively in the context of a retiree's willingness to contribute and demonstrate behaviors that are not necessarily required of their position, but are helpful to the organization. Dekas et al. (2013) referenced this type of behavior as organizational citizenship behavior (OCB). Huang, McDowell, and Vargas (2015) clarified this definition by adding that OCB "is characterized by discretionary acts, such as helping colleagues, voluntarily taking initiatives, or showing exceptional commitment to work" (p. 20). Pei-Lee and Hongryi (2012) recognized OCB as being involved in job involvement, job satisfaction, and knowledge sharing behaviors. Dekas et al. (2013) offered newer dimensions of OCB including *voice* - participating vocally, *helping* -

volunteering to assist others, *individual initiative* - going beyond expectations or job requirements, *employee sustainability* – contributing to the well-being of others, *social participation* - being involved socially, *administrative behavior* - ensuring tasks, schedules, and details are completed, and *knowledge sharing* - sharing and distributing one's knowledge or expertise to others. The act of working beyond when one intended, or working for the betterment of the company when one is not expected to, falls within this definition. In this study, OCB was considered as an underlying component to tacit knowledge sharing and was explored.

In the context of determining one's willingness to contribute beyond their job requirements, research has considered those perks or personal benefits that could incentivize someone to work beyond their intended retirement. Additional research has approached the rehiring process by extending employment timelines and offering customized benefit packages with flexible work arrangements (Redlitz, 2013). Gelb and Longacre's (2013) research identified the use of completion bonuses or mentorship bonuses as incentives for staying on to finish a group or team project or to train a mentor for a year. In a study that explored this strategy in an engineering-based environment, it was referred to as a "stop-gap, delaying the inevitable" strategy by Pollack (2012, p. 823). For those working in a field for more than 30 years, social incentives (i.e., recognition from coworkers or leadership) rather than monetary incentives have been shown to be more effective and of more value to the employee (Appelbaum et al., 2012). For many in the industry, the potential for providing consulting services to one's previous

employer, or to other utilities in the industry is a common topic whenever retirement plans are discussed.

Mentoring and Apprenticeships

As one of the oldest known processes for sharing knowledge, mentorships and apprenticeships have long histories of passing experiential knowledge from one generation to the next. Considered as one of the oldest and best strategies for sharing knowledge by Appelbaum et al. (2012), mentorships and apprenticeships involve what Mladkova (2012) stated was a master to apprentice relationship and in transferring experience and skills, the master is trying to both “articulate (make them explicit) and demonstrate them to the apprentice” and assist the apprentice by “reshaping the master’s knowledge to his own knowledge” (p. 109). Alderfer (2014) viewed the mentor-protégé relationship as one that was fundamental to adult development. Collins (as cited in Cheng, Ou, Chen, & Chen, 2014, p. 424) defined the apprenticeship process as “the transmission of the knowledge required for expert practice, observation, coaching and successive approximation”. Fetterhoff et al. (2011) viewed these learning by observation programs as opportunities to connect senior personnel and junior personnel with applications in real world settings where through these close relationship, there would be tacit knowledge transfer that could cross “generational, tenure, or hierarchical barriers”. Cheng, Ou, Chen, and Chen (2014) identified a process where mentors share their professional knowledge through a process referred to as a cognitive apprenticeship. Short (2015) viewed the mentoring process as a “one-to-one, confidential and relationship-

based arrangement” (p. 3) where it occurs on a regular basis. The use of mentoring and apprenticeship programs has been extensively studied in the literature and determined to offer organizations significant benefits beyond simply transferring experience-based knowledge.

The use of these programs has benefitted organizations in multiple ways. In addition to being a valuable tool for reducing knowledge gaps, Grice et al. (2011) viewed mentorships as providing a mechanism for the sharing of experience and advice as senior experts provide career path guidance. This was in line with Short’s (2015) recognition of the benefits of mentoring programs. Short stated that mentorships provide opportunities for learning, communicating experiences, facilitating intergenerational gaps in learning styles, and increasing innovation and improving workplace environments. In prefacing the value of mentorships in terms of workforce development strategies (i.e., retention, engagement, absence and well-being), Short (2014) suggested six main reasons for supporting mentoring programs. These included an enhancement of leadership’s capabilities, improved knowledge transfer, role modeling and credibility opportunities, increased access to experience, improved communications, and added value to employee retention/engagement. Mentoring and apprenticeship programs have been shown to facilitate cross-unit training and improve skill-sets, and have also been shown to support succession planning programs (Mayfield, 2010) and the retraining of older personnel (Shah & Gregar, 2014), especially when applied through phased retirement programs (Appelbaum et al., 2012) Although Mladkova (2012) and other researchers viewed the

idea of coaching or mentoring as the most common organizational approach for sharing tacit knowledge, Mladkova concluded that its application is often not well managed by organizations. This was recognition of the need for more research on how management could leverage these practices.

The effective role of tacit knowledge in mentoring and apprenticeship programs has become an increased focus of more recent research (Goffin and Koners, 2011). In addition to being studied in the military training of military EOD personnel (Connell et al., 2012), it has been a research subject in programs at NASA's knowledge continuity applications (Dalkir, 2011), and in other professions such as carpentry and plumbing vocations involving "learnable tacit know-how" (McIver et al., 2012, p. 95). This focus on apprenticeships and the role of tacit knowledge dates back to Drucker's 1993 recognition that once we entered the industrial revolution, this type of tacit knowledge transfer ended and that skill set was no longer owned by the craftsman: it became the shared property of the industry. The value of tacit knowledge in mentoring and apprenticeship programs is evident in the literature. Due to the importance of the role and relationship between the participants, it is important to understand how knowledge is transferred in the process and how these complex issues are addressed.

Establishing a mentor and mentee relationship is not enough to ensure knowledge transfer. The relationship and effectiveness of the program relies on many factors. It involves securing a mentor that is experienced, respected, and likely to guide the mentee in the right direction to achieve positive outcomes (Lazarus, 2015; Lyle & Smith, 2014).

It involves commitment, trust, and an understanding of the roles and value of the relationship. First, the knowledge and technical expertise of another person can be hard to comprehend (Xu et al., 2014). In addition to recognizing that knowledge or expertise becomes more valuable when it is held by one individual, Carmel et al. (2013) defined an expert as one that “demonstrates higher levels of efficiency, performs tasks with greater accuracy and cost effectiveness and holds subject specific knowledge, such as on methods and procedures, including knowledge of how to deal with problems and new situations” (p. 915). It is the linking of personnel and the sharing of their expertise that Dalkir (2011) identified as a demonstration of one’s “application of knowledge”. Dalkir added that by combining “learning by being told” with “learning by observation”, one could achieve a permanent record of the expertise through a personal interaction. This is considered an integral component in the mentorship and apprenticeship process.

The process of transferring knowledge through mentoring or apprenticeships is a complex process. It is accomplished through a process that Agbim et al. (2013) described as incorporating “thinking out loud” whereby the expert shares his or her thought process, insights, and possible causal factors considered as the situation evolves. Agbim et al. stated that through this process, the pros and cons considered by the expert are offered to the protégé, and the protégé is then given the opportunity to imitate the expert under the same conditions. It is through this process that the protégé builds what was referred to by Aggim et al. as their own useful models for a case-based reference to use in similar future

situations. By using the experience of the mentor in a personalized manner, the mentee interprets, personalizes, then applies the knowledge in a new situation or setting.

Research on the topics of cultural and environmental settings and the motivation of both the expert and the protégé has addressed several factors. One issue is the idea that successful mentoring happens “when it has vigor, value and continuity that come from structure and discipline” (Axelrod, 2012, p. 49). In these environments, one could anticipate that mentoring could be beneficial to both the mentor and the mentee. Research has added that there is an increased back-and-forth sharing of tacit knowledge in environments when there is high level of empathy, trust, and respect between the leader and the follower (Whisnant & Khasawneh, 2014). These personal and environmental attributes are significant to the overall effectiveness of the programs.

This mentoring can take place in many places, situations, and in unexpected scenarios. McIver et al. (2012) stated that the process of learning occurs over time and occurs through a process of “learning by trial-and-error” (p. 95). This is not limited to only formal work related environments. Mentoring programs can also exist along a continuum from informal to formal (Short, 2014). While the literature suggests that the value of the program relates to the formality of the working environment, it is also affected by many factors. For example, research has demonstrated that the effectiveness of the mentorships increase as the formality of the structured program increases (Mayfield, 2010). Additionally, for transferring knowledge in non working environments, one-on-one mentoring could take place in both the work environment or effectively in

neutral places outside of the office (Harvey, 2012). Finally, the mentoring process benefits when it is individually tailored to align mentees with mentors (Mayfield, 2010). By considering these issues, the effectiveness of the programs are not limited by the physical constraints of a formal work environment.

On a final note regarding this strategy, one of the drivers to implementing effective mentorship and apprenticeship programs in the literature relates to the concept of learnability. McIver et al. (2012) stated that this idea of learnability is an important aspect of the mentor-mentee relationship and that the ability of the protégé to learn and become competent in learned tasks can become the metric by which a program's success can be measured. It is through the process of imitation, personalization, and then the application of the knowledge to new situations that organizations are able to determine the effectiveness and future value of the program.

Communities of Practice

Like the mentoring and apprenticeship programs, the sharing of knowledge is not limited to a one-on-one, mentor to mentee, or expert to apprentice relationship. The sharing of knowledge can occur through large group interactions and through a common relationship or shared interest. Based on Nonaka and Takeuchi's (1995) SECI model, socialization is involved in the knowledge sharing process. Considering that social networks are a main communication channel for transferring tacit knowledge, Wei, Pu, and Chen (as cited in Surong and Wenping, 2010) stated that a community of practice (CoP) can be a primary tool or strategy for sharing knowledge. When considered as a

legitimate professional community, informal learning can occur, the community members can have access to additional industry resources, and those participating can receive various forms of informal or formal recognition (Wilmott & Knox, 2014). The practice of sharing knowledge through a community or social network is something that has expanded the way that workers communicate, and create and share knowledge. When created and conducted under the right conditions, CoPs can also offer an environment that fosters both the creation of new knowledge, and the sharing of existing knowledge.

CoPs may take many forms. Defined as “groups of people sharing an interest in an issue who meet periodically to discuss problems, brainstorm and share knowledge” (Agbim et al., 2013, p. 121), CoPs can range from a group that meets regularly around a water cooler or annually at conventions or conferences, to formally created communities with defined goals, participation rules, and leadership roles. Mladkova (2012) defined these environments as communities, created to be virtual or physical, or formed by formal or volunteer means, and as a place where groups of people can share common interests, knowledge, experiences, tools, and best practices to solve problems. With the definition of working privately or working publically changing, virtual communities are offering and generating new forms of data and new ways of looking at working together (DeLyser & Sui, 2013). When a CoP is on-line exclusively, it has been referred to in the literature as an On-line Community of Practice or OCoP. In regard to an OCoP, Swift (2014) stated that they may “capture valuable tacit knowledge that can be combined with empirical knowledge to develop evidence-based practice” (p. 31). Whether virtual or not,

the literature on the structure of the CoP has focused on how they provide subject matter experts with a forum and community to work together towards advancing their shared interests.

For the participants, there are professional and social benefits that extend beyond the sharing of information and experiences. Wenger et al. (as cited in Cordery et al., 2014) stated that CoPs consist of groups of people, with a shared investment, interest, concern, or problem, and contribute and benefit personally or professionally from participating in the group. Agbim et al. (2013) added that these communities provide an environment where the sharing of tacit knowledge is possible, especially when facilitated by an expert that offers members support, time, and recognition. CoPs have been shown to provide an environment where tacit knowledge and empirical knowledge can be combined and “can enhance knowledge development, strengthen social ties and build social capital” (Swift, 2014, p. 28). Chandra et al. (2015) recognized the social aspect of these groups as being based on cliques that enable members work more effectively and efficiently. As a forum to share information on topics of interest and address challenges faced by the participants, CoPs are providing value to organizations through both formal and informal means.

Although most CoPs are formed as informal members sharing an interest, the research has demonstrated that the formation of these communities often occurs along two paths. The first is through formal means and the second is through informal means. Chandra et al. (2015) noted that while many communities are informally established from

shared need or interest in a topic, organizations could construct a more formalized community by conducting a *Knowledge Flow Pattern* (KNA) analysis to develop a sociogram, or rather a map of potential members and their relationships identified by a specific domain of knowledge. And based on the outcome of the KNA, they could then form more formal socially structured CoPs. In their research, Chandra et al. concluded that the level of formal knowledge flow impacts the extent of collaboration and that in many cases employees will seek their informal network relationships before their formal network relationships in obtaining support or obtaining solutions to their problems. Although the formality level of the CoP may play a role in its effectiveness, it is accepted that CoPs offer participants with a trusted peer-based knowledge source. This is not to say that CoPs do not have their own challenges.

The value and issues associated with CoP knowledge sharing has been well researched. While CoPs provide a forum for the exchange and transfer of best practices (Cordery et al., 2014) and have been shown to further knowledge activities within the organization by more than “sixty percent of the participants” (Dzekashu & McCollum, 2014, p. 60), the use of CoPs have organizational challenges to overcome. For example, Mladkova (2012) noted that: (a) just over half of those communities studied did want to cooperate with other CoPs, (b) many of the CoPs were considered knowledge monopolies by others, (c) there were issues with CoP group elitism, and (d) knowledge protection concerns were often present. Additionally, Dzekashu and McCollum stated that mismanagement of these communities was still a prevailing issue. As a social forum,

CoPs still have the challenges associated with effective collaboration between members, knowledge hoarding, and with the social and political perceptions of one's role within the community.

For organizations, there is the issue of quantifying the value of CoPs in terms of operational improvements, personnel or resource savings, and bottom-line financial contribution. Cordery et al. (2014) noted that the literature is not completely conclusive on the tangible organizational benefits of CoPs. Their research attempted to place a value or to quantify the contributions of CoPs by assessing their use with the three categories of people, processes, and technology – the same three components used by Dzekashu and McCollum's (2014) to define KM. Cordery et al's study demonstrated that CoPs may be beneficial by increasing the organization's *human capital* (i.e., that knowledge held by its employees), its *social capital* (i.e., those benefits resulting from relationship-based resources), and its *organizational capital* (i.e., the systems and technology-based resources that support the organization). Like tacit knowledge, placing a value on CoPs face similar challenges. CoPs can be considered as a tool to enable the effective use of knowledge and can contribute to increasing the value of an intangible asset.

For many organizations, the use of technology has enabled and facilitated the effectiveness of CoPs. Although the use of intranets, portals, and other forms of groupware has been extensively used, industries vary on the level of embedding technology into the daily operations of the organization. The use of software, portals, and groupware as technology driven tools have been used to provide both a single source for

customer, employee, or supplier sharing of knowledge and to increase collaboration through knowledge sharing platforms. Examples of these include the use of *Lotus Notes* and *Shareware* (Grant, 2013, p. 101). As an illustration of their utility, the use of *Microsoft Office Sharepoint* can offer a platform for creating CoP information sharing sites, enabling document collaboration tools, automatically adding documents to a repository, and for keeping track of and communicating team alerts for changes (Chandra, Iyer, & Raman, 2015). These platforms provide a framework for the sharing of knowledge and have become standard applications in the daily operations of many organizations.

In the oil and gas industry for instance, Grant (2013) recognized that while most companies do not have dedicated staff or distinct budgets for KM programs, there have been attempts to integrate their KM programs into the functions of the organization. The trend noted by Grant had been to implement KM initiatives primarily through IT departments and through cross-functional teams. Grant viewed the use of CoPs in these industries as instrumental to facilitating knowledge transfer, adding that CoPs play a central role in KM initiatives and the involvement of rank-and-file organizational managers in creating innovative ideas, finding solutions to shared problems, and helping members to become ad-hoc mentors. Through a systematic approach, CoPs and information technology (IT) applications provide personnel with tools that do more than simple manage information.

As the level and scope of IT applications expand to include more knowledge capture features, the use new forms of CoPs will continue to increase. This was supported by Wilmott and Knox (2014) research when they approached CoPs from the perspective that they can be professionally focused (i.e., within the realm of work related activities) or can occur outside of one's respective business environment. In these cases, they referred to the latter as a *communities of interest* defined as an additional organizational resource for sharing and capturing valuable knowledge. Wilmott and Knox recognized that as a written record, virtual communities may provide an organization with archivable knowledge data that can be stored in a repository for future use and may represent an accredited or peer-reviewed type of resource, and can provide "a unique insight into the creation of knowledge through social learning" (p. 72). This research demonstrated how knowledge capturing features within CoPs could be used to offer organizations with new sources of knowledge.

Video Recording and Electronic Capture

The use of IT and technology-based tools has been well researched in knowledge sharing KM programs. Much of the research to date has addressed the theoretical, individual, cultural, and technical difficulties of working with tacit knowledge (Panahi et al., 2013), and has focused on the sole use of technology to transfer knowledge. Advancements in IT-based applications have had to overcome a few issues associated with a reliance on technology alone. A common thread in the technology-related literature has been the use of the words *enable* and *facilitate*.

The research on the use of technology for knowledge sharing activities has identified that it should be used as a support tool. As one of Fahey and Prusak's (1998) *Eleven Deadliest Sins of Knowledge Management*, they recognized that knowledge sharing was a personal and face-to-face process, and that while IT was a tool that could facilitate the transmission and distribution of data and information, knowledge sharing required "rich interactivity, communication, and learning that is inherent in dialogue" (p. 273). For Al-Qdah and Salim (2013), IT could be useful as an enabler in the transfer of explicit knowledge while tacit knowledge may require the use of more information and communications technology (ICT). This would allow for matching of the type of knowledge to the type of communication media to maximize the effectiveness of the transfer. This was supported by Venkitachalam and Busch's (2012) position that ICT could support the flow of tacit knowledge between individuals and aid in its codification. For Grant (2013), technology should be viewed as a source of securing "corporate memories" (p. 100). Mundra et al. (2011) and Panahi et al. (2013) viewed technology in general as playing an important role in KM activities but noted that there still existed varied views on the ability of IT to actually facilitate knowledge sharing. With technology accepted as a knowledge sharing enabler or facilitating tool, research has been focused on those applications that could capture expertise.

The use of technology for knowledge capture applications has included both in-person and virtual methods. In considering the use of technology, Suppiah and Manjit (2011) recommended that organizations should encourage the use of technologies such as

video conferencing, electronic forums, and social applications like *twitter* and *facebook* to share tacit knowledge. As a tool to capture knowledge or expertise, Dalkir (2011) stated that video recording of expertise for future use is one tool to permanently record “informal and unrehearsed expert demonstrations” (p. 113). The use of video recording to capture knowledge has been applied to learning environments and in other contexts. In school settings, Lee and Chiu (2013) determined that the use of video in the classroom helped students to better comprehend difficult concepts. They added that when viewed multiple times, students were better able to understand complex ideas or difficult to grasp concepts, their critical thinking skills improved, and more effective learning occurred. The use of technologies such as video recording provides a means for capturing the experiences of those with the knowledge without having to put it into an explicit form.

Capturing the tacit knowledge of workers may involve more than simply determining the knowledge in their head, it may involve capturing their movements, whether they were aware of them or not (Perjanik, 2015). An example of this was observed in the Yoshida et al.’s (2011) study of workers and their factory production. In their study, video recording was used to record skilled expert engineers and capture their tacit knowledge through a the process known as *human motion capture*. This process involved combining the video of their physical movements with their responses to interview questions. Along this line, Wang and Lien (2013) stated that in conducting research, the use of video recording could be a supplemental tool resulting in three advantages. These included collecting of skills in their context, the ability of the system

to collect non-language data, and the robust value that comes from what was referred to as text reflection. This was in addition to other nonverbal behaviors that could be captured. Video recording offers one of many mechanisms for capturing experience, and for putting it into the right context of those that possess it.

The literature on the use of technology for electronic recordings extends to include those other forms of communication and interactions that involve the sharing and capturing of knowledge. Referred to in much of the literature as collaboration-based technologies, the effective and efficient use of socially-based applications are increasingly being integrated to facilitate communications and sharing and to capture that knowledge in hard form. In considering the need for collaboration, Khuzadi (2011) stated that it was a necessity for team-based innovation and that the systems used must incorporate a knowledge capture component to leverage the vast amount of knowledge involved. The use of collaboration-based applications with knowledge capture features has seen a significant increase.

One field benefiting from the use of collaboration is education and training. In recognizing that knowledge acquisition for training purposes can originate from the interviewing of senior workers, Cheng et al. (2014) stated that the use of inter-active multimedia-based systems offered an effective means for the collaborative transferring of tacit knowledge. The value of these collaborative tools was evident in the training and knowledge capture technique presented by Shanahan and Tochelli (2014). In studying knowledge sharing and the use of video study groups, Shanahan and Tochelli presented a

technique whereby teachers could view, share, and explain their video captured teachings on the topics of explicit and tacit knowledge. Through group review, their understandings and misunderstandings of what they were doing could be shared in context with others. In this case, the group reviews of the video allowed those on tape to share how they were making their tacit knowledge more explicit in a collaborative social environment. For all involved, the value of the video related to its use as a professional development tool in assisting with their sharing of different knowledge types (Shanahan & Tochelli, 2014). As a training tool, video capture technologies offered organizations a feedback and tacit knowledge capture tool that could be used multiple times in the future.

Additional collaborative tools that offer the same type of benefit are available to organizations. Noting that Wiki technologies, video conferencing, and other systems such as bulletin boards, e-mail systems (i.e., *Lotus Notes*), and large data search engines were becoming commonplace in the workplace, Khuzadi (2011) stated that their knowledge capture features are more routinely being used. Referred to as a technique by Mayfield (2010), Wikis offer organizations a web-based application to share information, and to collectively elaborate, edit, and extend the information as a living or ongoing document. Davenport and Prusak (1998) regarded systems like *Lotus Notes* (a.k.a., a popular groupware application) as providing organizations with *knowledge architecture*. Panahi, et al. (2013) added that Wikis specifically can provide for collaborative knowledge sharing and capturing activities by social means. These applications extend the benefits achieved with video recording to on-line or virtual environments.

This is the case with the expanding use of social platforms and social networking sites (SNSs). Panahi et al. (2013) stated that a CoP and a SNS were collaboration tools that provide a forum for sustaining tacit knowledge sharing, and offered experts a source to form and promote their peer relationships while sharing knowledge. Panahi et al. added that although much of the literature has focused on the potential of SNS for tacit knowledge sharing, they noted that SNS tools could complement tacit knowledge sharing but not be a substitute for it. It was Davenport and Prusak (1998) that recognized that technology would be more beneficial as the tacitness of the knowledge increased and that the sharing of tacit knowledge would still occur through direct and interactive processes. Dalkir (2011) provided an example of this by referring to NASA's mentoring program and the use of recordings, virtual collaboration tools, and video tracking to provide personnel with a direct connection to the expertise on a face-to-face basis as well in a permanent form. These tools all shared many of the needed characteristics of capturing tacit knowledge including a method for communicating ideas and experiences, a forum that could substitute for face-to-face interactions, and a focus on social relationships. Whether this involves electronic tape, digital recordings, or provides a log of the communications from a SNS, these technologies provide a means for capturing knowledge within a more personalized environment.

The use of videotaping and knowledge-sharing technologies involves those strategies that capture knowledge in a recorded format. Taking this position, Panahi et al.'s (2013) view that the use of technology and SNS were complementary to the process

of tacit knowledge sharing will be a consideration for this study. Panahi et al.'s position is that video recording, blogs, storytelling, and other forms of personal communication offer the "most important benefit for the externalisation of tacit knowledge" (p.389). This position will be taken during the study as a reminder to address and collect evidence on all forms of communication and knowledge sharing technologies, even when their use is not identified as a recognized capture strategy. Of importance in these processes will be the ability of the system to capture tacit knowledge and store them in embedded multimedia files for future organizational use. Noting Panahi et al.'s statement that there is a lack of empirical studies on the role of SNS on the many dimensions of knowledge, this study provides an opportunity to view this phenomenon within the context of a specific industry.

Storytelling

The practice of storytelling has a long history in knowledge sharing. As a knowledge capture strategy, this approach involves the coding of lessons learnt and experiences gained through the use of metaphors and expressed stories (Goffin and Koners, 2011). It has been defined from several perspectives. Kalid and Mahmud (2008) defined organizational storytelling as a KM technique used to "describe complex issues, explain events, understand difficult changes, present other perspectives, make connections and communicate experience" (p. 2). Wijetunge (2012) defined it as "a detailed narrative of past management actions, employee interactions, or other intra- or extra- organizational events that are communicated informally within the organization"

(p.213). Mladkova (2012) defined stories as a complex system of symbols that may “give sense to things and events and represent norms, experiences, and explanations of reality” and as “a virtual experience that enables the listener or reader to create his own tacit knowledge in reality, simulated by the story” (p. 111). Petrick (2014) stated that stories allow someone else to see an experience or the reasoning taken from the eyes or view of someone else. And Dalkir (2011) viewed storytelling as “an excellent vehicle for capturing, coding, and transmitting valuable tacit knowledge” (p. 107). In all of these definitions, storytelling has been presented as a personalized communication-based process that allows for the rich, complex nature of knowledge to be shared.

In regard to the benefits of storytelling, there is ample evidence showing its benefits. Wijetunge (2012) stated that the literature strongly supports the positive role of storytelling in the sharing of tacit knowledge. Additional research has shown that storytelling is an effective tacit knowledge capture strategy and that it has effectively been used with retiring subject matter experts (SMEs) in large South African organizations (Whyte & Classen, 2012). It has increased knowledge retention levels by a factor of 20 when compared to not being presented in a story format (Redlitz, 2013). It has successfully improved tacit knowledge sharing in new product development programs while contributing to building positive team cultures (Goffin & Koners, 2011). And, storytelling can be leveraged further by combining it with available software applications such as *TellStory*, *StoryMapper*, and *The Well* so it can be made available for organizational use in the future (Kalid & Mahmud, 2008). Storytelling allows the

storyteller to share knowledge within a specific personal context. Given that research has estimated that more than 50% of the knowledge held by organizations is tacit (Suppiah & Manjit, 2011), quantifying the benefits of strategies like storytelling remains to be a challenge. With this understood, Wijetunge's (2012) evidence suggested that the aim of storytelling could be to capture the "42 per cent of the organizational knowledge" that is held in the minds of one's employees (p. 221). The subject of organizational researchers for the past 30 years, storytelling as a tacit knowledge capture strategy has received ample support in the literature.

Over this time, the study of organizational storytelling has evolved. Work has focused on the development of taxonomies and processes one could follow to maximize the efficiency of this strategy. For example, in 1983 Martin and Powers' research of the seven types of organizational story categories, Simmon's 2001 recognition of six types of influence-related stories, and Straker's 2008 method of cataloguing organizational stories were integrated into Whyte and Classen's (2012) introduction of a KM framework for classifying stories into 14 KM constructs. These approaches provided researchers with new ways for looking at storytelling from a structured and knowledge capturing perspective.

One of these approaches resulted in the generation of a new storytelling model. Wijetunge (2012) viewed the capturing of stories from the perspective of developing a six-step process and story capturing model. With the goal of determining how the tacit knowledge of retiring senior executive could be captured, Wijetunge concluded that the

effectiveness of the stories would depend on two issues, namely the clear conveyance and context of the message. Although researchers continue to offer clarity and organization to the storytelling strategy, Whyte and Classen (2012) stated that the storytelling strategy requires long term planning and a managerial commitment of its use. In the electrical utility industry and the technical work of engineers in the field, storytelling by senior personnel allows for the transferring of rich and complex knowledge to new engineers.

Additional Socially-Based Strategies

Additional research involving personal communications, person-to-person interactions, and environments conducive of sharing experiences have been included in the literature. An example of these include the use of a town hall meeting as a socially-based strategy that offers an environment for the group sharing of knowledge. Generally held as an informal meeting, the participants discuss topics that would benefit from the input of those attending the meeting. By providing a forum for a group consensus to be formed, sharing of knowledge and collective learning occurs (Mayfield, 2010).

Additional environments include conferences, industry conventions, and other group activities that bring together those in the same industry.

What these activities have in common is their ability to allow industry colleagues to meet face-to-face, to offer a knowledge rich environment to discuss real world practices, and to provide an environment where sharing knowledge is encouraged.

Harvey (2012) approached the environmental issue from the point of view that mutual exchanges are socialization phenomena. For Harvey, the learning and exchanging of

knowledge involves both explicit and tacit knowledge, occurs by flowing in both directions, and increases when the proximity of workers of different generations is tightened. Environments that are rich in knowledge sharing provide an opportunity for exchanging experiences and learning from others. Conferences and trade association meetings have been shown to provide such an environment.

While conferences often include presentations and papers on technical topics, and therefore are designed to share explicit knowledge, Henn and Bathelt's (2015) research focused on conferences as being communities where knowledge workers could share both explicit and tacit knowledge. They approached their study considering two methodologies. By approaching the topic from the perspectives of field-configuring events (FCEs) and temporary clusters, both the value of the knowledge obtained and the flow of knowledge could be better understood. With the concept of FCEs related to studying the social aspects of how industry-based association meetings and conferences shape and influence industries, and with the concept of temporary clusters referring to analyzing the flow of knowledge at these events, the contribution of explicit and tacit knowledge was shown to contribute on an individual and organizational basis. For attendees linked by some form of relational proximity, Henn and Bathelt added that conferences were crucial environments where exchanges:

extend from conference sessions to brief hallway discussions, conversations at social events, lunch exchanges, and so on. In these contexts, not only are explicit knowledge components constantly contextualized and illustrated, but tacit

knowledge elements are explicated to others and demonstrated in their relevance (p. 107).

With this perspective, practices such as water-cooler conversations, training sessions, industry conferences, and other socially-based gatherings allow for the transfer of tacit knowledge. By their nature these conferences, sessions, and industry events are conducive to increasing the sharing of information and knowledge, and industry real-world practices.

On a final note, socially-based strategies are dependent on environments and the level of trust that exists between the participants, colleagues, or leadership. This idea of trust and its role in the sharing of knowledge is an essential factor and critical aspect for those sharing tacit knowledge and assessing relational social capital (Hu & Randel, 2014; Panahi, Watson, & Partridge, 2013). Pitrowsky, de Sá Affonso da Costa, and Ribeiro Salles (2014) stated that trust, cooperation, and the availability and willingness of those involved are integral to the knowledge sharing process. In technical fields, the style of leadership has been shown to positively affect the willingness of subordinates to trust and provide a reason for sharing knowledge (Whisnant & Khasawneh, 2014). In their study of engineers, Whisnant and Khasawneh stated that in assessing effective leadership and supervisory encouragement, trustworthiness and the state or quality of the relationship can enhance the sharing of knowledge. They concluded that even when distrust exists between the leadership and an employee, tacit knowledge sharing will continue if their relationship is of a solid or high-quality nature.

Gap in the Literature

The existing literature on the two lines of tacit knowledge capture strategy research has provided a general understanding of those strategies available to organizations and their applications in a limited number of industries. Supported by the conceptual foundations and theories underpinning the study, there are research-based recommendations to study knowledge sharing practices for the hard to imitate and valued resources within a learning culture and to leverage them to provide comprehensive organizational benefits. The research gap addressed by this study considers existing research and the conceptual framework from the literature. The limited amount of research relating to the electric utility industry, and what strategies have been implemented in similar fields is very limited. There is a literature gap in the research on capture strategies applicable to this field and to the engineering profession in particular, and on the effects of knowledge management programs on the operational continuity of electric utilities.

A common thread in the literature on the study of tacit knowledge revolves around the need for industry specific managerial tools to aid in the capturing of tacit knowledge of retiring personnel. Additionally, more empirical evidence is needed to improve the understanding and validate the conceptual theories within a different context. Existing gaps in the literature exist and revolve around multiple topics. These include Easa and Fincham (2012) and Andreeva and Ikhilchik's (2011) statement that further advancing research in organizational and national contexts were needed and that specific

gaps in understanding knowledge were needed in specific cultural contexts. Glavas and Mish (2015) added that more qualitative studies were needed on sustainability-based strategies. Ferreira, Reis, Serra, and Costa (2014) stated that more research was needed on top management teams and human resource management's leadership of RBV designated assets. Although the range of topics vary and the literature identifies multiple research gaps, the risks and quantified benefits of implementing capture strategies at electrical utilities is completely lacking in the literature. Management has limited resources to increase their knowledge of these much needed knowledge management practices.

For this study, an introductory level of literature exists on the application of tacit knowledge capture strategies in high-tech industries, yet its value and contribution to understanding the phenomena within a utility context is underexplored. The study of the tacit knowledge capture strategies of engineers at electric utilities provides utility leadership with a social, cultural, and organizational environment to further the understanding of knowledge management practices to better react, plan, and implement knowledge programs to address as real world situation. The gap in the literature relating to the application of capture strategies offered this researcher the opportunity to empirically study the phenomena within the context of a knowledge-rich environment.

Summary and Conclusions

The review of the literature available on tacit knowledge capture strategies provides a wide breadth of information on the topic. Two lines of research were revealed.

Following the discussion on the theories that underpinned the conceptual framework for the study, a discussion was provided on the extensive research that explored the use of a specific strategy within an organizational context. These articles focused on research that examined what strategies were applicable or used within a general organization or industry. The discussion then addressed the research that focused on one strategy such as organizational mentoring, storytelling, or videotaping programs and included a discussion of their use, benefits, and challenges. Following this discussion, current research on tacit knowledge capture strategies in the electric field and related industries was presented. While there is existing research on the topic of tacit knowledge capture strategies and their application in many industries, there is an apparent lack of empirical studies in the engineering-based electric utility industry. This literature review illustrated the need to explore these tacit knowledge capture strategies in more detail and in the context of a heavily knowledge-based environment. This chapter identified literature of the conceptual framework underpinning this study and on the individual and industry specific knowledge capture strategies more recently studied.

Chapter 3: Research Method

Introduction

The purpose of this qualitative research study was to conduct a case study of multiple electrical utility organizations to explore and understand the tacit knowledge capture strategies currently used in the industry. In Chapter 1, the background of the study and the brain-drain issue facing the industry was presented. The leveraging of knowledge management (KM) programs and a description of the various knowledge types were provided. Additionally, the research problem, purpose, nature of the research, research question, and conceptual foundation were discussed. In Chapter 2, the results of the literature review were provided to further understand the current focus on tacit knowledge capture strategies research and to highlight those dominant strategies used across organizations and industries.

Based on this review, there was an apparent lack of research directed toward knowledge capture strategies within the context of larger technology-based industries. A case study provides an opportunity to study what organizations are currently doing, and to explore what has worked, and what has not within the industry. In Chapter 3, I explain the research design and rationale for the qualitative approach and how the case study is best suited to address the topic of interest. In addition, I include a discussion on the role of the researcher, the data collection and analysis components, and address the issues of trustworthiness, protection of human participants, and the dissemination of findings.

Research Design and Rationale

To expand upon the tradition of using the qualitative approach and exploratory case study methodology to investigate what practices, systems, and programs organizations have used, this study incorporates multiple organizations to answer the research question, *What strategies are electric utilities implementing to capture the tacit knowledge of retiring electrical engineers and technical personnel?* Recognized as the inductive approach for conducting research, Bendassolli (2013) stated that it is the ultimate goal of qualitative research to achieve an understanding of a “particular situation, or individuals, or groups of individuals, or (sub)cultures, etc..” (p. 2). From evidence collected, an inductive reasoning process is followed to generate conclusions based on the observations and collection of evidence (Afisi, 2013). This study methodology will use the traditional case study approach with selected participating utilities to determine what strategies are being implemented across the industry to capture the tacit knowledge of senior engineers.

It is generally accepted that the choice of research approach should be aligned with the research question or questions. The qualitative research approach is appropriate for answering “how” questions (Dzekashu & McCollum, 2014). “How” and “why” based qualitative approaches are appropriate when the researcher has little control of the events or topic under study (Pitrowsky et al., 2014). When combined with topics focused on exploring or understanding phenomenon in a specific context, the case study of one organization or of multiple organizations is suitable for exploring it in a real world

setting. This current study seeks to understand specific KM practices within the context of electrical utilities and the qualitative approach and the case study methodology provide a suitable exploratory framework for the constructs under investigation.

In terms of design, qualitative studies allow for design variation throughout the study. Maxwell (2013) stated that a characteristic of qualitative research is that the design of the research occurs during the entire research process. Maxwell added that while a tentative research plan may be developed upfront, emergent insights may lead to new research questions, new activities or approaches to collecting and analyzing new types of data, the development of new or related theories, the addressing of new validity threats, the restructuring of the participant pool, and new research strategies during the course of the study. This flexibility is appropriate for research where the data collection and analysis process may lead the research into unforeseen directions.

Qualitative studies are generally associated with research focused on how something happens. Noting that quantitative researchers seek to find the extent that the “*variance in x causes variance in y*”, Maxwell (2013) compared this to how qualitative researchers “tend to ask *how x* plays a role in causing *y*, what the *process* is that connects *x* and *y*” (p. 31). In comparison to quantitative methods, the research question and conclusions in this study are not written in hard and narrowly defined terms, but rather they are made in the context that much of what is collected involves understanding the unobservable nature of the phenomena by the evidence collected in the field. With qualitative methods described as facilitating issues in an “in depth and detailed” form

(Patton, 2002, p. 14), the goal is to collect a wealth of information from a smaller number of participants. This process offers flexibility in the types of question asked and the range and type of responses offered. This is where qualitative research offers insight into phenomena in natural environments.

Exploring the programs, systems, and processes used by electric utilities must allow for variations in the participants responses, understanding of knowledge management (KM) programs, and specific tacit knowledge capture practices. As demonstrated in previous studies on the topic of tacit knowledge and considering the appropriate scientific approach for this study, single cases or multiple cases have the added benefit of representing a real-life setting and the complex concepts of expert knowledge (Baars, 2011). As an approach focused on exploring or understanding a phenomena in a specific context, Dinur (2011) stated that a case study lends itself to emerging theory research. The qualitative approach methodology provides the exploratory framework for the constructs under investigation.

Role of the Researcher

The independent nature of this researcher's role supports studying this topic. As a participating member in the industry, I possess insight into existing organizational structures, market conditions, and corporate support levels for personnel training investments and knowledge sharing capabilities throughout the industry. This includes working alongside engineering colleagues, some of whom have more than four decades of experience working in this field. Considering the reflexivity, the voice, and perspective

of the researcher is important to a study (Patton, 2002). As a self-aware knowledge services manager in the industry, I possess a basic understanding of the political, social, cultural, ideological, and economic perspectives of the industry. Although I am not in a position of power over the participants, I am aware of the challenges that electrical utilities experience with their wide array of internal and external stakeholders.

As the instrument in this study, I bring a conservative yet pragmatic view to the relationship between employees and employers. I view the relationship as being mutually beneficial, and when successful, capable of being sustained for many years. As a person born in 1965, and technically as a member of the Gen X group (i.e., born between 1965 to 1978), I am close enough in age to reflect on Kuyken's (2012) view of baby-boomers as the group inventing the "prolongation of retirement" and replacing the words "old" with "senior", "experienced" or "aged workers" (p. 368). I also have the personal perspective that aligns with the GenY view of one's individualism and capability of being comfortable and productive in changing environments and circumstances discussed by Kuyken (2012). With an understanding of the importance of collecting unbiased evidence, decisions made on who will participate and potential conflicts that could arise are going to be considered in advance. Properly addressing the reflexivity of the researcher can be considered to strengthen the credibility of the study (Patton, 2002). To foster reflexivity and appropriately address it in this study, the training, preparation, industry experience, analytical capabilities, views, perspectives, and awareness of potential biases of this researcher will be noted in the analysis section.

Methodology

The methodology chosen for this study is in line with current literature. In order to understand what tacit knowledge capture strategies an industry is implementing, the case study methodology has been shown to be a suitable approach (Baars, 2011). The multiple case study methodology involves the gathering of evidence by conducting semi-structured interviews with multiple representatives at three to five electrical utilities. The case study approach provides an opportunity to collect information from multiple sources while applying a conceptual framework in a new environment. When this approach is followed at multiple organizations, it can be ideally structured to conduct both within-case and cross-case analyses of the phenomena. The following data collection section discusses the participants and the interviewing process, and is followed by the data analysis section and a discussion of the content analysis process of coding, categorizing, and theme development.

Data Collection

The data collection primarily came from the semi-structured interviews of currently employed electrical engineers. When possible, human resource representatives and executive leadership personnel were also interviewed at multiple electrical utilities. The population for this study was electrical utilities physically located within the United States. This was supplemented by direct observations of the phenomenon in electrical utility and industry conference settings, reviews of corporate annual reports and internal human resource program and policy documents, observations of written, recorded, and

maintained KM records (i.e., video recordings, electronic files, etc...), and interviews of retired engineers no longer employed at utilities as a possible source of triangulation.

With the primary goal of determining what strategies are being implemented, interviewing of current personnel provided the most representative picture of the topic.

Choosing relevant organizations is critical to gathering rich evidence that addresses the research question. In seeking organizations that represent the topics of interest across the industry, the study focused on what Patton (2002) referred to as *information-rich cases* that “manifest sufficient intensity to illuminate the nature of success or failure, but not at the extreme” (Patton, 2002, p. 234). By focusing on the case study investigation of this type of organization, is expected that each can be characterized by what Yin (as cited in Joia & Lemos, 2010, p. 417) stated were “attributes necessary for it to be considered a revelatory case study”. With a consideration of this purposeful sampling, the units of analysis consisted of those organizations chosen based on their size, leadership structures, availability to participate, and their varying levels of KM implementations and industry involvement.

Following the sampling considerations of Joia and Lemos’ (2010) research of tacit knowledge capture of a Brazilian oil company, this study focused on a few specific characteristics:

1. the organization is a U.S. electric utility with a basic to advanced institutional KM program; and

2. the organizations has participated or contributed in the advancement of industry guides, standards, or in the research on electrical generation, distribution, or transmission of electrical power systems or maintenance programs.

With a priori consideration, this researcher used a level of personal judgement in choosing those organizations that have demonstrated experience in KM programs and a commitment to contributing to the betterment of the industry. Establishing the participants followed the recommendations of Dzekashu and McCollum's (2014) study and involved the purposeful selection of representatives from HR, engineering and operations, and executive leadership with "direct or indirect responsibility for improving knowledge assets in the organization" (p. 57). The participants included engineers with three or more years at the current organization and 10 or more years of industry experience, or human resource and leadership personnel with knowledge of their knowledge sharing programs to participate in the study. These requirements were verified with each participant prior to conducting their interview. The identification of participants was aided by organizational inquiries into KM programs and responsibilities at the different utilities, and personal knowledge of engineers approaching retirement age. An additional consideration for organizational inclusion was based on their level of knowledge and experience on the topic and their ability to contribute in a timely basis.

Interviews were conducted with engineers, human resource representatives, and executive leadership personnel from multiple electrical utilities. This was similar to the

study conducted by Darabi and Clark (2013) and their interview technique consisting of semi-structured, in-depth, and face-to-face encounters with purposefully selected participants. Following the recommendations of Rosario et al. (2015), the use of semi-structured questions provided a predefined yet flexible sequence of questions that guided the direction of the conversation.

To provide a comprehensive view of the strategies being implemented, the interviewing was not limited to the Engineers. The interviewing of Human Resource (HR) personnel was included as HR is often involved and influences an organization's success. Barney & Clark (2007) stated that "most corporate annual reports boldly state that the firm's people are its most important assets" (p. 121), yet noted that "Few HR executives can explain in economic terms, how a firm's people can provide sustainable competitive advantage and the role that the HR function plays in this process" (p. 122). The HR participants are expected to benefit the study by providing a different perspective and data for triangulation purposes.

To maximize the evidence collected, participants that demonstrated knowledge and a willingness to participate were requested from the different departments at each utility. To encourage participants to share as much as possible, open-ended interview questions were asked. Existing research on interviewing multiple participants with knowledge and learning-based organizations has demonstrated that open-ended semi-structured interviews consisting of senior management, middle management, and frontline employees was an effective tool for understanding a phenomenon under

consideration in multiple organizations (Yeung, Lai, & Yee, 2007). To ensure adequate time to collect the data, the interviews began in January 2016 and concluded in March 2016.

In determining the number of participants in the study, a literature review identified multiple benefits and risks. Mason (2010) proposed that while there are multiple issues or factors to consider, “the guiding principle should be the concept of saturation” (p. 1). According to Mason, the number should be high enough to capture all relevant evidence, yet small enough to avoid repetitive analysis that does not contribute to answering the research questions. Although multiple researchers have offered guidelines ranging from 20 to 50 participants, a case study review by Tesch (as cited in Mason, 2010, p. 4) showed as few as one and as high as 95 participants have been used. In one of the cases discussed by Mason, it was noted that the first six interviews provided sufficient and meaningful evidence to represent 60 interviews in a case study of a highly homogenous population. Similar research on knowledge loss strategies by Daghfous, Belkhdja, and Angell (2013) involved four organizations. Suppiah and Manjit (2011) studied tacit knowledge sharing behavior and organizational culture type and concluded that seven organizations were sufficient to study the dimensions of interest. For this study, the tacit knowledge capture strategies at seven utilities were explored

In support of the decision to use this number of organizations, this case study follows the research conducted by Dai (2012). Dai’s study investigated four business firms and examined how these firms advanced innovation through OL. The four firms

were winners in OL and performance programs and were selected from the 2004 and 2007 American Society for Training & Development's (ASTD) BEST Awards. The appropriateness of the number of cases chosen is ultimately based on the validity, meaningfulness, and insights that come from the cases in answering the research questions (Patton, 2002). The validity was checked by ensuring that the data collected accurately measures what it was intended to measure and was appropriate for the research (Suppiah & Manjit, 2011). Seven utilities were sufficient to illustrate what strategies are being implemented and to address the research question. In considering the value of cross-analysis of the cases, three organizations were identified as being the absolute minimum sample number for this study.

The termination of the participant interviews was based on a saturation check. This was achieved when sufficient data were provided, and no new meaningful information is being provided. The number of organizations under study was seven. The data collected was sufficient to comprehensively address the research question and continued data collection resulted in redundancy. To ensure adequate time to conduct interviews with multiple participants, the location and scheduling of interviews allowed for flexibility.

The setting of the interview appointments was completed in advance, thus allowing the participants adequate time to prepare. Following existing KM based research this study adhered to the practice of providing basic information to the participants in advance and as needed to continue the collection of relevant data. This practice followed

Whyte and Classen's (2012) statement that the interviewees should not be prompted on the topic too much but rather should be "allowed to use language and concepts with which they were most comfortable" (p. 965). Basic information on the types of knowledge and the range of strategies were provided to clarify the context of the study and the focus of the interview. Sharing basic definitions prior to the interview on the definition of explicit knowledge and tacit knowledge had been shown to enhance the value of the data collection process (Hu & Randel, 2014).

The one-time interviews were conducted with the aid of *Citrix GoToMeeting*. This internet-based communication tool has gained acceptance with the post baby-boomer generation and when they occur in a synchronous environment (i.e., in real time), they have been shown to allow for a richer form of communication to occur (Sullivan, 2013). The questions asked were designed to collect "in depth explanations" when possible and were intended to capture the "nature of the phenomena" to provide the research with the rich understanding of its existence (Maxwell, 2013, p. 80). The interview questions asked in this form of study considered the type of evidence needed to address the particular situation under investigation (Ryan et al., 2014). The final interview format was chosen based on schedule coordination and travel logistics.

With the research interview questions designed to elicit the data needed to understand the phenomena of interest, sub-questions were added as needed. The data collection protocol began by contacting utilities that have demonstrated KM programs, have acknowledged the use of knowledge capture strategies, and had indicated an interest

in supporting research on the topic. The data collection protocol ended after the interview had been completed and the recorded interview had been transcribed and checked by the participant for accuracy. The contributions of the participant were acknowledged and an estimation of the dissemination of the summary findings were provided.

Data Analysis

With existing literature and the experience of this researcher providing a basic level understanding of the strategies used in organizations, general strategic categories were predefined as a starting point for conducting the interviews. With these strategic categories identified, the interview line-of-questioning provided a basic framework for the inquiry. With the initial research and interview questions focused on the practices, systems, and programs used by the participating organizations, the analysis included the collection and recording of the data, the transcription of the collected data word-for-word by a third party, the categorization and coding of the data, and the generation of emerging themes with the aid of *NVivo*, a computer-assisted qualitative data analysis software (CAQDAS) application. Following Dzekashu and McCollum's (2014) statement that "content analysis is practical when open-ended questions are used in soliciting information, because it allows for defining content categories through coding" (p. 58), the data were collected and analyzed according to some of the key features of the collected data. The following is a discussion of the data analysis process that included capturing the interview data, transcribing it, generating categories and codes, and determining the

emerging themes. With the aid of qualitative research software, the analysis of the data was through a structured format.

Before conducting the study, I developed open-ended semi-structured interview questions to guide the interview. These questions were based on those strategies identified in the available literature and the knowledge of current utility practices by this researcher. To collect responses on the topics of team knowledge acquisition and team knowledge sharing during interviews, Chuang, Jackson, and Jiang (2013) focused on descriptive categorical questions that related to opinions, views, observations, or experiences that would demonstrate or illustrate acquisition and knowledge sharing activities. Considering previous research, these researchers had a priori insight into what factors would guide their interviews. A similar approach was used in this study.

The process of data analysis and the development of categories, codes, and emerging themes began with what Bendassolli (2013) referred to as “central meanings that organize experiences” and came directly from the ideas and concepts taken from the data. In the development of the categories, attention was given to those categories and groupings that answer the research questions and can be compared across the cases. This approach was successfully used in Chuang, Jackson, and Jiang’s (2013) study of tacit knowledge capture and the organizational practices for the acquisition and sharing of tacit knowledge in high tech industries. The developed categories and subsequent codes and themes originated from those tacit knowledge capture strategies identified in the literature review.

The coding process involved the review of the transcribed interviews and involved multiple approaches. Mantere and Ketokivi (2013) stated that the initial stage of coding, or what they referred to as *microcoding*, involved “the drawing of empirical generalizations based on the data” (p. 79). With data collected in the interviews, and based on these general statements developed, Mantere and Ketokivi added that the data considered “noteworthy and relevant” are identified, coded word for word, and provide the foundation for the development of themes. The initial microanalysis was followed by more open coding where a larger number of empirical categories lead to the emergence of themes. Bendassolli (2013) stated that these would ultimately be formed from “repeated ideas, sentences, concepts words, images and sounds...” (p. 9). This process involved extensive transcript review and approaches such as word count functions and word trees. The process became more complex as the number of participants increased.

The process of capturing interview data from multiple cases and organizing, coding, and analyzing such robust evidence involved extensive data handling capabilities and extended beyond the cognitive limitations of this researcher. To more efficiently and effectively capture, review, and retrieve key information, the researcher used *NVivo* as the CAQDAS software. This process, however, did not alleviate the timely review of the evidence, including the capturing of different aspects of the phenomena of interest, the extensive time reviewing written notes and collected documents, the process of transcribing recorded interviews verbatim, the analysis of trends or topic similarities, the highlighting of key information, and the analyzing of all of the captured data one page at

a time. With the video or on-line communication recording tools (e.g., *Citrix GoToMeeting*) used, the collected videos or accompanying documented evidence will be electronically captured and stored in password protected systems. Both single-case and multi-case analyses will be performed electronically.

The choice to use software to aid in the analysis of qualitative research has been discussed in the literature. For this study, *NVivo* was chosen as it met Seidman's (2013) recommendation that the researcher find a system that works with their style of research and can enhance the researcher's capabilities. Additionally, the cost, training period, hierarchical features for coding, advanced search and data manipulation tools, graphical and mapping features, and level of support for its use were considered. A final consideration was the design of the system in terms of organizing, storing, and accessing the data for future retrieval.

In regard to the gathering and analyzing the collected data, folders were created to store the internal and external sources of data. Promotional and financial literature, noted observations, organizational photos, and corporate and organizational web site material were organized according to their sources, classifications, and established nodes or codes. This included the capturing of internal documents, external documents, memos, demographics, financials, bibliographical sources, and the results of related literature reviews. Captured photos were added to the nodes in a manner similar to the videos or interview files. Notations and areas of interest in the photos were highlighted. Any hand written notes were scanned and imported as a PDF file. Text, graphs, or pictures within

collected documents were entered into the nodes through the *NCapture* features. To be able to increase the value of the data and to see it from different perspective, QUERY functions were used to generate word frequency tables, tag clouds, tree maps, and potentially conduct cluster analyses. These tools helped to ensure that the nodes were comprehensive and to determine if additional new nodes were needed. As a final step in the management of the data, the modeling feature within *NVivo* will be used.

Instrumentation and Materials

In the interviewing of electrical utilities a questionnaire, survey, or written instrument was not used to collect the data. Semi-structured open-ended questions developed from the literature were asked. This included the asking of follow-up questions that expanded upon responses. Inquiries were made into other strategies not included in the interview questions to identify any implemented strategies not previously identified in the literature. Additionally, by including multiple interviews from multiple participants within the same organization, a triangulation strategy was used to increase content validity. Recognizing the “researcher as the instrument” analogy, or what Patton (2002, p. 4) referred to as a “participant observer”, I was directly involved in the collection of the data. As an active participant in ASTM International and the Institute of Electrical and Electronics Engineers, Inc (IEEE), I am involved in the formation of industry standards, training, and education programs. The independent nature of the researcher’s role supports researching this topic from this unique perspective. As a participating member of the industry, insight into organizational structures, market and employment conditions,

corporate support levels for personnel training and investments, and general trends in the activities of engineers are understood. The role of the researcher included establishing participants, collecting of the data through the asking of interview questions, obtaining supporting documents from multiple sources, and the analysis and interpretation of the responses and collected evidence.

This researcher was aware of how the perceptions, views, and biases of the interviewer can play a crucial role in the collecting and interpretation of the data. As the instrument, the training, preparation, field experience, and analytical capabilities of the researcher can strengthen or weaken the credibility of the study (Patton, 2002). The reflexivity or self-reflection of the researcher was documented and considered Patton's reflexive triangle that addresses the views, knowledge, and perceptions of the participants, the audience, and the researcher. I was aware of the importance of being self-aware to ensure that the conclusions made are supported by the data and represent the real-world situation.

Issues of Trustworthiness, Quality, and Credibility

Issues affecting trustworthiness, quality, credibility, and reliability are important considerations in research. To address credibility (or internal validity) and dependability (the qualitative counterpart to reliability), the study adhered to Goffin and Koners' (2011) recommendation that the data include forms of "initial coding (categorization), a re-coding, and independent reliability checks" (p. 305). These steps included the use of computer-aided tools for data analysis, interviewing individuals from the engineering

department, human resources, and leadership within each utility (i.e., a triangulation strategy), and data saturation. Transferability (or external validity) was established through the interviewing of a wide array of participants from different departments and divisions within the utilities. The design of the study, and the means taken to collect and analyze the data incorporated steps to ensure that after reviewing the same data, someone else knowledgeable on the topic would have come to similar conclusions.

To address the components and threats to quality, the use of multiple data sources and the interpretation techniques were documented and supported with accepted practices. As the participating researcher, the overall quality of the study was enhanced by: (a) being cognizant of the unbiased development of the research question, (b) the choice of processes followed in analyzing the data, (c) recognition of any assumptions brought to the study, (d) and the appropriateness and suitability of the conclusions made. To improve the validity or accuracy of the conclusions made, a triangulation strategy was implemented.

With regards to confirmability (or objectivity), the data interpretation process was well documented and reflexivity was considered through the study. On the topic of rigor, the quality of the analysis was demonstrated by providing additional emphasis on generating alternate conclusions or explanations accomplished with an *advocacy* and *adversary* approach. In addition, the generation of alternative explanations expanded the study. To ensure credibility of the researcher, the clear and complete sharing of how

access to the participants was secured, how the interviews were conducted, and unexpected study issues affecting the participants or the researcher were provided.

Protection of Human Participants and Dissemination of Findings

In considering the extent to which the research is broad or narrow, the organizations under study were determined by the purpose of the study. Additionally, the type of data to be collected, the resources and time available, and the size of the organizations willing to participate in the research were considered. Based on the purpose of understanding how organizations leverage their KM programs to capture tacit knowledge, the protection of participants was a consideration in the study. This included protecting all senior engineers, those newer engineers that work alongside them, representatives from human resources, and leadership that participate. Institutional Review Board (IRB) approval was provided (# 10-23-15-0317198) and expires on October 22, 2016. This protocol included the documented steps to protect the participants and was provided to all participants. The IRB related documents included the use of an invitation letter, a letter of cooperation, a participant consent form, and confidentiality form.

During the interviewing process, additional precautions were taken to protect the participants. From the initial Invitation Letter, to the final research publication, protections were clearly communicated to all participants. With unlimited methods for data collections in qualitative research, Sullivan (2013) stated that authenticity, ethical and technical issues must be addressed. In presenting the study to the participants, the

Participant Consent Form which outlines the purpose of the study, the type of information to be gathered, the option to omit or terminate their participation in the study at any point, the level of confidentiality involved, and all further uses of the data were provided to the participants prior to their participation. Additionally, confidentiality of the participants and their organization were and will continue to be protected.

With this study, it was important that the participants: (a) understand what data were collected, (b) the timeframe requirements for their participation, (c) why their contributions were needed, (d) how the data were to be used, (e) how their participation would benefit them or their organization, and (f) how the data would be used in the future. With data collected with the *Citrix GoToMeeting* application, additional collection method issues were discussed prior to beginning the interviews. The option of ceasing participation or ending one's participation and the confidentiality of the data were included. It was important to ensure that the participants understood that their participation was voluntary, and that their responses to the questions should represent the way things were really done at their organization.

This included considering the authenticity of the participants in responding freely and in a manner on-line as they would have in person (Sullivan, 2013). Maxwell (2013) stated that it was a primary ethical obligation of the researcher to understand the perceptions of those involved and to thoroughly address any separate ethical and technical issues introduced with the study. Considering this, I engaged in ethical research before, during, and after the research was complete. This involved addressing ethical

issues that: (a) could have originated, (b) were involved in the stated research problems and questions, (c) were included in the data collection process, (d) were involved in data analysis and interpretation, and (e) could have been included in the final writing and disseminating of the research.

In anticipating potential ethical issues, the purpose and research details affecting the participants were included in the participant consent form. This form was provided to the participants to build credibility and clearly represent the role of the researcher. Personal privacy issues were documented and shared with the participant prior to conducting the research. Ethical issues involving the research problem and questions were addressed by comprehensively describing the problem, how the study would benefit the participants, and how the issues would be addressed during the interview questions. The importance of this issue was also included in the documentation and pre-study meeting with the participants.

The study involved the above steps as well as procedures for the collection of potentially proprietary or confidential information. Due to the competitive nature of the participating organizations, generic codes were used to protect the identity of the participants and their organizations. Additionally, corporate approval was required to ensure that the information requested of the participants would be provided freely and could be used in the study on a confidential basis. Again, the option to not participate was provided prior to the start of the study, and would remain in effect throughout the study. To gain agreement from those individuals participating, and their respective

organizations, access to the participants at the research sites were documented in advance.

Lastly, in regard to ethical issues with data analysis and interpretation, the issues of anonymity, the time that the data will be held, and the ownership of the data was provided to the participants in advance. The steps taken were outlined in the participant consent form. I adhered to Grinnell's (2011) recognition of: (a) the importance of validation, corroboration, and verification; (b) the risks that could lead to conducting research misconduct; and (c) the need to document any potential "conflicts of interest" that could arise in all stages of the research project including the analysis, the development of conclusions, the publication, and the sharing of research knowledge in the scientific community. In the making of research conclusions and disseminating the findings, I adhered to Mantere and Ketokivi's (2013) statement that while it is the scientific community's task to evaluate a researcher's conclusions for reasonableness, it is the primary task of researchers, scholars, and scientists to act reasonably in their duties.

The research plan was reviewed by the Institutional Review Board (IRB) to determine the extent that participants are subject to risk. The invitation letter, participant consent form, and confidentiality form were provided to the participants in advance of the study, and authorized signed documents were maintained with the study records. As a highly personalized approach to conducting this study, the researcher showed respect in all activities initiated before receiving approval, during the study, and after publication of

the results. Attention was given to protect the stress level and personal well being of all participants.

Summary and Conclusions

Following the introduction of the study in Chapter 1, a thorough literature review of related research was presented in Chapter 2. From the review, a discussion of the research on tacit knowledge capture strategies and their application in multiple industries was presented. Chapter 2 included a thorough discussion of the most dominantly researched strategies. The review addressed research on those strategies used across multiple industries, as well as a those strategies expected in the industry of interest. In Chapter 3, I explained the research design and rationale for the qualitative approach and how the case study methodology were best suited to determine what strategies organizations are implementing. A discussion was presented covering the role of the researcher, the heavily data-laden data collection and analysis components, the instrumentation to be used, the issues of trustworthiness, quality, and credibility, and the protection of human participants and the dissemination of findings. In Chapter 3, I also presented the research method, and supported its appropriate use for understanding and exploring tacit knowledge capture strategies used by electric utility organizations. In Chapter 4, the results of the study are presented.

Chapter 4: Results

Introduction

The purpose of this qualitative research was to study seven utility organizations and explore and understand the tacit knowledge capture strategies currently used in the industry. For this research, tacit knowledge capture strategies were defined as the processes, practices, and systems used to capture the tacit knowledge of current and retiring engineers. What was needed for management to ensure operational continuity was a better understanding of what strategies are currently being implemented in the industry to capture this tacit knowledge. Although no pilot study was conducted, data were generated through interviews of nine participants from seven U.S. organizations. The number of organizations increased to seven at which time data saturation was achieved. This study sought to answer one research question: *What strategies are electric utilities implementing to capture the tacit knowledge of retiring electrical engineers and technical personnel?* In Chapter 4, I describe the settings of this study, the demographics of the participants, how the data were collected and analyzed, evidence of trustworthiness, and the findings related to the research question.

Setting and Demographics

The research study consisted of a semi-structured interview with participants currently employed at seven U.S. electrical utilities. I invited engineers or electrical technicians with 3 or more years at their current utility and 10 or more years of industry experience, or human resource and leadership personnel with knowledge of their

knowledge sharing programs to participate in the study. The demographic information of the participants pertinent to the study is summarized in Table 2.

Table 2

Participant Demographics

Organization (ORG)	Participant (P)	ORG department	Participant's years at ORG	Participant's years in profession
ORG1	P1-1	Grid Planning Engineering	40	40
ORG2	P2-1	Power Delivery	5	15
ORG3	P3-1	Substation Design	37	37
	P3-2	Workforce Planning	6	6
ORG4	P4-1	Production & Control	1	26
ORG5	P5-1	Transmission & Power Engineering	28	28
ORG6	P6-1	Substation & Transmission Engineering	16	30
	P6-2	Transmission Training	26	33
ORG 7	P7-1	Substation, Transmission, & Distribution Standards	27	35

Data Collection

To identify electric utilities and recruit participants for this study, the focus was on those organizations that have demonstrated an active participation in industry associations and have contributed to the development of industry standards. Using a publically available member list of the International Institute of Electrical and Electronics Engineers, Inc. (IEEE) Power Engineering Society and existing contacts at the utilities known by the researcher, an initial letter of invitation and a letter of cooperation were

delivered electronically to potential community research partners. Of those four organizations that replied and agreed to provide participants for the study, their signed and approved letters of cooperation were submitted to Walden University and IRB approval number 10-23-15-0317198 (expires 10/22/16). As an active member of the engineering industry, and a professional involved with sharing knowledge and contributing to improving electrical utility industry standards, I made the assumption that these same organizations would provide participants open to participating and sharing the extensive experience.

The letter of cooperation stated the requirements for the participants. To secure rich information from those closest to the topic, the participants were required to be an electrical engineer or electrical technician with 3 or more years at their current utility and 10 or more years of industry experience. Additionally, I included the option for human resource and leadership personnel with knowledge of their knowledge sharing programs to participate in the study. Once an interested participant was identified at each organization, a signed participant consent form was secured and the interview was scheduled.

As demonstrated by Yeung, Lai, and Yee in 2007, interviewing participants within knowledge and learning-based organizations demonstrated that open-ended semi-structured interviews were effective for understanding a phenomenon under consideration. The semi-structured interviews of the nine participants from seven organizations were conducted by telephone and comprised a predefined yet flexible

sequence of 21 questions (see Appendix A). I conducted the interviews during daytime operating hours for all participants. The first interview was in January 2016 and the final interview was in March 2016. All interviews were scheduled for 90 minutes and all were completed within the scheduled time frame. One interview was conducted with each participant. This data collection process followed the recommendations of Rosario et al. (2015) and included components from previous research on tacit knowledge capture strategies identified in the literature review. The questions were developed in advance and were amended to account for a prior general understanding of organizational practices utilized across industries. The guiding interview questions are provided in Appendix A.

Considering time, resource, and geographical limitations, a web-based *Citrix GoToMeeting* application was used to conduct telephone interviews of the participants. Participants were provided a call-in number and meeting access code prior to the interview. When the participant joined the call, the participant was reminded that the interview would be audio-recorded, and the recording feature was enabled. The interview began with a brief review of the research question, a working definition of tacit knowledge, an overview and clarification of the goal of the study, and an expectation of the format and time requirements of the interview. I asked questions and addressed topics that needed clarification before moving to the guiding interview questions.

The 90 minute interviews were recorded and converted to a MPEG-4 format. Although this format was chosen in part for its feature of capturing any technical issues

that might have occurred during the interview, no technical difficulties were experienced. The files were immediately converted from the Citrix GoToMeeting application and transferred to the researcher's password protected computer. All recordings were transcribed word for word. The file was then emailed to the participant asking them to review the transcribed interview for accuracy and additional comments. A transcriber confidentiality form was secured prior to engaging the services. The participants were asked to reply within 10 days with amendments. Of the nine transcribed interviews that were sent to the participants, one was returned with minor additional comments. The *Citrix GoToMeeting* application functioned optimally. There were no technical difficulties encountered with the use of the application.

One variation was encountered in the data collection process presented in Chapter 3. This involved the interviewing of multiple participants within the same organization. Based on feedback during the early recruiting process, a common theme expressed by the community research partners related to resource limitations and legal confidentiality concerns. As a result, participation by the community research partners was limited to the interviewing of the electrical engineers or technical personnel, and personnel from workforce planning and training. Extended delays and decisions not to participate in the study were made at the executive leadership and legal department level. The noted reasons related to resource constraints associated with the interviewing of multiple personnel within the same organization.

In determining the number of participants in this study, this research considered similar research on knowledge loss strategies by Daghfous, Belkhodja, and Angell (2013). Their research concluded that seven organizations were sufficient to study the dimensions of interest. After completing the first four interviews and reviewing the initial collected data, it was determined that additional evidence would be needed to reach data saturation. The number of organizations was increased to the point where sufficient evidence was collected, the amount of interview data was still manageable considering time and resources, and repetitive analysis was avoided. This was achieved when the number of organizations was increased to seven and the number of participants was increased to nine.

In summary, the member list of the IEEE Power Engineering Society and existing contacts at the utilities known by the researcher provided multiple organizations with a demonstrated commitment to contributing and sharing knowledge in the industry. With the letters of cooperation received and IRB approval received for the collection of data, participants meeting the position and experience requirements were identified, their participant consent forms were secured, and I scheduled the interviews directly with the participants over a two month period. To account for time, resources, and geographical locations of the participants, the web-based *Citrix GoToMeeting* application was used to audio-record the interview. After conducting the interviews, I converted the audio-taped interviews to an electronic format, they were transcribed word for word, and the participants were provided the transcribed files to review for accuracy and additional

comments. The number of participants was increased to ensure that saturation was achieved. With no unusual circumstances encountered, nine participants from the seven organizations were interviewed and their information rich responses were collected for analysis.

Data Analysis

The purpose of this qualitative research study was to conduct a case study of electrical utility organizations to explore and understand the tacit knowledge capture strategies currently used in the industry. To determine the implemented strategies, the literature review and experience of this researcher provided general knowledge to develop three knowledge focused knowledge management (KM) interview categories to guide the interviews. These broad KM interview categories included one section on culture and leadership of knowledge, one category on KM background and programs, and one on implemented capture strategies. The first two KM interview categories provided background and contextual information to better understand the environment for which the tacit capture strategies were being implemented. The third KM interview category focused on questions that would elicit what strategies the electric utilities were actually implementing

Within these three KM interview categories, 21 predetermined questions (see Appendix A) were used as the basic framework for the inquiry process and were followed by two clarification and wrap-up interview questions. This data analysis section reports on the process used to move inductively from coded units to larger representations

including the categories and themes for each. It begins with a brief discussion of the coding process, the development of categories, and the generation of the emerging themes. While not including every response, multiple interviewee quotations are provided to emphasize their importance. The purpose of this section is to report on the data analysis process resulting in the themes.

Open-ended semi-structured interview questions were developed as an interview guide. These questions followed Chuang, Jackson, and Jiang's (2013) recommendations to focus on descriptive categorical questions that related to opinions, views, observations, or experiences that would demonstrate or illustrate acquisition and knowledge sharing activities. Following Dzekashu and McCollum's (2014) use of content analysis the use of "content categories" proved to be suitable in this study. I followed the process recommended by Mantere and Ketokivi (2013) and initially made a few empirical generalizations from the evidence collected. Using the features of *NVivo* (e.g., word frequency tables), and including what Bendassolli (2013) stated were "repeated ideas, sentences, concepts words, images and sounds..." (p. 9), codes and categories were identified. I developed 132 codes and 33 categories from the collected data. These codes and categories are provided in Appendix B.

I used the codes to develop a number of empirical categories. Additional attention and focus were given to those categories most related to the research question. In a similar manner to Catania and Randall's (2015) study, the analysis of extensive interview data generated from the 21 questions resulted in a significant number of codes. Much of

the category development activity was achieved with the use of the QUERY functions within *NVivo*. These included the use of word frequency tables and tree maps. From these categories, themes emerged. I was receptive to discrepant cases and the data were coded and factored into the analysis. The following three sections address the three groups of interview questions. For each section, a brief introduction is provided, each interview question is stated, and multiple participant quotations are provided as support. Following the quotations, a brief summary on the data and the emerging themes is presented.

Culture and Leadership of Knowledge

The first KM interview category addressed in the interview related to culture and leadership of knowledge. An organization's leadership and culture can influence or constrain the sharing of knowledge. Pivec and Potocan (2015) stated that when employees feel more connected, dedicated, and loyal to their organization, they are more likely to support their knowledge management programs. Understanding the culture and the leadership styles, forms, and involvement are components of Dalkir's (2011) tool for measuring an organization's KM program integrations, and were used as the focus of this interview section

Before exploring the actual tacit knowledge capture strategies, it was important to understand the culture and leadership of the participants' organization. The first six questions asked were in regard to the value placed on knowledge, the consideration of knowledge sharing in performance evaluations, the distance between those that have the knowledge and those that need it, the rewards or incentives for promoting the sharing of

knowledge, the issues associated with knowledge hoarding, and the perception of knowledge as an organizational resource. Utilizing the content analysis methodology, assisted by the analysis tools within *NVivo*, primary codes and were identified and used in the development of categories and the emergence of central themes. The interview questions and some of the participant quotations that were coded and categorized included the following:

Interview question 1: How is knowledge or knowledge sharing valued?

P2-1: I think it is appreciated. But it is hard to see how leadership appreciates it because they do not express it.

P3-1: I do not know so much at the executive level whether they value it.

P3-2: Knowledge loss and recognizing how critical the knowledge is, is very important and recognized. It has not been so important that any people, resources, program resources, or technology resources have been provided to help capture it. I view it as maybe not as important as we say it is, because we are not putting forth what is needed to capture it.

P4-1: At this point in time, it is improving. The history has been that the company did not necessarily value knowledge in the big scheme of things, and that is visually evident in many of the processes and structures of the organizational groupings.

P6-1: There is a long tradition of the company spending money to ensure proper training. There is varying degrees of that. Overall, I think the company does value knowledge.

P6-2: I think it is valued to different degrees based on different leaders, but overall I think it is valued.

The data from the participants illustrate that the value placed on knowledge and knowledge sharing exists, but that it has not been clearly expressed across the organizational layers within the company. Additionally, the data suggest that value placed on knowledge extends to the value placed on experienced employees and the programs invested in by leadership. This varying view of the value of knowledge by the participants is consistent with Trees's (2016, January, p. 18) statement that organizations that acknowledge the value of knowledge and have clear goals and objectives around its value, are four times more likely to have documented programs in place and 15 times more likely to benefit from those programs.

Interview question 2: How is knowledge sharing a component of performance evaluations?

P3-1: It gets mentioned on my evaluations. I think it is more informal than formal. But it is mentioned

P4-1: I would say that knowledge sharing in that sense was built into some of the performance review processes but it was not a formalized component that people were required to do, or actively pursue or had time for.

P5-1: There is a developing others that has been put on there as a competency in the annual review.

P6-1: There was another section on competencies that included teamwork and leadership and that was an opportunity for the management to have a good conversation around you as a senior engineer, or a principal engineer, and are you operating at a level that is leveraging your knowledge...

The data show that four of the seven organizations in the study did not have an active documented knowledge sharing component as part of their performance evaluation program. Of those that did, the sharing of knowledge is identified as a new or secondary objective behind quality, budget, and other production metrics. Participant P4-1 noted that performance evaluations are a consideration in career and management advancements within the organization. This is an example of utilizing an organization's intellectual capital while maximizing an employee's career capital (Sutherland, Seabela, Crossen, & Nyembe, 2015).

Interview question 3: How is knowledge protected, isolated, or kept separate (i.e., between older from newer employees)?

P2-1: As far as going from senior engineer to your brand new engineer, there is not integration. If it is, it is as if there was an imaginary line, there is an imaginary wall.

P3-2: I do not think that there is any thought to it at all. It is whatever cube is vacant when somebody new comes on.

P4-1: There may be pockets here or there of realizing that if you have a bad category or a bad cluster of old timers that have bad habits, that you might shield them from new employees to try to not have the new guys not learn the bad habit. It is not that it is really knowledge related, but business culture related.

P6-2: What I have seen in more partnering of experience with the junior newer engineers coming in. Just the opposite - trying to share that knowledge and not separate it.

The idea of keeping experienced engineers away from newer engineers was discussed with each participant. It was stated by two participants that in cases of potential shielding of bad habits or of bad influences, purposeful separation of personnel has occurred. Although there were no stated strategies identified, all of the participants recognized the importance of physical commingling of senior engineers with the less experienced and younger engineers. The physical separation of engineers by function and by department was noted as a challenge to the beneficial daily interaction and knowledge sharing between engineers.

Interview question 4: How are rewards, incentives, or benefits considered in promoting knowledge sharing?

P2-1: There are some rewards. In one case, a senior engineer was acknowledged at an awards ceremony. But a reward in terms of money or compensation? No, not that I know of.

P3-2: There are no incentives for someone to share their knowledge.

P4-1: Engineers, specifically knowledgeable people, are encouraged to have working luncheons or meetings or quarterly meetings where they have discussions with some of the new employees and that while not having a monetary benefit or reward associated with that, it is certainly considered as a positive career influencer.

P6-1: We are probably not very consistent on this. They will get a little recognition but there is nothing beyond that.

P3-1: I do not think we have any reward type program.

P7-1: I do not think that there is a reward system for those that want a technical career.

The data show that formal programs of monetary or non-monetary rewards are not actively used to reward, incentivize, or promote knowledge sharing. Although knowledge sharing was identified as a component for being “fast tracked” for new positions within the organization and a consideration for career advancement, in isolated circumstances the use of small awards were provided to recognize projects or activities of high merit and value to the organization.

Interview question 5: How is “knowledge hoarding” a component of the work environment?

P4-1: I would not say that it is a pervasive culture or problem, but I would say that there are people like that. I would not say that that is necessarily

condoned by the company, but at the same time is not actively opposed tried to be rooted out.

P5-1: I have heard of that in other geographical areas of the company, but in our area, that is not tolerated.

P6-1: It is something that I have encountered. I think it is human nature and I think every organization will have some tendency toward that. I do not know if there is any one answer to addressing that. I think that may be the sort of thing that is improved by the building of the culture over a period of time.

P7-1: We do have a number of individuals here and at other locations that think knowledge hoarding is a way of maintaining their utility. Management here is trying to break down those barriers and turn it into open-source information.

Three participants identified the culture of the organization as being instrumental to avoiding knowledge hoarding. By recognizing a more open environment that acknowledges the value of being a resource, participants suggested that the mindset could be addressed. This supported Rubin (2013) view that with the wrong culture, “expertise of the individual over the advancement of the organization as a whole will encourage people to keep crucial knowledge to themselves instead of sharing it” (p. 39).

Interview question 6: How is knowledge perceived?

P2-1: So they do value the knowledge, but I am not sure how it is perceived though.

P4-1: Very much at this point in time from a leadership perspective as an intellectual asset. We have become very protective of that information and in recognizing that we have put a lot of work into developing and documenting these things. From that standpoint, I think that has heightened the idea of protecting whatever competitive advantage we think we might have because we have gotten good at something.

The research data reflect responses covering a wide range of understanding. Although all participants recognized knowledge as an intellectual asset, and something capable of managing, the idea of protecting it and treating as a tool for achieving a competitive advantage was not universally identified. In comparison to the question of the value placed on knowledge and knowledge sharing, the participants responses ranged from not having a clear idea of how it was perceived, to understanding that it could be a valued asset in the more competitive and changing transmission business. Barrios and Reyes (2015) noted this ambiguity in the electric utility when they stated that “We have gone from the age where knowledge was transferred from a mentor to apprentice, to an age where the perception is knowledge can be downloaded in an instant” (p. 82).

The first six interview questions sought to understand the culture and leadership of the organizations. Utilizing the content analysis methodology, and the codes and categories developed from the data, two themes emerged. The first theme identified the

importance of creating a culture that fosters, enables, and recognizes knowledge sharing activities and the existing lack of uniform embedded company-wide programs that recognize and incentivize personnel to share tacit knowledge at electrical utilities.

Supporting Mousavizadeh, Ryan, Harden, and Windsor's (2015) statement that "Knowledge has been recognized not only as a process but also as a critical competitive asset" (p. 36), the second theme to emerge from the data was that although knowledge was considered a valuable intellectual asset by senior leadership, the management of utility knowledge requires all level of personnel support to effectively share, support, protect, and leverage it as a competitive asset. For a majority of the participants, the perceived value of this resource was not clear nor was it shared by leadership.

Knowledge Management Background and Programs

The second knowledge management KM interview category related to KM background and programs. Grant (2013) stated that the real challenge with KM initiatives is in the implementation. In trying to understand what influences successful KM programs, Grant recognized that leadership takes on the role of establishing and then embedding KM practices within the daily operations of an organization company-wide. This was a recurring topic of discussion in all of the interviews conducted. Researchers Yusof, Ahmad, Nirmala, and Lishudrzaimah (2013) stated that knowledge transfer was not only a basic organizational necessity, but that it should be supported with exchanges between experts and novices. They understood the need for knowledge transfer and the

need for formally structured KM programs throughout all levels of the organization to efficiently and effectively use the knowledge.

Sohrabi and Naghavi (2015) noted that KM programs have played different roles throughout time. In their view, KM in the 1980s was focused on down-sizing activities and underestimated the effects of their experience-based knowledge walking out the door. In the 1990s, they acknowledged that KM programs were refocused on those internal and embedded KM programs that would avoid repeating the past. With the challenges that exist in the electrical utility industry regarding minimizing headcount, or what Pierson (2012) stated were the minimum resources needed to produce uninterrupted output and maintain operational continuity, exploring the current KM activities was warranted in this study. Although fully determining KM maturity levels is facilitated with the use of tools and models, such as the member-based nonprofit APQC's *Levels of Knowledge Management Maturity* tool, utilizing their five-stage maturity model would have been outside the scope of this study. To better understand the capture strategies, having an increased understanding of the engineer's experience with KM programs was needed. This allowed the use of the tacit knowledge capture strategies to be understood within the larger KM context. Before exploring the third KM interview category on tacit knowledge capture strategies, it was important to first understand the background and daily use of KM programs at the participants' organizations.

Utilizing the content analysis methodology, assisted by the analysis tools within *NVivo*, the primary codes and six developed categories were obtained for this KM

interviewing category (see Appendix B). Five questions were asked that focused on the participant's familiarity and use of these programs. These questions sought to illicit the participant's experience with what and how KM programs were introduced to them, how they were used, how leadership was involved with their use, and to whom the programs were directed within the organization. The interview questions and related quotations that were coded and categorized included the following:

Interview question 7: What is your experience with organizational programs, procedures, or systems focused on knowledge management?

P2-1: We do have *Sharepoint*, various *Sharepoint* sites for engineering because we have engineering with substations, distribution, and all moving parts of our organization.

P4-1: I would say at my previous employer that there was nothing officially that I was aware of to get the same kind of programs going and get the same concept going. I would say that this is fairly new in my experience.

P5-1 the programs that I have seen have been more in the explicit knowledge side of things, not the tacit knowledge.

The data indicates that KM programs in use are predominantly focused on the capturing, management, and accessing of explicit knowledge. Recognized by Pierson (2012) as an explicit knowledge management tool, and by Dalkir (2011) as a tool for measuring an organization's KM program integrations, *Sharepoint* is the most referenced KM application provided by the participants. Three of the participants commented on

their current and future expanding use of this application on a company-wide or enterprise basis and their use for managing projects and daily activities. Yusof, Ahmad, Nirmala, and Lishudrzaimah (2013) stated that when these KM systems are embedded, they not only leverage existing knowledge and create new knowledge, they can use technology for “getting the right information to the right people at the right time...” (p. 50).

Interview question 8: If present, how were they introduced to you?

P2-1: There was a rollout. We actually just picked out one area to start with and then slowly rolled it out.

P3-1: I think we are the second group to test through it.

P7-1: It has input from a couple of different departments. So, there are some difficulties there. So in some cases, we will go through and implement a new system, but won't follow-through with training, documentation, or verification of performance improvements. We will just declare victory as soon as the initial commissioning requirements are completed.

The data show that KM implementations are predominantly introduced by management or senior leadership and involve a phased roll-out. With participants from city utilities and privately held utilities responding, the introductions of these programs proceed through different channels. Coordination with other city departments has been a challenge for one participant, and multiple years of system configuration work were provided as roll-out challenges.

Interview question 9: To what extent is their use encouraged, recommended, or mandated by leadership?

P2-1: At this point in time it is encouraged. I would say parts of that like the engineering review board where we will look at a few of the people that need to be promoted or get career upward mobility. That will probably become mandated.

P3-1: I think the leadership that is promoting it are the people that are putting it together. I do not feel like the different organizations are promoting it because it takes a lot of time. It is time that we need to be doing something else.

The data indicate that universally, all of the implemented KM programs identified were expected or mandated to be used by personnel as part of their job functions.

Although one participant indicated that the use of a new system was going to be a challenge for the older engineers, it was still understood that its use would be mandated.

Interview question 10: How is leadership involved with their use?

P2-1: When it comes to the enterprise level, yes, it (the decision to implement an enterprise-wide system) will be made by them.

The participants were generally not aware of who actually made the decision to go with a particular system used. Although O'Dell and Hubert (2011) and Trees (2016, February) noted that executive involvement increases the credibility and helps to ensure a programs' success, Trees (2016, February) added that engaged leaders that are involved

in establishing the programs will embed these programs into the daily duties of their employees to ensure their success. The responses support the trend that senior leadership are aware of existing decentralized systems limitations and there was a need for enterprise systems. With the success of these programs contingent on what Trees (2016, January) identified as dedicated resources and assigned people to support the programs, the participants accepted that they would support whatever systems were implemented.

Interview question 11: How are these programs directed?

P4-1: In practice, I think we will obviously focus on knowledge critical positions first but the ultimate goal is that they will apply across the board.

P6-1: It is applied across the board.

P6-2: I know that a lot of these programs are department specific. We are trying to base our needs on the biggest needs or challenges that we are going to have when you look at the highly technical people or groups.

The data show that KM programs implemented on a company-wide basis, yet those organizations with more formal training programs and knowledge risk assessments will focus on those individuals or departments with potential retirement or knowledge risk issues. These findings support Jennex and Durcikova's (2013) findings that aligning an organization's limited resources with those key knowledge holders can be an effective strategy.

The two themes to emerge from interview questions seven through eleven relating to Knowledge Management Background and Programs dealt with understanding the

participants' experience with KM programs. The first theme was that the experience with KM programs involved the capture, management, and reuse of explicit knowledge and predominantly the use of *Sharepoint*. These programs were used across the organization and specifically for key knowledge holders where the risk of knowledge loss was regarded as high. The second theme to emerge was that the decision to implement a KM program was made at the senior leadership level. The actual person or department approving the KM program was not always clear to the participants. Once the decision was made to implement the system and commit time and resources its use, the programs were embedded within the daily activities of the organization and its use was mandated company-wide.

Implemented Capture Strategies

The third KM interview category was identified as Implemented Capture Strategies. To address the research question, *What strategies are electric utilities implementing to capture the tacit knowledge of retiring electrical engineers and technical personnel?* the interview questions for this KM interview category were guided by those previous strategies identified in the literature. When combined with the themes developed from the Culture and Leadership of Knowledge , and the Knowledge Management Background and Programs interview categories, this third category of interview questions provided the depth of evidence on the tacit knowledge capture strategies implemented within the organizations. Data saturation was achieved with seven organizations. Utilizing the content analysis methodology, assisted by the analysis tools within *NVivo*,

primary codes and 19 categories were obtained for this third category (see Appendix B). Multiple themes emerged from the analysis and are presented in the summary of this section. A more thorough discussion of the findings and emergent themes are presented in the Results section of this Chapter.

Ten questions were asked regarding internal and external tacit knowledge capture strategies with the first eight focusing on those internal or embedded strategies. The questions were asked to collect data on capture strategies including; mentoring or apprenticeships; training and learning opportunities; communities of practice (or CoPs); the use of video conferencing; electronic forums or virtual collaboration tools; the use of web-based applications like Wiki, blogs, and videos; other electronic systems such as bulletin boards; storytelling; exit interviews; and other internal strategies used to capture tacit knowledge. Following this set of interview questions, two additional questions were asked to determine external capture strategies. These related to external participation in industry conferences, conventions, or other external events and the sharing and capture of that externally derived knowledge.

To collect rich responses, each interview question was expanded when possible with the one or more follow-up questions. These included *What strategies are currently being implemented?*, *What is your experience with each strategy?*, *Could you describe your level of participation?*, *How effective is the identified strategy?*, *How are these strategies communicated, implemented, and received?*, and *Do challenges exist in their*

implementation, example?. The interview questions and related quotations that were coded and categorized included the following:

Interview question 12: In regard to Mentoring or Apprenticeship, what strategies are implemented for the Front-End or On-boarding benefit (i.e., as training tools) or for the Rear-End or Off-boarding benefit (i.e., to capture retiree knowledge)?

P1-1: Our management style is almost a written procedure for mentoring and how to do it.

P2-1: They do not call it a mentorship or apprenticeship, but they do a rotation. They do rotate between departments but I do not think there is an actual time on it.

P4-1: On the engineering side, what we do have a Rotational Engineer Program. They are assigned a mentor each that would see them through their two year rotation.

P6-1: One that we have as a common practice in the transmission the substation engineering arena is the idea of a sponsor engineer. So every engineer that is assigned tasks to do always are explicitly assigned to them a senior principal engineer.

P3-1: It is pretty common. One year, we had a group of about half a dozen young engineers right out of school and we were assigned somebody. There were the others that unofficially mentored.

P7-1: A new hire will be assigned a mentor when they come on board to teach them process, procedure, how things work here at the organization.

The data show that mentorships, both formal and informal, and apprenticeships were actively used at all of the organizations for the on-boarding of new engineers and technical personnel. Through coding and content analysis, the data reveal that senior or principal engineers are involved in these programs in varying capacities, the mentor-mentee assignment were typically made by management, and the program focus has been on bringing new personnel up to speed. Although the duration, departmental rotation, and final role of the newly hired engineers follow different paths under the various organizations, one consistency evident in the data was that all of the programs involve the assignment of a single senior mentor as a knowledge resource. While the data identified many of the issues identified by Lazarus (2015), including the establishment of goals, the pairing process of mentor and mentees, structures for length or duration, and the level of support provided in the program participants noted that their mentor programs were developed as tools to bring new hires up to speed and that they were not necessarily directed to be a tool for capturing tacit knowledge of the senior or retiring engineers at the end of their career. When asked specifically about mentor programs or off-boarding programs designed to strategically capture the tacit knowledge of senior or retiring engineers, the data show that there were few programs in place with that focus.

Responses included:

P1-1 I am thinking that it is more informal.

P2-1: Now, what we have not done is the shadowing. I hate to say it but we have not done it. What happens is most of these guys have been here forever and when they retire or they resign and go to a new place, well nobody knows who the next candidate is going to be because of the hiring process.

P5-1: On one side of the business, they are trying to transfer that knowledge to the new people that are coming in, but before people leave, I have only seen that done in my department with one person that I know of and that has been it.

P6-2: We do not have a formal program for the post or as they leave. We have done a few things on our own, not as a formal program.

P7-1: In some cases it may be a year or two out, and it may be as little as six months. In those cases where they believe it to be a critical position, they will double fill the position, essentially recruit for a replacement for you and have them shadow you through the job throughout the remaining time you have before retirement.

The data on both on-boarding and off-boarding mentorships supports the findings of Yusof, Ahmad, Nirmala, and Lishudrzaimah (2013). Their research showed that mentorships based on only the on-boarding side did not completely address the gap of capturing the knowledge of the senior personnel. For knowledge continuity, combining both on-boarding and off-boarding mentorships have been shown to be important to knowledge transfer in the literature. The data suggest that the established on-boarding

programs alone were not fully capturing the end-of-career expertise and allowing “right-seat rides to transfer critical tacit knowledge from staff who leave or retire” (Baxter, 2012, p. 42).

Three themes emerged from the data. The first theme was that mentoring as an on-boarding mentorship and apprenticeship strategy is actively used by the participants for bringing new or less experienced personnel up to speed. The second theme was that off-boarding mentorship programs were an under used strategy when focused on capturing tacit knowledge of the senior engineer. The third theme to emerge from the data was that mentoring programs face challenging issues related to headcount constraints, limited financial resources, the communication of upcoming retirements, and being “one-deep” in terms of knowledge expertise.

Interview question 13: How are knowledge sharing training and learning opportunities embedded in daily operations (i.e., scheduled or occasional conducted)?

P1-1: We have a weekly staff meeting that deal with the mundane, and then we expand it a half hour or hour each week where we have the group actually teach topics to each other. We just call them extended staff meetings.

P4-1: That formalized training community would be part of our engineering development program so the senior engineers would be expected as part of their performance goals to present formalized training to the young guys on a monthly or quarterly basis.

P6-1: We try to capture more formally through our internal training university program. The instructors for those sessions are almost exclusively our own staff, generally someone at the senior or above level. We also organize our project work around teams. Typically, those teams are led or co-led by one of our most knowledgeable senior people in that field.

P7-1: They will put on training course in this system or that system, then it is a little less likely, but occasionally, they will take a person with a high level of experience or knowledge and ask them to put on training to bring everyone else up to speed in that particular area.

The research data indicate that training programs are an integral component of knowledge sharing for the participants. The coding of the data utilizing word frequency tables and the word mapping function indicated that staff meetings and formal training programs were major knowledge sharing components for the participants. The use of formalized training programs as a knowledge sharing strategy was the first to emerge from the data. A second theme to emerge was the broad use of lessons learned (a.k.a., lessons learnt) at staff meetings, project meetings, and when significant incidents occurred. As a knowledge sharing and learning tool, lessons learned was identified as a practice used at five of the seven organizations in the study. On further questioning of their use, participant responses included:

P4-1: It can go back to the military's lessons learned. We do have formal project reviews or lessons learned in some situations.

P6-2: We document any event with a lessons learned. We obviously share when there is an event where an error occurs. We are sharing that, and we are looking at different ways of getting that information out and to the different groups that need to review it.

P7-1 Identifying specific lessons learned and what was the issue, and how was it corrected? And based on the correction action taken were there any better options that may have had a better outcome? Having that discussed and documented and shared is an excellent step forward.

Interview question 14: In regard to Communities of Practice (or CoPs), how are Formal or Informal groups used to share knowledge, and are they electronic or face-to-face?

P3:2 We are doing something called communities of practice. One interesting thing is that while it is an informal knowledge sharing mechanism, H.R. does not have any governance, or oversight, or execution for that. But they really get the people together while it is member led completely.

P3-1: There are like four or five of us that are transformer counterparts from the different organizations. We are all at different various stages and I am the one closest to retirement. We all have a tight circle and we talk frequently about what is going on, we share experiences, or we ask questions. We have an informal group already.

P6-2: In energy supply which is our power plant division, we try to group our engineers by their competency, or their systems I should say. If a new engineer comes in, they can work with a more senior engineer that may be in another state, but they will work on the same systems for that plant.

The data show that both formal and informal communities are used for knowledge sharing. Communities of Practices (CoPs) was only identified at one organization as a formal strategy for capturing knowledge of senior or retiring engineers, but the data suggested that the social aspect of communicating with other personnel with similar positions, interests, or needs was occurring for all personnel. A theme that emerged was that those participants from larger utilities were more likely to have and share knowledge through formal CoPs.

Interview question 15 & 16: How are video conferencing, electronic forums, virtual collaboration tools and social applications like *Twitter* and *Facebook* used? And, How are Wiki, blogs, video, and other systems such as bulletin boards, e-mail systems (i.e., *Lotus Notes*), and Web 2.0 applications used?

P1-1: No multimedia stuff going on. Paperwork and handouts and those kinds of things, but nothing electronic.

P4-1: We would use technology to capture *Powerpoint* or other training documents so as to make them available for others across the organization in an electronic database to access. Videotaping would be the next step but we really have not got there.

- P5-1: We have had more face-to-face meetings, but moving forward, I think we will be having more video conferences where we will be adopting best practices or try to learn from the others.
- P6-1: We have the *Knowledge Keeper System* with a video recording process.
- P6-2: We had an engineer about to walk out the door with a vast amount of knowledge. So knowing that, for six months we had him do various amounts of videos. We have done some that but more on an informal basis. From the technical standpoint, IT and web conferences, video conferences, that is the area that we really need to grow. We need to get into the twenty first century with our video capabilities.
- P7-1: We had one of our substation supervisors retire and during his last year, I had him go through and document all of the practices with photos, references, annotations, etc... and we conducted training after training with this kind of documentation with the intent of taking his knowledge and trying to data dump it into instruction manuals that expand upon the actual instruction manual.

The data show that technology has not been universally viewed or financially supported by leadership as a tool for capturing tacit knowledge across the industry. The data indicate that the investments of financial capital in knowledge capturing technology range from negligible to a two million dollar plus investment in an engineering simulator. One noted exception to this was a technology used in specific technical applications. An

emerging theme was the potential perceived benefit from the novel use of videos to capture the knowledge or skills of experienced technical personnel in the field. For those participants without formal technology driven strategies, the concept of supplementing their programs with the use of videos and video repositories (e.g., the *Knowledge Keeper System*) to capture tacit knowledge was a potential learning application for their training programs. This aligned with Nath's (2015) statement that the use of technology may positively affect tacit knowledge sharing and perceived learning. For two participants not utilizing the noted video technology, significant interest in their future use was expressed.

Interview question 17: How are stories used to share positive or negative experiences, and if so, do you have an example of a story that was shared?

P2-1: It is a major-major deal. What we have been trying to do between the training group and them is if you do not want to tell the stories, tell us and let us get the stories right and we will talk for you.

P3-1: It is used in our informal group to share our experiences, but not anything formal.

P6-2: I am very familiar with that strategy and it is used in our training, but it is not used as a formal strategy that has been rolled out to all of the training groups. My group understands the value of that and they will use it where they feel that it is appropriate.

P7-1 I do not think storytelling as such is recognized.

The data indicate that storytelling has been used within the training and social communication programs of five of the seven organizations in the study. Participant P2-1 identified storytelling as a purposeful strategy and recognized that as their senior engineers left, so had the stories that were second nature to them. A theme that emerged from the data was that for all participants, there was an awareness of the value of general storytelling to personalize and add context to tacit knowledge transfer. This was true whether a formal storytelling strategy was implemented or not. The data potentially support Kratka's (2015) position that learning and knowledge sharing occurs with storytelling at a subconscious or different personal level.

Interview question 18: How are exit interviews conducted, and if so, could you share an example of how it was implemented?

P2-1 A supervisor might go and try to capture some specific information on the projects they were working on and where they left off at to have a status update of the progress of that person so when the next person comes in, they could possibly take over where they had left off.

P3-2: We are working on an exit interview strategy. We do not currently do exit interviews at our organization. We actually have time setup twice a year where you are doing this assessment on your knowledge to help capture things, so as to not get in a position where the only time we are doing this is when, or if we catch wind that people are leaving.

P6-1 I would say that we do not do some of that. There is some emphasis but it is too late at that point to take everything out of their brains.

P6-2: Some of it is done on a case-by-case basis, but we do not have a formal program

The data show that the use of exit interviews to specifically capture the knowledge of the retiring engineer has been used in isolated circumstances. Formal Human Resource (HR) exit interviews were common practice but the data indicate that they focused more on issues relating to the reason for leaving, views and comments on the company as a whole, and other HR topics. Two themes emerged from the data. The first theme was that challenges exist in determining or knowing when a particular engineer will be retiring. And although Baguma, Ragsdell, and Murray (2015) recognized that exit interviews could be implemented over a one to three month period, the data show that that the organizations that implement this strategy indicated a much longer time period was needed. The second theme was that establishing a strategic interview and transition plan were not formal programs implemented at utilities: They were implemented on an informal base on an as-needed basis. Only one of the nine participants noted that a formally documented exit interview program was being developed to compliment their recurring six-month personnel assessment program.

Interview question 19: What other strategies are used at your organization that could capture tacit knowledge?

P4-1: The first is we can put them in a temporary position which will allow us to fill that position with a new employee. Realizing that it is a temporary add to the headcount and not a permanent situation, that person comes in and job shadows that person that is leaving. So the main driver is to keep this person on for a longer period of time but not have them walk out the door cold one day.

P5-1 We have hired back retirees and I have seen a lot that. But we tend to hire them back not to train or develop others, but to continue to do work. Every time somebody retires, they do what they can to hire them back. Here again, it is because they did not do a good job transferring that knowledge before they left.

An additional strategy to emerge from the data was the practice of rehiring retirees as consultants. The data show that all seven organizations have either informal or formal programs in place and have used this practice to retain the knowledge of senior retiring engineers. Two participants identified that formal programs have allowed retirees to stay with the organizations for multiple years. One participant noted that this had resulted in one retiree returning for seven years. Additionally, the data show a strategy of using knowledge risk assessments for identifying, managing, and capturing the knowledge of personnel.

A second strategy to emerge was the use of formal knowledge risk assessments as purposeful strategies for determining risks to organizational and technical knowledge

continuity. Two participants identified the use of formal knowledge risk assessments as key strategies to transferring experience-based tacit knowledge. Responses to a follow-up interview question regarding knowledge risk assessments included:

P1-1: One of the things the company does for almost every individual is a yearly view of everyone's position and play the "what if" game if they were to leave, who else in the organization could fill their role? Could they step in immediately and fill it?

P3-2: We actually have time setup twice a year where you are doing this assessment on your knowledge to help capture things, so as to not get in a position where the only time we are doing this is when, or if we catch wind that people are leaving.

P4-1: We have hired a company and they do a process called *Broadscope* and what that basically does is we identify exactly those key and critical positions that are near to retirement or if they were to leave would be hard to replace from a continuity and knowledge-based perspective.

Interview question 20: How does your organization participate in industry conferences, conventions, or other external events?

P1-1: If you send someone off to something, they know when they get back that they are going to be teaching.

P2-1: They do send members to different conferences to go capture different information and bring it back.

- P4-1: That is a process in transition right now. There were some instances where at a staff meeting, there would be stories told of what they learned there. We are still trying to get people active and then build on that culture to have them bring back that knowledge and share it with the organization.
- P5-1: So even within the same company, you have that all over the place. You have managers that insist that you do it and there are other managers that absolutely do not have that requirement on people attending.
- P6-1: That is definitely an informal practice but it typically goes like this. If you are lucky enough to go to somewhere like this, and not everybody gets to go, so when you come back, we want you to come back and do a little lunch time session and give us the highlights of what you learned.
- P6-2: It is a case by case situation and it depends on the expectations from the leadership or manager in that organization. I expect them to come back and be ready to debrief and share that information with their peers.

The data suggest that the practice of sharing knowledge from industry conferences, conventions, or other external events does occur on a more informal basis. A theme that emerged was that organizational knowledge sharing requirements were at the discretion of management. The data do not completely support that external events are a component of a tacit knowledge sharing capture strategy. The sharing of knowledge gained and exchanged with co-workers as a result of attending these events is better identified as a component of the training programs focused on knowledge sharing.

Interview question 21: What other external strategies are implemented at your organization?

The participants were not aware of additional external strategies at their organizations.

To receive data rich responses that represented various engineers in the industry, the guiding interview questions, and subsequent follow-up questions (see Appendix A) were designed to illicit open and robust responses. To allow for discrepant cases to be factored into the analysis, I used additional follow-up questions to clarify initial responses and to provide a basis for comparing and contrasting responses from participants from the same organization. I was receptive to discrepant cases as they offered different perspectives of the same phenomena and allowed for a more representative picture of the organization. To develop the emerging themes, the data were coded and the discrepant data were factored into the analysis.

Data Analysis Summary

To address the research question, *What strategies are electric utilities implementing to capture the tacit knowledge of retiring electrical engineers and technical personnel?* I structured the interview guide into three separate KM interview categories including Culture and Leadership of Knowledge, Knowledge Management Background and Programs, and Implemented Capture Strategies. Content analysis resulted in the formation of 132 primary codes and 33 total categories (see Appendix B).

The first KM interview category identified as Culture and Leadership of Knowledge provided insight into the participant's work culture and the role of leadership with knowledge related activities. Six interview questions sought to understand the culture and leadership of the participants' organization. Two themes emerged from the primary codes and eight categories. The first theme identified the importance of creating a culture that fosters, enables, and recognizes knowledge sharing activities and the existing lack of uniform embedded company-wide programs that recognize and incentivize personnel to share tacit knowledge at electrical utilities. The second theme to emerge from the data was that although knowledge was considered a valuable intellectual asset by senior leadership, the management of engineering knowledge requires all levels of personnel support to effectively share, support, protect, and leverage it as a competitive asset.

The second KM interview category was focused on the participants' experience and knowledge of organizational KM programs. Content analysis of the data resulted in the formation of six categories (see Appendix B). Two central themes emerged from the data analysis. Interestingly, the first was that the KM programs involved the capture, management, and reuse of explicit knowledge (i.e., predominantly utilizing *Sharepoint*) and they were used across the organization for key knowledge holders where the risk of knowledge loss was regarded as high. The second theme to emerge was that the decision to implement and support the resources for a KM program was made at the senior leadership level.

The third KM interview category was identified as Implemented Capture Strategies. To address the research question, *What strategies are electric utilities implementing to capture the tacit knowledge of retiring electrical engineers and technical personnel?*, these interview questions were guided by previous strategies identified in the literature. This third category provided the evidence to identify the actual tacit knowledge capture strategies implemented within the organizations. Content analysis resulted in the formation of 19 categories (see Appendix B). With no discrepant cases or non-confirming data identified in the study, the central themes and implemented capture strategies being implemented are presented in the Results section of this Chapter.

Evidence of Trustworthiness

In Chapter 3, I presented the issues affecting the trustworthiness of qualitative research in terms credibility, transferability, dependability, and conformability. The coding process was conducted on data from seven organizations to increase credibility and validity and included the interviewing of multiple respondents within the same organization. This section addresses those strategies and strategy adjustments included to assure credibility, transferability, dependability, and confirmability: all issues that were addressed to strengthen this qualitative research.

With regards to credibility, or internal validity, two strategies were followed. These included first, developing guiding research questions and follow-up questions that illicit experience-based responses (i.e., *What is your experience with each strategy?*, *Could you describe your level of participation?*, *Do challenges exist in their*

implementation, example?, etc...). Second, *NVivo*, a computer-assisted qualitative data analysis software (CAQDAS) was used to electronically document, track, and analyze the large amount of information-rich data. Reflexivity was considered in the interview process and in data analysis to improve credibility. Additionally, I strictly adhered to the approved Walden University IRB Plan for the protection of the participants.

With regards to improving transferability, or the transferring of conclusions to other organizations or to the U.S. electrical utility industry, two strategies were used. First, efforts were taken to secure participants that represented a cross section of the electric utilities in the United States. As documented in Chapter 3, the goal was to interview the number of organizations and participants needed to sufficiently answer the research question. The number of organizations involved in the study was seven and the number of participants was nine. At these numbers, data saturation was achieved and the data collection concluded. By adjusting the transferability strategy, seven organizations provided rich data to address the research question. Additionally, the purposeful sampling of organizations active in IEEE industry activities offered organizations able and willing to share their experience for this study.

With regards to increasing dependability, the strategy of triangulation was used. Although commonly referred to as a practice to increase the reliability in qualitative studies, I interviewed multiple participants in multiple organizations, and also participants within the same organization. I conducted interviews with participants in electrical engineering, workforce planning, and corporate training programs.

Triangulation allowed for data collection with multiple perspectives. Multiple participants from different departments of the same organization provided the opportunity to analyze the data for consistencies, similarities, and differences.

Lastly, with regards to confirmability, or objectivity in qualitative research, I was an active participant in the data collection process. As the instrument, I brought a pragmatic view to the relationship between employees and employers and maintained a neutral position on the culture, role of leadership, and practices experienced by the participants. I was aware of the importance of remaining unbiased in the data collection and analysis process. And to not influence responses and keep the rich discussions flowing, I used reflexivity to remain supportive and non-biased, yet objective.

Results

To address the research question, *What strategies are electric utilities implementing to capture the tacit knowledge of retiring electrical engineers and technical personnel?*, I first collected data to understand the culture and leadership of knowledge and second, on the participants' experience and knowledge of organizational KM programs. Several themes emerged from the data that helped to understand the implemented tacit knowledge capture strategies in their organizational context. In summary, the themes included:

- Creating a culture that fosters, enables, and recognizes knowledge sharing activities at electrical utilities was important to knowledge sharing.

- There was a lack of uniform embedded company-wide programs that recognize and incentivize personnel to share tacit knowledge at electrical utilities.
- Knowledge was considered a valuable intellectual asset by senior leadership.
- The management of utility knowledge requires all level of personnel support to effectively share, support, protect, and leverage it as a competitive asset.
- KM programs at electric utilities involved the capture, management, and reuse of explicit knowledge, predominantly utilizing *Sharepoint*,
- KM programs were used across the organization and for key knowledge holders where the risk of knowledge loss was regarding as high.
- The decision to implement and support a KM program was made at the senior leadership level.

With the culture, leadership, and KM programs central themes identified, the findings to the research question, *What strategies are electric utilities implementing to capture the tacit knowledge of retiring electrical engineers and technical personnel?* can be addressed. The themes that emerged from the data support that multiple tacit knowledge capture strategies are being implemented at electrical utilities. The strategies identified included:

- *Formal and informal on-boarding mentorship and apprenticeship programs.* Although the apprenticeship programs are more focused on the technical and trade personnel, the use of on-boarding mentorships were universally

recognized as a knowledge sharing, and to some degree tacit knowledge capture strategy. When considered specifically for the capture of tacit knowledge of senior or retiring engineers, there was a lack of strategically used formal and informal off-boarding program.

- *Formal and informal off-boarding mentorship programs.* Off-boarding mentorship programs were a used but an underused strategy when focused on capturing tacit knowledge of the senior engineer. Although senior engineers take an active role in on-boarding mentorships, the primary focus is on supporting newer hires as a resource, and not on shadowing the senior engineer to capture the key tacit knowledge and experience critical to ensuring operational continuity.
- *Formal and informal training programs.* The research data indicate that training programs, ranging from staff meeting, extended staff meetings, leaning management systems, and up to and including formal corporate universities are embedded tacit knowledge capture strategies at electrical utilities.
- *Lessons learned (a.k.a., lessons learnt).* The practice of lessons learned was identified as a component of training meetings by several utilities, but it was also identified as its own form of knowledge sharing strategy. When led or attended by senior engineers, these lessons learned programs provided a

forum for the capturing of that experienced-based tacit knowledge of the participating senior engineers.

- *Communities of practice (CoPs)*. Both formal and informal CoPs were used as knowledge capture strategies, yet their direct application to capturing the tacit knowledge of senior retiring engineers was not identified as a purposeful strategy. The groups of personnel are linked by similar job function, or technical topic, and are involved in company or industry group CoPs. They do so to communicate and share knowledge and experience. A theme that emerged was that those participants from larger utilities were more likely to have and share knowledge through formal CoPs. Although most groups are formally or informally formed, the data suggest that their participation of the members do so on an informal basis: management is not involved in their member communications.
- *Technology enabled tools*. Technology has been used as a strategy to capture the tacit knowledge of senior or retiring engineers in various ways. Although being aware of the limitations and potential issues that could arise from its use, all of the participants viewed the use of video recording practices (e.g., *Knowledge Keepers*) as a potential and novel approach to tacit knowledge capture. The increased use of a recordable communication medium (e.g., *Yammer*), video conferencing, web conferencing, and large engineering

simulators were identified as innovative tools for a strategy to capture the tacit knowledge of senior or retiring electrical engineers.

- *Storytelling.* Storytelling was identified by one participant as a purposeful strategy for capturing the tacit knowledge of senior electrical engineers. It was recognized by a majority of the participants that storytelling is a tool whereby both positive and negative stories could be used to educate, train, and share experiences within a specific context.
- *Exit interviews.* The use of exit interview strategy to specifically capture the knowledge of the retiring engineers has been used in isolated circumstances. Participants identified that a primary challenge to implementing this strategy was not having knowledge of when personnel were actually going to retire or leave the organization.
- *Rehiring of retirees as consultants.* The strategy of rehiring retirees as consultants was identified as part of formal staged or phased retirement program by participants. Moreover, the practice of rehiring retirees was a standard practice noted by all participants. Although the rehiring of retirees was identified as a tacit knowledge capture strategy, the data indicated that the strategy was actually more intended to keep the knowledge from retiring, versus capturing it while they were a consultant.
- *Knowledge risk assessments.* A strategy identified by two participants was the formal use of knowledge risk assessments (KRA) for determining risks to

organizational and technical knowledge continuity. These two KRA programs included the use of a consulting company in one case, and an embedded managerial knowledge assessment on a reoccurring six-month basis.

- *External events.* The data suggested that the practice of sharing knowledge from industry conferences, conventions, or other external events does occur on a more informal basis. The data does not clearly support that external events are a component of a tacit knowledge sharing capture strategy. The sharing of knowledge gained and exchanged with co-workers as a result of attending these events is better aligned as a training component for programs focused on general tacit and explicit knowledge sharing.

Summary

I conducted semi-structured interviews of nine participants from seven different electrical utilities in the U.S. The demographics of the participants were provided in Table 2. The participants included seven electrical engineers and one electrical technician, one participant from workforce planning, and one participant from training. The organizations were invited to contribute to the study, and after receiving their approval to participate as a community research partner, the participants were recruited and their consent was secured. Call-in interviews were conducted in January 2016 and completed by March 2016 and were recorded, transcribed, and verified by the participants for accuracy. The data were analyzed with the aid of *NVivo*, and included the coding of the data, the development of categories, and the identification of emerging

themes. I analyzed the interview questions individually and then presented the emerging themes relating to culture and leadership and the participants' experience with KM programs.

After analyzing the data to better understand the culture, leadership, and KM programs experienced by the participants, and presenting evidence of trustworthiness, I provided the results as they related to the research question, *What strategies are electric utilities implementing to capture the tacit knowledge of retiring electrical engineers and technical personnel?* In summary, the data show that electric utilities have implemented tacit knowledge capture strategies including: (a) formal and informal on-boarding mentorship and apprenticeship programs, (b) formal and informal off-boarding mentorship programs, (c) formal and informal training programs, (d) using lessons learned in training programs, (e) communities of practice, (f) technology enabled tools, (g) storytelling, (h) exit interviews, (i) rehiring of retirees as consultants, and (j) knowledge risk assessments. In Chapter 5, I interpret these findings, and then present the limitations of the study, recommendations for further research, and implications for social change.

Chapter 5: Discussion, Conclusions, and Recommendations

Introduction

The purpose of this qualitative research study was to conduct a case study of three to five electrical utility organizations to explore and understand strategies used to capture the tacit knowledge of current and retiring engineers. What was needed for management to ensure operational continuity was a better understanding of what strategies were currently being implemented in the industry to capture this tacit knowledge. This empirical study followed the qualitative approach consisting primarily of a multi-organizational case study involving semi-structured interviews, and explored how tacit knowledge was effectively and efficiently captured and transferred in real world situations, and specifically in the engineering and technical departments of large electrical utilities. The study sought to answer the research question, *What strategies are electric utilities implementing to capture the tacit knowledge of retiring electrical engineers and technical personnel?*

To answer the research question, nine participants were interviewed from seven U.S. utilities. The analysis of the data found that electric utilities have implemented 10 tacit knowledge capture strategies including: (a) formal and informal on-boarding mentorship and apprenticeship programs, (b) formal and informal off-boarding mentorship programs, (c) formal and informal training programs, (d) using lessons learned, (e) communities of practice, (f) technology enabled tools, (g) storytelling, (h) exit interviews, (i) rehiring of retirees as consultants, and (j) knowledge risk assessments.

Interpretation of the Findings

Two lines or patterns of approaching the subject material were observed in the literature. The first line focused on specific strategies (e.g., mentoring or storytelling). The second line focused on which strategies have been applied or used within a general organization or industry. This study was aligned with the second line observed in the literature. It addressed the tacit knowledge capture strategies implemented within the context of a specific industry. The following includes a comparative interpretation of the findings that confirm, disconfirm, or extend knowledge found in the peer-reviewed literature described in Chapter 2.

Guided by the literature review and 11 previous studies on tacit knowledge capture strategies, interview questions were condensed to eight groups including mentorships and apprenticeships, communities of practice, video recording and electronic capture, storytelling, exit knowledge transfer interviews, other internal strategies, external events, and other external strategies. After analyzing the data, the results of two previous studies most closely compared closely to the results. The literature revealed that the data aligned with the studies conducted by Jennex and Durcikova (2013) and Honeycutt (2008).

Although these studies were published three and eight years ago respectively, their strategies identified included both explicit and tacit knowledge capture strategies still being used at other utilities. From the literature, Tennessee Valley Authority (TVA) and Duke Energy (Duke) conducted knowledge risk assessments and identified multiple

explicit and tacit capture strategies. These included: (a) documented procedures and job aids, (b) diagrams, (c) maps, (d) models, (e) patents, (f) document retention standards, (g) business continuity/disaster recovery plans, (h) team document storage sites, (i) searchable web sites, (j) customer account management tools, (k) equipment maintenance logs, (l) case management tools, (m) blogs/Wikis, (n) interview guides, (o) training and apprenticeships, (p) storytelling, (q) succession planning, (r) having a deep bench of experts who can guide others, and (s) having the expert transition relationships with the new employee.

The findings in this study focused only on those tacit knowledge strategies identified by Jennex and Durcikova (2013) and Honeycutt (2008) but implemented across engineering departments in electrical utilities. In comparison, the strategies identified in both this study and those previously identified at TVA and Duke included apprenticeships, training programs, technology enabled tools, storytelling, rehiring of retirees as consultants, and knowledge risk assessments. Although not the primary focus of this study, similar explicit capture strategies were identified in this study that confirmed those previous identified. No strategies identified in the earlier studies at TVA or Duke were disconfirmed in this study.

Multiple strategies were identified in this study that had not been previously identified in the TVA or Duke studies. These five newly identified electric utility strategies included lessons learned programs, the use of formal and informal on-boarding or off-boarding focused mentorship programs, the use of exit interviews, the rehiring of

retirees as consultants, and formal and informal communities of practice. Although used by TVA and Duke to identify knowledge capture strategies, the actual process of conducting the knowledge risk assessment was identified as a new sixth purposeful tacit knowledge capture strategy in this study. This study contributes to the literature by identifying additional tacit knowledge capture strategies not previously identified. The capture strategies found in this research extend the empirical studies of Mladkova (2012), Appelbaum, et al. (2012), Connell, Schechtman, and Hasty (2012), Whyte and Classen (2012), Al-Qdah and Salim (2013), Redlitz (2013), Panahi, Watson, and Partridge (2013), and Bhanumathi and Rathb (2014) by illustrating their implementation within the electric utility industry and specifically, in the capture of tacit knowledge of electrical engineers.

The analysis and interpretation of the findings were improved by understanding them within the context of the theoretical framework. This framework provided insight into the categorization of knowledge, its value to the organizations as a resource capable of being managed and leveraged, and an increased understanding of how organizations used knowledge to learn and create learning cultures and environments. Interview questions regarding culture, leadership, and the implementation of KM programs were included to provide additional context for the understanding the implementation of the tacit knowledge capture strategies. The three theories and their consideration in the findings are included in this section.

With regards to Nonaka and Tekeuchi's (1995) knowledge creation theory and the (SECI) model, the distinction between the two types of knowledge was an integral

perspective in understanding capture strategies. Attention was provided to ensure that the types of two knowledge types were understood by the participants: This was a critical component in the collecting of evidence. The data found that Nonaka and Takeuchi's knowledge typology was suitable for studying knowledge in the context of this study. The separation of knowledge by these types provided the participants with the idea of tacit knowledge as "experienced-based know-how" and tied it to the importance of the cultural and social aspects involved in the model.

To supplement the six questions focusing on culture and leadership, five questions were asked on KM programs and the management of tacit and explicit knowledge. These included references to how information cycles through the organization. This study explored the implementation of tacit capture strategies within the context of both explicit and tacit knowledge programs. The findings support the tacit-explicit nature of knowledge and addressed Andreeva and Ikhilchik's (2011) statement that the consideration of the SECI model for knowledge creation required more empirical evidence. Expanding upon current research by Connell (2013), Dzekashu (2009), and Hall (2012) this research contributed to the research on knowledge creation theory and provided supplemental findings to the universality of the SECI model.

Two specific questions were asked in regard to understanding organizational knowledge as a resource. They were asked to determine the value or perspective of knowledge at the organizations. Considering the resource based view (RBV) and the more comprehensive resource based theory (RBT) of the firm, the data found that

purposeful management of knowledge as an intellectual asset, and treating it as an asset capable of providing a competitive advantage were themes identified in the study. These findings extended the idea that knowledge-based and intangible assets were resources with utility (Cawley & Snyder, 2012).

For the final theory underpinning this study, OL theory contributed to understanding how electrical utility organizations implement capture strategies, and how they create learning-based organizations to sustain knowledge for future use. From the eleven questions focusing on culture, leadership, and KM programs attention was given to organizational introduction, the encouraged or mandated use of knowledge based programs, and leadership involvement in their month. The findings show that there were different levels of learning occurring within the industry.

Although the data show that the desire to learn was evident at all organizations involved, actual focused resources to implement programs were not at the same level. A learning component was identified as being integral to nine of the 11 tacit knowledge capture strategies being implemented. The two strategies not found to have an identified learning component included the rehiring of retirees as consultants and conducting knowledge risk assessments. In this study, OL theory provided a perspective for understanding how organizational behaviors, practices, and programs involve a learning component and how the presence of a learning environment supports or contributes to capturing and sharing tacit knowledge and sustaining it for future use.

Limitations of the Study

There were multiple limitations in this study. Although the literature review provided a foundation for exploring knowledge capture strategies, the first limitation was that the interviewing of nine participants may not have identified all of the embedded strategies at those organizations involved in the study. Additionally, although data saturation was achieved with seven organizations, additional unexplored strategies may still be used in other organizations within the industry. This limitation relates to the generalizing of the findings beyond the organizations or cases studied, and those externalized generalizations (Patton, 2002).

Supporting Dinur (2011), the second limitation in this study was that it did not address the causal relationships between the types of tacit knowledge involved and type-specific approaches to capturing it. To minimize potential limitations associated with participant's understanding the concepts of tacit and explicit knowledge, a working definition was communicated in the participant consent form and verbally prior to conducting the interviews. This step assisted, but did not completely eliminate the potential limitations associated with not understanding the technical aspects of the topic.

A large component of tacit knowledge transfer is the face-to-face or social interaction involved in the process. The conducting of data via face-to-face interviews was not the best option considering the costs and geographic challenges of meetings with the participants. A limitation was the use of the web-based *GoToMeetings* to conduct the interviews. To reduce this limitation, and address the value of collecting data in a natural

setting, I followed the recommendation of Ryan et al. (2014) and had participants participate in the interview while they were in their natural work environment. With this, the on-line interviews may not have comprehensively captured the same data had the interviews been conducted face-to-face.

The last limitation dealt with the participant's providing truthful and reality-based responses during the interviews. With a concern that participants may paint the organization in the best light possible, a theory posited by Joia and Lemos (2010), interview questions were repeated at different times throughout the interview and a triangulation strategy was used for data collection. Additional evidence on this potential limitation was noted when two participants asked that specific responses be omitted from their interview records. This suggested that one, there could have been additional data that the participants did not want to provide, and two, that even with the confidentiality of the data discussed in advance there may have been unidentified underpinnings to the given responses.

Recommendations for Further Research

I make three recommendations to further research on this knowledge-based topic. The first recommendation is that the empirical research on tacit knowledge capture strategies be expanded to include other countries or electric utility related industries (e.g., electrical utility consulting firms, electric utility service organizations, or electrical equipment original equipment manufacturers). This supports the recommendations of Carmel et al. (2013) that more research is needed in the professional services, and

specifically those knowledge-intensive industries. The need for operational continuity exists throughout the world, and as the need for reliable power expands and electrical power grids connect more of the world, there is a continued need for research to improve the management the knowledge of this intellectual asset called tacit knowledge.

The second recommendation is to further investigate the role that organization's culture and leadership play on knowledge capture and sharing, and on the use of KM programs that leverage knowledge to achieve competitive advantage in this changing industry. I included components of culture and leadership, and KM programs in this study to better understand the context for implementing tacit knowledge capture strategies. Additional empirical research on knowledge hoarding, the use of performance evaluations for increasing knowledge sharing, and new strategies for increasing the value and perception of knowledge would be of value to management.

The third recommendation addresses the identification of industry best practices for the capturing of tacit knowledge in the electric utility industry. The use of best practices is a readily accepted strategy by those in technical industries. From the North American Electric Reliability Corp.'s (NERC) use of best practices in the reporting for demonstrated compliance (Carpentier, 2014), to their use in Shell Oil's Practice Excellence through Accelerated Replication program (a.k.a., the PEARL program) (Grant, 2013), and to process improvements at DuPont Chemical, Inc. (Sanford, 2012), determining the best practices from this research could provide what Macmillen and Stead (2014) stated was as a gap in the literature – studies on the application of best

practices. For those in the electrical utility industry where size, geography, market segment, and organizational structure vary from organization to organization, research is required to provide managers with those best practice strategies that most efficiently and effectively leverage resources. As Rossi, Kerga, Taisch, and Terzi (2014, p. 459) concluded, and quite appropriately considering the electrical utility industry, best practice implementation requires knowledge and an understanding that “one size doesn’t fit all”. Further research addressing the best practices of the tacit knowledge capture strategies identified in this research could also be aligned with the needs of a specific group, department, division, or related utility enterprise.

Implications for Social Change

Reliable and sustainable energy is dependent on electric utilities’ efficient use of their resources and the industry’s ability to operate with minimal interruptions. A component of this is the organization’s management of the skills, experience, and knowledge needed to ensure operational continuity. With the social impact of electric utilities related to building communities and increasing the quality of life around the world, improved management tools and strategies provide them with knowledge to better leverage their tangible and intangible resources to meet these goals. By understanding what strategies are being implemented to capture the explicit and the more challenging tacit knowledge of senior and retiring engineers, management will be equipped with tools to create long term organizational success and impact communities positively.

In terms of social benefits, existing scholarly research on tacit knowledge has focused on the need to capture tacit knowledge to benefit hospitals, schools, and the general workforce (Sopko, 2010); the social value of improving organizational decision making processes (Dzekashu, 2009); and the broader social benefits that come from operating more competently, successfully, and effectively (Connell, 2013). This research focused on specific tacit knowledge capture strategies that operationally help electric utilities delivery power. As a result of this research, it contributes by offering: (a) electrical personnel with an understanding of the importance and value of individually capturing and sharing experience-based knowledge, (b) management with 10 embedded strategies that can maintain the organizational know-how needed to ensure operational continuity, and (c) the electric utility industry with improved tools to improve the delivery of safe, reliable, sustainable, and affordable power to meet the needs of a growing and demanding society.

Conclusion

With the first of the baby boom generation turning 65 in 2011, it is expected that some of them will include those most knowledgeable and experienced electrical engineers currently employed at U.S. electrical utilities. The empirical results of this study illustrated that while not unique, implementing strategies to capture the tacit knowledge of senior and retiring electrical engineers is a valuable endeavor. The study found that electric utilities have implemented capture strategies including: (a) formal and informal on-boarding mentorship and apprenticeship programs, (b) formal and informal

off-boarding mentorship programs, (c) formal and informal training programs, (d) using lessons learned in training programs, (e) communities of practice, (f) technology enabled tools, (g) storytelling, (h) exit interviews, (i) rehiring of retirees as consultants, and (j) knowledge risk assessments to address the issue.

Drawing on the evidence from the interviews of seven organizations this study concludes that ensuring operational continuity requires the effective management of the intellectual assets of an organization. As stated by Sohrabi and Naghavi (2015, p. 388), the ultimate value of knowledge could be understood as follows:

In modern world, all scholars in the science of economy and business assume knowledge as the ultimate code for achieving a competitive privilege in modern companies. Therefore, any method or model that keeps knowledge advancing then forming its distribution will be respected as the code of companies' success in present world.

The purpose of this qualitative research study was to explore electrical utility organizations and understand the tacit knowledge capture strategies currently used in the industry. What was found were 10 capture strategies or real-world practices being implemented throughout the industry including formal and informal on-boarding mentorship and apprenticeship programs, formal and informal off-boarding mentorship programs, formal and informal training programs, lessons learned, communities of practice, technology enabled tools, storytelling, exit interviews, rehiring of retirees as consultants, and knowledge risk assessments. As electric utilities address their changing

demographics and the challenges associated with a changing workforce, understanding the tools and resources available will be needed to effectively manage and lead this industry forward. These findings provide management with knowledge-based strategies to better leverage their know-how and ensure operational continuity for the delivery of safe, reliable, and sustainable power.

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Appendix A: Guiding Interview Questions

Review of the Central Research Question:

What strategies are electric utilities implementing to capture the tacit knowledge of retiring electrical engineers and technical personnel?

Part 1: Brief overview and clarification of the study to include:

- Defining of Tacit/Explicit Knowledge for Interviewee (emphasis on intellectual capital and “know-how”). Experience-based and the social aspect of knowledge sharing
- Goal of representing a realistic picture of the industry with both defined and embedded strategies
- Asking the interviewee if they have any questions before starting.
- Description of the Interview consisting of 3 Parts.

Part 2: Culture and Leadership of Knowledge

1. How are knowledge or knowledge sharing valued?
2. How is knowledge sharing a component of performance evaluations?
3. How is knowledge protected, isolated, or kept separate?
4. How are rewards, incentives, or benefits considered in promoting knowledge sharing?
5. How is “knowledge hoarding” a component of the work environment?
6. How is knowledge perceived?

Part 3: KM Background

7. What is your experience with organizational programs, procedures, or systems focused on knowledge management?
8. If present, how were they introduced to you?
9. To what extent is their use encouraged, recommended, or mandated by leadership?
10. How is leadership involved with their use?
11. How are these programs directed?

Part 4: Implemented Tacit Knowledge Capture Strategies

12. What strategies are implemented for the Front-End or On-boarding benefit (i.e., as training tools) or for the Rear-End or Off-boarding benefit (i.e., to capture retiree knowledge)?
13. How are knowledge sharing training and learning opportunities embedded in daily operations (i.e., scheduled or occasional conducted)?
14. How are formal or informal groups used to share knowledge? And are they electronic or face-to-face?
15. How are video-conferencing, electronic forums, virtual collaboration tools and social applications like twitter and *Facebook* used?
16. How are Wiki, blogs, video, and other systems such as bulletin boards, e-mail systems (i.e., *Lotus Notes*), and Web 2.0 applications used?
17. How are stories used to share positive or negative experiences, and if so, do you have an example of a story that was shared?
18. How are exit interviews conducted, and if so, could you share an example of how it was implemented?
19. What other strategies are used at your organization that could capture tacit knowledge?

For Questions 12-19: Additional question to expand upon initial responses include:

- What strategies are currently being implemented?
- What is your experience with each strategy?

- Could you describe your level of participation?
 - How effective is the identified strategy?
 - How are these strategies communicated, implemented, and received?
 - Do challenges exist in their implementation, example?
20. How does your organization participate in industry conferences, conventions, or other external events?
21. What other external strategies are implemented at your organization?

For Questions 20-21: Additional question to expand upon initial responses include:

- How is industry participation viewed and supported by leadership?
- Are their resources available to participate in these external events?
- What activities are available to share the knowledge gained at these external events?
- What technologies are used to share experiences and knowledge?

Wrap-up and concluding questions:

22. Were there any questions asked that were confusing or that you would like clarified?
23. Would you like to add anything to your responses before we conclude the interview?

Appendix B: List of Primary Codes and Categories

Primary Codes

apprenticeships - on-boarding
 budgetary constrained
 chain-of-command
 commingling of engineers
 communities of practice - company-wide
 communities of practice - formal
 communities of practice - industry
 communities of practice - job function
 communities of practice - networking events
 component of competency
 consultants - band-aid solution
 consultants - legal constraints
 consultants - practice sustainability
 consultants - rehiring of retirees
 competitive advantage
 document management system use
 engineers - integration
 engineers - limitation in community
 engineers - over-training
 engineering review boards
 enterprise-wide systems
 exit interview - formal knowledge assessment
 exit interview - frequency
 exit interview - H.R. driven
 exit interview - informal knowledge assessment
 exit interview - project hand-off
 explicit knowledge capture
 external events - attendees
 external events - benefits
 external events - decision to attend
 external events - knowledge sharing expectation
 external events - resources
 focus - across the board/company-wide
 focus - knowledge critical positions
 forced participation
 formal program - not present
 formal program - present
 hit-or-miss approach
 H.R. led practices

implementation - systems driven
implementation - leadership driven
informal program - present
internships - off-boarding
internships - on-boarding
job rotation
leadership participation - led
leadership participation - involved
leadership participation - proposed
KM introduction - citywide
KM introduction - company roll-out
KM introduction - out-of-date implementation
KM introduction - phased-in
knowledge as power
knowledge hoarding - as power
knowledge hoarding - across the board
knowledge hoarding - human nature
knowledge hoarding - improved by culture
knowledge hoarding - not condoned
knowledge hoarding - not encountered
knowledge hoarding - not pervasive problem
knowledge hoarding - old-timers
knowledge - interviews
knowledge - risk assessments
knowledge - walking out the door
knowledge value - black box
knowledge value - books and table use
knowledge value - investment
knowledge value - recognition/acknowledgement
knowledge value - resource allocation
lessons learned - documentation/video-recording
lessons learned - formal project review
lessons learned - industry associations
lessons learned - nuclear field
lessons learned - significant events
lessons learned - storytelling component
management led assessments
mandated system use
mentorships - as a resource
mentorships - assigning of mentors
mentorships - exception-based mentoring
mentorships - formal programs

mentorships - informal/ad-hoc
mentorships - off-boarding
mentorships - on-boarding
mentorships - senior engineer
one-deep
open-sourced information
perception - employee-owned asset
perception - intellectual asset
perception - none
perception - worthy of protecting
physical separation of engineers
position expectations
positive career influence
professional recognition
proximity challenges
redundancy - gap
retirement - announcements
retirement - staged/phased
retirement - transition planning
rewards - financial
rewards - non financial
senior clustering
shielding bad habits
Sharepoint
skill-set acquisition
succession planning - annual reviews
succession planning - career path mapping
succession planning - engineering review boards
succession planning - principal engineers
succession planning - redundancy
succession planning - what if's
technology - leveraging
technology - resource allocation
technology - simulators/tools
technology - video conferencing
technology - video recording
tools to leverage
training - beyond books/table
training - formal programs
training - historical context
training - informal programs
training - on-the-job

training - round table meetings
 training - senior engineer presentations
 training - senior engineer teams
 training - staff meetings
 training - standards working groups
 training - technical meetings
 training - training departments
 training - webinars

Categories

CL-knowledge hoarding
 CL-perception of knowledge
 CL-performance evaluation
 CL-physical separation
 CL-protection and separation
 CL-rewards and incentives
 CL-value of knowledge
 KM-extent of use
 KM-focus
 KM-implementation
 KM-introduction
 KM-leadership involvement
 KM-risk assessment
 TKCS-capture late (2of3)
 TKCS-do nothing (1of3)
 TKCS-extended retirements
 TKCS-external events
 TKCS-exit interviews
 TKCS-formal CoPs
 TKCS-formal succession planning
 TKCS-hiring from others
 TKCS-informal CoPs
 TKCS-lessons learned
 TKCS-mentoring front
 TKCS-mentoring rear
 TKCS-other internal strategies
 TKCS-picking a mentor
 TKCS-rehire as consultant (3of3)
 TKCS-rehire as consultants
 TKCS-storytelling
 TKCS-technology use
 TKCS-training