5-11-2013

Toward a New Understanding of the Project Manager as a Mixing Value of Organizational Knowledge: A Case Study Approach

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TOWARD A NEW UNDERSTANDING OF THE PROJECT MANAGER AS A MIXING VALVE OF ORGANIZATIONAL KNOWLEDGE: A CASE STUDY APPROACH

BY

THEODORE NICHOLAS BIBBES

A Dissertation Submitted in Partial Fulfillment of the Requirements for the Degree

Of

Executive Doctorate in Business

In the Robinson College of Business

Of

Georgia State University

GEORGIA STATE UNIVERSITY
ROBINSON COLLEGE OF BUSINESS
2013

ACCEPTANCE

This dissertation was prepared under the direction of the *Ted Bibbes* Dissertation Committee. It has been approved and accepted by all members of that committee, and it has been accepted in partial fulfillment of the requirements for the degree of Doctoral of Philosophy in Business Administration in the J. Mack Robinson College of Business of Georgia State University.

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ACKNOWLEDGEMENTS

If you can't describe what you are doing as a process, you don't know what you're doing.
W. Edwards Deming

About three years ago, in a conversation with a friend from the Georgia Department of Corrections, a tiny seed was planted in my head about getting my doctorate. For various reasons, that seed took hold and germinated. I knew I didn't want to do go the traditional Ph.D. route, but I wondered if there was another option. After some exploration, and discussions with others, I was directed to Georgia State University's new Executive Doctorate in Business program. Now, after three years of work, I am completing my dissertation and it is time to acknowledge all the people who helped, supported, and just plain put up with me as I made my way through the process.

First I acknowledge God, and thank Him for his presence and support throughout all aspects of this journey. There were many times of self-doubt and questioning of my own ability or resolve to accomplish the work required for a successful completion, but through prayer and faith I found the internal strength and resolve to meet the challenge. He also helped me along the way by providing support and help through friends and colleagues.

As I mentioned above, I would not have started this quest without the encouragement of my friend Lori Battle. Nor would I have taken that first step without the support of my friends and colleagues at the Georgia Governor's Office of Customer Service; especially my direct supervisor Katie Christopherson, and the Director of Customer Service Joe Doyle, both of whom supported me from the start.

The EDB program itself has been instrumental in this work. Maury Kalnitz, Lars Mathiassen, Heather Jacobs, and the whole staff within the EDB program have put together a truly outstanding advanced academic program. A driving factor in my decision to pursue this degree was the desire to become a better writer, and possibly be published in the various project management or business journals I read. As I sought to find my voice, the EDB faculty showed us the path, and helped to keep me on track. Feedback is always hard to take, but theirs was always honest and for the purpose of making each of us better writers.

When I say "each of us," I am talking about my other 18 2013 EDB classmates. A major strength in this program has been the cohort structure, and we have been cohorts in the truest sense of the word. The shared experience of this program with those 18 people who share the same sense of curiosity and passion for business and self-development has made the journey not only enjoyable, but also swift. I whole heartedly acknowledge that without the camaraderie of Andrew, Angela, Barry, Darren, David, Doug, Gaynor, Hazen, Isabelle, Karl, Keisha, Ken, Kevin, Pam, Stephen, Steven, Suzanne, and Theresa, my experience and accomplishments would not be as satisfactory.

This research and manuscript would not be what it is without my committee. Each member has brought something unique to the process, and it has been my pleasure and honor to work with each of them. Dr. Minna Rollins, D.Sc. proved to be an invaluable source of help and guidance. Her advice and encouragement were always timely and on-point. My committee chair, Dr. Wesley Johnston, Ph.D. gave me just enough room to explore this combined area of Knowledge Creation and Project Management, while also ensuring my direction and focus remained clear and true. Dr. Adrian Souw-Chin Choo, Ph.D.'s feedback helped keep me honest. I consider each a friend, and would work with them again in a heartbeat.

I would not have been able to complete this research at all without the cooperation of my research participants. Oz, Jacob, Sally, Lucille, Vickie, Tom, and Salma graciously let me into their organization. Their insights and cooperation enabled me to complete this work, and for that I am eternally in their debt and thankful.

But this journey would not have started at all if my parents had not instilled a strong sense of the importance of learning. My research is a direct factor of my father, Peter Bibbes', influence. I remember as a teenager and young adult, him talking about his project management and PMI responsibilities. It was through his encouragement that I attained my PMP certification, and it is with great pride that I can turn to the "Acknowledgements" section of the PMBOK to find his name listed as one of the first to put PM practices into written form. I hope this manuscript lives up to his example.

Finally, I must thank my family for their support and understanding. My wife, Dawn, who took over bedtime and weekend playtime duties with our daughter, Charlotte, when I disappeared to the basement to read and write during the first year; and then supported us in my second and third years as I became a stay-at-home dad and studied during the day when Charlotte was in school. Thank you for letting me do this. I love you both.

Ted Bibbes
February 26, 2013

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ABBREVIATIONS AND DEFINITIONS

Knowledge Creation Theory	KCT
Knowledge Management System	KMS
Knowledge Management	KM
Project Management Body of Knowledge	PMBOK
Project Management Office	PMO
Project Manager	PM
Project Team Member	PTM
Socialization-Externalization-Combination-Internalization	SECI
Thermostatic Mixing Valve	TMV

ABSTRACT

TOWARD A NEW UNDERSTANDING OF THE PROJECT MANAGER AS A MIXING VALVE OF ORGANIZATIONAL KNOWLEDGE: A CASE STUDY APPROACH

BY

THEODORE NICHOLAS BIBBES

February 25, 2013

Committee Chair: *Wesley J Johnston, Ph.D.*

Major Academic Unit: *Executive Doctorate in Business*

In the areas of Project Management and Knowledge Management, past and current literature have included studies on the project and project team levels, but a specific focus on the role of the Project Manager in managing knowledge within the team has not yet been explored. In order to add to the discussion and close the gap, this research illustrates how knowledge is created within the project team environment, and the specific role the Project Manager plays in the process. By combining a modified model of Nonaka's SECI Knowledge Creation Theory and the role of the Project Manager, this research shows how PM's act as a "mixing valve" in the flow of knowledge in a dynamic, multi-directional, process within the project team environment. By developing this view, this research contributes to the knowledge management literature by describing a more dynamic SECI Model of knowledge creation than previously discussed. It contributes to the project management literature by applying the SECI process model of knowledge creation to the field of project management, and the specific actions of the Project Manager when acting within the project team environment. By outlining these actions, this research identifies possibilities for future research in measuring knowledge creation.

1 INTRODUCTION

1.1 Research Domain

In today's knowledge rich and focused business environments, competitive advantages can be gained through the efficient management of knowledge; whether creating new knowledge or transferring existing knowledge throughout the organization. In accordance, the importance of knowledge as a critical success factor and dynamic capability has been well documented during the last 20 years, the prevalence of knowledge as a major factor in the organizational literature, and the discussions of it as a factor in organizational success continue to grow. Additionally, both academic and managerial literature have documented and highlighted the importance of well-structured projects as a means to organizational success. More recently the combination of the two areas has focused on knowledge management projects to convert and deliver knowledge to, and throughout, an organization.

In the seminal article introducing dynamic capabilities, "Dynamic Capabilities and Strategic Management," David Teece and colleagues introduced the concept of the use of the resources to develop competitive advantage. Through the development of firm specific processes and knowledge, organizations develop the ability to dynamically meet the challenges of their environment (David J. Teece, Pisano, & Shuen, 1997). A factor in the development of dynamic capabilities is the creation and sharing of knowledge by the firm's resources- the workforce. J.C. Spender further positions knowledge as a dynamic capability (Spender, 1996) and in his discussion provides a basis for this view by stating that a knowledge-based view of the firm provides a platform for viewing "the firm as dynamic, evolving, quasi-autonomous system of knowledge production and application." He further states "to know is to be able to take part in the process that makes the knowledge meaningful." This is consistent with Nonaka, Toyama, and Nagata who view knowledge as related to human actions, not static or absolute, but part of a dynamic human process (Nonaka, Toyama, & Nagata, 2000).

Knowledge is more than a static asset; it is itself dynamic, and changing (Nonaka, Toyama, & Konno, 2000; Spender, 1998). Nor is decreased when shared, rather with each sharing it is enhanced and

changed as it is combined with the current knowledge of the receiver. The sharer retains the shared, and subsequently receives new knowledge with which to add to his current knowledge and thus continue the creation process. As Spender points out, we do not possess certain knowledge, but rather are bound by learning processes. The process is unique to the individual as he or she gains experience. Developing, gaining, or acquiring new knowledge, understanding and internalizing it, and then dispensing it throughout an organization is considerably more beneficial to the organization than limiting itself to a narrow and fragmented focus associated with short learning horizons and limited learning capabilities (Tallman & Yip, 2010).

Based on the work of Teece (D.J. Teece, 1981, 1982; 1997) and others like Nonaka, Von Krogh, and Spender, the study of knowledge and its relationship to organizations has spanned the spectrum of analysis. Stemming from this research are the ideas of explicit and tacit knowledge (Kogut & Zander, 1992; Nonaka & Von Krogh, 2009; Von Krogh, 1998), knowledge management and managing knowledge assets (Baskerville & Dulipovici, 2006; Despres & Chauvel, 1999; Eppler & Sukowski, 2000; Goel, Rana, & Rastogi, 2010), and organizational knowledge creation (Nonaka, Toyama, & Nagata, 2000; Von Krogh, 1998) are among the many areas of research under the umbrella of Knowledge Management.. However, among the missing elements in these discussions, has been a directed focus on the role of the Project Manager (PM), or an indication of who is responsible for knowledge management activities.

Previous research has studied knowledge and knowledge management at the project and team level. Additionally, studies in project management have focused on a wide range of issues from defining project success to managing teams. Within these discussions has been the inherently understood role of the PM; that the PM is part of the overall discussion and they should apply the learning's to their own project management activities. Absent from these studies is a specific focus on the role the PM plays; the actions and behaviors PM's use, or should use, in order to fulfill their job duties. In order to add to the discussion and close the gap, this research is focused on knowledge creation (an aspect of knowledge sharing) within the project team environment, and the role of the PM in the creation of knowledge through the conversion process from explicit to tacit knowledge and back.

This research explores and illustrates a different understanding of the PM's role in facilitating and leading project team members to develop both ends of the knowledge continuum for themselves, their team, and the organization. This paper shows how PMs interact with their project team to facilitate the creation of knowledge. By adapting Nonaka's SECI model of knowledge creation, this research constructs a view of the PM as an individual uniquely situated to aid and drive the development of knowledge within an organization by appropriately facilitating, controlling and aiding in the conversion of the organizations explicit knowledge into tacit knowledge, and tacit knowledge into explicit knowledge within the project team. This research contributes to the current knowledge creation discussion by building a conceptual model that displays the knowledge creation process as part of an infinite loop, which enables a more dynamic flow of knowledge and places the Project Manager at the cross-roads between tacit and explicit knowledge. From this view, the PM facilitates and drives the flow of knowledge within the project team environment.

Viewing the PM's role in this manner contributes to both the academics and managerial bodies of knowledge. Academically, knowledge creation has not been viewed from the project management perspective. By presenting a new view of the role of the PM, a new stream of research can be undertaken to more fully define and understand the interactions of the PM, the project team, and other stakeholders. From a practitioner's perspective, a new understanding of their role in the creation of knowledge can help PM's refine, or re-define, the actions and practices employed in managing projects.

1.2 Research Perspective

The study of knowledge has focused on the development and transfer of knowledge itself (Nonaka, 1994; Spender, 1996). Treating knowledge as an entity, Nonaka and Takeuchi present and discuss the creation of knowledge between the tacit; the knowledge we hold internal to ourselves, and the explicit; external and codified or written knowledge. Spender builds on this work by positioning knowledge as a dynamic theory of the firm. We also find knowledge a growing topic among the literature on project management. Among the voices in this area are: Oshri and Newell who studied knowledge

management systems, and Newell, Bresnen, Edelman, Scarbrough, and Swan who explored the aspect of sharing knowledge across projects.

Explicit in these studies is the transfer of knowledge in some form from one person to another. Implicit is the assumption that this transfer "happens" as a natural course of business. There is no indication of responsibility. To this point, the responsibility of ensuring knowledge is created and transferred within or between organizations has been left to the individual. The literature provides tools, paths, and processes for these actions, but no definitive obligation by managers or leaders; rather the responsibility of these actions seems to be everybody's. There is no catalyst. No instigator of the creation, conversion, and transfer of knowledge from explicit to tacit, and the reverse.

1.3 Research Approach

The explicit "how" nature of the research question guides the research to a qualitative case study methodology (Eisenhardt & Graebner, 2007; Yin, 2009). A case study strategy is called for in this research for two reasons. First, the inductive nature of theory development is well suited for case studies. Second, case studies offer "rich, real-world context in which the phenomena occur" (2007, p. 1). Through the recurring cycle of data collection and analysis, the emergent theory is formulated and built.

1.4 Organization of Manuscript

This manuscript is organized as follows; Chapter 2 will review the literature concerning knowledge, Knowledge Creation Theory (KCT), and Project Management. In so doing, the researcher will set a foundation from which a new examination and view of the role of the PM will be conducted. Chapter 3 will describe and discuss the concept of the Mixing Valve and its practical use in the control of hot and cold water. Additionally, the concept of knowledge as a type of hot and cold water flow will be introduced. In this discussion the researcher will review and examine the various roles and expectations associated with the PM position. A new model will be presented from which to view the role of the PM. This discussion will lay the groundwork for the study methodology and research analysis. Chapter 4 will be a discussion of the research methodology. The researcher will present an inductive, qualitative case

study. By doing so, the researcher will build the model described in Chapter 3. In Chapter 5 the results and conclusions of the data analysis are discussed in reference to the proposed model and the Project Manager's role in organizational knowledge creation. The actions of the Project Manager are discussed through the lens of the four SECI model processes. Using quotes and examples from the research data, we see how the PM acts as a mixing valve, and drives the creation of knowledge in the project team environment. Chapter 6 presents the summary of findings, limitations and implications of this research, as well as the contributions to both practice and theory.

Chapter	Title
1	Introduction
2	Literature Review
3	Conceptual Model: The Mixing Valve
4	Research Methodology
5	Results and Discussion
6	Summary
7	References
Appendices	

Table 1: Manuscript Organization

2 LITERATURE REVIEW

Before exploring or developing a new way of thinking about the role of the project manager, we must have a frame of reference from which to build. The following is a review of the literature concerning knowledge, Knowledge Creation Theory, Project Management, and the Project Manager. In so doing, the researcher sets a foundation from which a new examination and view of the role of the PM is conducted.

2.1 Knowledge

The search for the answer to the question; "what is knowledge?" dates back to the earliest philosophers. In his essay "The Two Typical Theories of Knowledge," Alexander Philip (Philip, 1915) notes the early Greek philosophers "were endowed with a singular clearness of intellectual vision. They readily recognized that Knowledge was an intellectual process" (1915, p. 44). A key element is that the creation or acquisition of knowledge is a process. As defined by Pettigrew, a process is "A sequence of individual and collective events, actions and activities unfolding over time in context" (Pettigrew, 1997). Accordingly, in this research a process is defined as "a set of actions, that when combined in sequence, produce a recognizable outcome." When we view knowledge, especially its creation, in this manner, we provide the boundaries to study it. We understand knowledge is created by an instigating factor. It has a starting point; a place we look to and recognize as the beginning. As part of a process, we also understand knowledge creation leads somewhere; it is not a one-time, static occurrence, but rather part of a progression of development.

When considering knowledge, it is important to keep in mind that its creation does not appear on its own. Some may argue that we hold it innately, which is knowledge we just "have," like walking or talking. The researcher counters this argument with the argument that even these seemingly basic aspects of our selves are gained through the processes of experience.

Our knowledge is a representation of our experiences in the world (Philip, 1915). Without experiencing or observing (observation is a form of experience) an activity we fail to comprehend its

effect on us or the world. We learn to walk through a process of trial and error experiences. This process can be described as follows:

1. We experience the movement of our limbs.
2. We experiences what makes us move and or not move.
3. We observe others standing
4. We experience the sensation of standing
    a. First with the help of other
    b. Second by holding on to something
    c. Third by ourselves
5. We experience the moving of our legs as we have observed others do
6. We learn and remember what works and doesn't work
7. We KNOW how to walk.

Without the trial and error experiences, we would not learn and know how to walk. Merely seeing something for the first time, via video or photograph, does not automatically develop or create knowledge (Philip, 1915). At best, we derive a sensation from the presented image, but this is merely information; a data point that has yet to be combined in some way with other data points. Sensations are internal to us; they do not have a common point or frame of reference. Without a common nexus, the knowledge attained is incomparable to others (1915). Knowledge without a common frame of reference is NOT knowledge, it is only data to be stored until such a time as a common reference can be applied and compared.

As baby's we may see a picture of a landscape, but without another piece of data with which to combine it, it has no meaning. At some point in the future, we have an experience; such as a parent expressing the beauty of the landscape. Now we have a reference through which these two data points may be combined. As we grow and mature, the accumulation of data points throughout our lives provides easier and faster access to common references. We add data points like feeling the warm sun on our face, which provides favorable sensations. We smell flowers, which also provide favorable sensations. When we combine these data points, we come to "know" that the landscape we saw is beautiful. Likewise, if the sensations we experience are not favorable; the sun caused pain or the flowers smelled bad, our

combination of data points would lead us to the knowledge that the landscape is not beautiful. Either way, the picture of the landscape, in and of itself, is not knowledge until it is combined with other frames of reference.

The nexus of ideas and data is where the common understanding is developed and knowledge created. This implies a communication of ideas, thoughts, and meanings. Further, the communication of meaning implies a codification. By codifying our knowledge, we put structure and form to it. Classifying knowledge in this way was first presented by Polyani (Polyani, 1967), and has been accepted and used throughout the body of work concerning knowledge. When we codify our knowledge we create an image or reference; a data point which others can access. Once accessed, they can interpret it in combination with their own experiences. In this way we are able to communicate the thoughts, ideas, and (to some extent) meaning of our knowledge. This has come to be recognized as "explicit" knowledge. Examples include images, words, and the combination of them. Codification is the outward articulation of our personal understanding.

When we codify our knowledge, it is not lost to us. It remains internal to us, and according to Nonaka (Nonaka, 1994) creates new knowledge for us as well. Polyani (Polyani, 1967) refers to this internal type of knowledge as "tacit." The literature recognizes this type of knowledge as hard to articulate and personal in nature (Nonaka, 1994). Our mental model of the world is comprised of our tacit knowledge base (1994). These two types of knowledge make up the two main foundational constructs of knowledge. It is the interplay between them where we find knowledge to be created, and is the area where this research and discussion takes place.

2.2 Memory and Knowledge

Our ability to store and recall experiences from the past (memory) provides us with the ability to learn from these experiences. A simple example involves our experiences with the stove top. At some point in our past, we experienced (saw) the red glow and felt (experienced) the emanating heat from a stove top burner. While the knowledge of pain associated with the combination of these two experiences was tacit to our parents, and made explicit in the articulation of their warnings, we did not yet have the

personal experience of the pain. Once experienced (learned) for ourselves, the explicit knowledge shared by our parents became tacit knowledge to us, but in no way diminished the knowledge of our parents. This experience was stored in our memory for recall at a later time. Without memory, the tacit knowledge of a red, hot stove top equaling pain would be non-existent. We would be reduced to repeating the mistake of touching the stove top, and experiencing the pain of burned flesh, and therefore never learn from the experience.

Our ability to recall the stove top experience also allows us to apply the lesson learned to different, but similar, situations. We see a glowing ember in the fireplace and feel the emanating heat. Our memory tells us the combination of the two is painful, and we therefore should not touch them. Even though the direct experience is not the same, our ability to recall similar situations and adapt them to the current situation is our ability to learn. Without memory, this is not possible.

Organizational memory can be applied in this same manner. This is evidenced in the proliferation of the drive for knowledge management systems (KMS). These systems are designed to store and retain archived data. Storing and retrieving archived data is the same action we take when we remember something. In the case of organization, this memory recall is enabled through technology. The experiences of the organization are housed in its memory in the form of documents, reports, and other explicit knowledge.

The creation of documents throughout the lifecycle of a project is a means of conveying and communicating the knowledge developed. But the storage and maintenance of the documents provides a repository of knowledge only. The KMS then is the organizations memory that can be accessed and used by members from other areas to access the knowledge gained through the experience of others. These representations of past organizational experience are the explicit knowledge of the organization.

Rumelhart and Ortnoy describe the process of memory as associating various known internal schemas and allows us to remember and subsequently know things (Rumelhart & Ortony, 1976). The schema process provides an explanation of how we are able to make inferences about unobserved phenomena and come to correct conclusions, thus exhibiting knowledge through the correct application of

actions to a given situation. We can extrapolate the constructs of schema as presented by Rumelhart and Ortnoy to organizational knowledge, by viewing the organization as a single entity, and therefore sharing a single cognitive frame of reference, the organizations schemas are developed through shared organized actions. For example, the process improvement schema for an organization describes how that organization goes about improving processes.

An example can be found in the implementation of Lean methodologies. Lean is a process improvement methodology and thought process. It is based on the Toyota Production System, popularized through the published works of James Womack; "The Machine that Changed the World" and "LEAN Thinking" (J. P. Womack, 2007; J.P. Womack & Jones, 2004). The basis of this system is to eliminate waste in the manufacturing process. In order to do so, the organization must learn to think differently, and therefore develop new and different schemas.

In "The Machine that Changed the World," the authors describe how Taiichi Ohno (a Toyota engineer and one of the fathers of TPS) realized how western mass production methods would not work in Japan (J. P. Womack, 2007). This required a new schema for the production of cars. These schemata have been codified through numerous books and training material, and become part of the quality and process improvement efforts across a broad spectrum of businesses- from manufacturing to services, from food prep to finance, from the frontline to the front office.

The production floor codifies and captures their waste reduction schemata, which is then stored the organization's memory. These schemata include things like: "work on only one piece at a time until that piece is completed" and "do not start working on another piece until the last piece has been taken and accepted by the next step in the process."

A front office customer service manager, wishing to improve the processes in his department, accesses the organization's memory (KMS) and retrieves the schema for process improvement. He then applies the schema to his operation and realizes improvements. Since the two areas were different in their work processes, the schemata did not match exactly and slight modifications were made. This created new knowledge.

As organizational members use the organizations schemata, there may be an administrative-process improvement schema available. The administrative-process improvement schema would be different from the manufacturing-process improvement schema, which in turn is different from service-process improvement schema. Each of these would then be used with other schema, like the work-rules and social-work-interaction schemata, to create knowledge within the organization regarding improved administrative processes. The new knowledge could then be captured explicitly in written documents such as the organizations policies and procedures manuals. As the new explicit knowledge is disseminated throughout the organization and experienced by the organizational members, it is internalized by the individuals and converted to tacit knowledge.

Tacit organizational knowledge is manifested in the same manner- through the application of known and understood organizational processes. These are processes members of the organization perform with little or no explicit direction or instruction. For example, the common action of punching-in is a schema used without repeated instruction by hourly workers. Under this common schema, hourly employees will get not get credit for "work-time" before a set number of minutes before the official start time. While the explicit knowledge is represented in the Employee Handbook, the tacit knowledge is represented by multiple employees showing up to work at approximately the same time and going through the same procedures to conform to the stated guidelines.

2.3 Knowledge Creation Theory

As stated earlier, the creation of knowledge is, first and foremost, a process (Goel, et al., 2010; Nonaka, Toyama, & Konno, 2000; Von Krogh, 1998). We do not come to "know" a thing by merely hearing or seeing. Knowledge is created through experience, whether through the accepted sharing of others experience, or a combination of personal action and shared knowledge. The constructivist view, as discussed by Von Krogh, emphasizes that knowledge is not universal, but is tied to our personal experiences and senses (Von Krogh, 1998). We therefore create knowledge that is unique to us and it is the sharing of this internal knowledge when new knowledge is created. This has been characterized in a four step process (Nonaka, 1994; Nonaka, Toyama, & Konno, 2000; Nonaka, Toyama, & Nagata, 2000;

Nonaka & Von Krogh, 2009), where the knowledge is created first through Socialization, then by Externalization, followed by Combination, and moving to Internalization (SECI) (Nonaka, Toyama, & Hirata, 2008). Like all processes, the knowledge creation processes is influenced and managed through the manipulation of resources (Spender, 1998). As resources are applied to the process, the organizations body of knowledge, conversely, applies meaning to it and therefore, transforms it into something new.

An individual's inability to articulate his or her tacit knowledge (their justified beliefs) is one reason why the Project Manager's role is important. It is the job of the PM to move the project participants and team members along the continuum from explicit to tacit knowledge. When viewed in association with the correspondence doctrine; that organizational realities are represented internally through their correspondences, such as reports and other documents (Von Krogh, Nonaka, & Aben, 2001; Von Krogh & Roos, 1995), the PM must provide context to the knowledge provided and therefore turn mere information into usable knowledge.

Implied in the above, is the idea of a social network structure among team members. As such, the PM is the focal point within the network. A Project Network Structure model proposed by Ayas and Zeniuk (Ayas & Zeniuk, 2001) enables tacit knowledge to be made explicit among the team members. This model is also consistent with the SECI model, in that both provide an avenue or process through which the tacit knowledge of all team members can be captured, documented, and converted to explicit knowledge for the benefit of the team. When this is accomplished, we can conceive that project costs and cycle time will be reduced (Julian, 2008). By reducing project cycle times and costs, the organization gains and develops greater flexibility. It enhances their dynamic capability to meet the challenges of the marketplace.

Knowledge, its attainment, creation, and use, are also processes (Nonaka, Toyama, & Nagata, 2000), and effectively managed processes provide organizations with the ability to adapt to environmental changes; regardless of the pace of the change. Adapting knowledge to a different or changing environment requires organizational participants to learn and convert existing knowledge into new internalized knowledge that meets the needs of the situation and benefits the organization.

Figure 1: Explicit - Tacit Knowledge Linear Model (adapted from Nonaka & Von Krogh, 2009)

Nonaka and Von Krogh explore the process of organizational knowledge creation. They make the argument that "all tacit knowledge remained embodied, forever locked away in people's neural networks" (Nonaka & Von Krogh, 2009). In their paper, they propose a continuum from explicit to tacit knowledge (Figure 1), and our state of knowledge can be at any point along this line. They argue that knowledge, an experience of discovery for example, resides within the scientist (tacit), becomes general scientific knowledge (explicit) and moves along a continuum to become independent from the creator. Their linear view however, does not provide for any type of catalyst or intervention. It assumes we move along the continuum as individuals.

As previously stated, knowledge is converted through a defined process. First presented by Ikujiro Nonaka in 1994 (Nonaka, 1994), and later refined by others (Nonaka, et al., 2008; Nonaka, Toyama, & Konno, 2000; Nonaka, Toyama, & Nagata, 2000; Nonaka & Von Krogh, 2009) the theory describes and defines a four step process through which our experiences are converted into knowledge. The four steps are: 1) Socialization (S), where tacit knowledge is shared and combined with other tacit knowledge; 2) Externalization (E), where tacit knowledge is made explicit; 3) Combination (C), where explicit knowledge is combined with other explicit knowledge; and 4) Internalization (I), where explicit

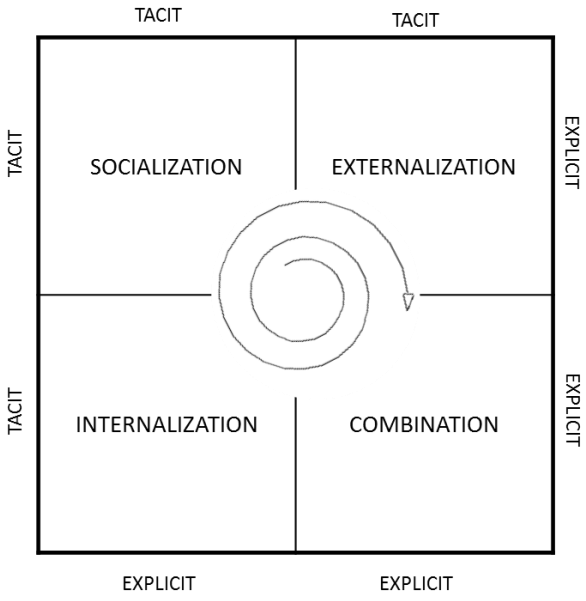

Figure 2: SECI Model (adapted from Nonaka, 1994)

knowledge is made tacit. Each step in this process is required and exhibited in project management actions.

"Socialization" refers to the creation of new tacit knowledge. In describing the Socialization process, Nonaka (Nonaka, et al., 2008) uses the example of Honda Motor Company and their quest to build a vehicle for the European market. In order to "know" the needs of the market, they sent a team of engineers to learn about it by first living there, and learning how Europeans live on a daily basis.

In this same vein, the PM, above all team members, needs to be adept in the "socialization" of knowledge creation. He needs to be able to acquire tacit knowledge through his own experiences, and learn about the tacit knowledge of other team members through direct interaction and observation.

But the PM must also be cognizant of the tacit knowledge of others. In doing so, the PM brings team members together, in both formal and informal settings so all team members can learn from one another in face-to-face situations. In this way, as the project team members (PTM) gain experiences, assigned and provided by the PM, these experiences are converted to tacit knowledge as contextual understanding is applied.

The "externalization" of knowledge refers to coherent communication of tacit knowledge to others. Nonaka describes this as taking place in the form of teams explaining a product concept, or workers describing how to do something in the form of training manuals (2008).

The same sorts of actions occur in the team setting and are directed through the efforts of the PM. Externalizing the knowledge of the team is a key skill for PM's in that they must be able to communicate personally, in both a group and one-on-one manner, with team members. Through personal interactions, PMs explain and contextualize the explicit knowledge, and as the leader and facilitator of team activities, the PM also works with the project team members to draw out the tacit knowledge of the team members and make it explicit.

"Combination" refers to the creation of "explicit knowledge into more, complex and systematic sets of explicit knowledge" (2000, p. 9). Computer communication networks are a mode of this knowledge creation. The emphasis on Knowledge Management Systems is an example of this type of

creation. The problem is the technology based KMS does not provide context. PMs, as project team leaders, can act as the technology substitute for the purpose of combining sets of explicit knowledge. As noted previously, project teams are often dynamic, fluid, and multi-functional; as team members convert their tacit knowledge into explicit knowledge through the externalization process, the PM would then act to situate this new knowledge form so that it can be combined with other established sets and forms of explicit knowledge.

"Internalization" refers to the embodiment of knowledge from the explicit into the tacit. Granted, this action is primarily self-contained within the individual, but the PM is a key component of this process of knowledge creation within the team environment. Through his actions, the PM aids and facilitates the internalization of created explicit knowledge by ensuring it is shared with the project team. While the conversion into tacit knowledge by the team members (Nonaka, Toyama, & Konno, 2000) is internal to them and cannot be forced or specifically directed by the PM, the PM nonetheless is the key means by which, and through whom the relevant shared knowledge is ascertained.

As noted by Nonaka, the creation of knowledge is a continuously building process. As we move through the creation cycle, each stage builds on, and is elevated from the previous. The continuous elevation results in an upward spiral wherein our knowledge and the knowledge others is continually expanded. On a team level, the created knowledge would also continue to be elevated as the Project Manager ensures it is shared with other team members, and even outside the team. These actions then create additional new knowledge as knowledge is flowed through the team, or allowed to flow to other teams.

Building on this framework, Nonaka, Toyama, and Konno (Nonaka, Toyama, & Konno, 2000) recognize that context is an important aspect in the creation of knowledge. We may share the same explicit knowledge but unless we also share the same context of that knowledge, we will "know" different things. "Context," refers to the set of circumstances or facts that surround a particular situation or process where they occur (Dictionary.com, 2012). It is the environment, the place, where meaning can be shared and jointly understood.

The combination of the modes of knowledge creation, a place for it to happen, and the continuum through which it occurs provides the constructs of our theory. It is through this lens that we examine and explore the role of the project manager in knowledge creation.

2.4 Knowledge Brokers

Nonaka's conceptualization of knowledge creation implies we move through the creation steps as our needs or the situation dictates; that is without any specific guidance. But having someone to guide us through the knowledge creation process is not altogether absent from the discussion. Authors such as Andrew Hargadon, Simon Burnett, Nory Jones, and Jonathan Lomas note Knowledge Brokers as guides in the knowledge creation process (Burnett, Brookes-Rooney, & Keogh, 2002; Hargadon, 1998a, 1998b; Hargadon & Sutton, 2000; Jones, Herschel, & Moesel, 2003; Lomas, 2007).

Hargadon equates Knowledge Brokers to factories, whose output consists of innovative solutions. By spanning multiple markets, they combine existing technologies in new ways to create new solutions. Their strength comes in that they are able to bridge the gap between disparate or disconnected groups. In so doing, they are suitably positioned to transfer ideas from existing knowledge bases to new areas and create new knowledge (Hargadon, 1998a).

An implied concept in his description is a sense of that Knowledge Brokers are rogue idea generators (Hargadon & Sutton, 2000). Their contributions come from an inherent drive (and are supported best by organizational practices that exploit this drive) to share their ideas with others. In Hargadon's model, Knowledge Brokers simply bring people together. An important and vital role in the knowledge creation process, but somewhat limited and disconnected from the team or group environment, is where the actual creation occurs. Similarly, Lomas, whose study in health services positions Knowledge Brokers "between the worlds of research and action (Lomas, 2007, p. 131)," and in doing so also positions them outside of the group or team creating the knowledge or performing the tasks.

In neither description by Hargadon or Loams is there a discussion of the assignment of responsibility. Knowledge Brokers, from the viewpoint of these authors, are not specifically responsible for creating the environment of knowledge creation. They are essentially consultants who provide a

channel, or a means, through which knowledge from one area is transferred to another. While the transfer of knowledge from one to another (individual or entity) will create knowledge as in Nonaka's SECI model, the organization or individual must be prepared to accept it. As an outsider, the Knowledge Broker is not responsible for creating this environment. That task is the realm of organizational leadership.

But we cannot dismiss the concept of Knowledge Brokers wholesales with respect Project Managers. PM's, as the leaders of their teams, share many of the attributes described in the Knowledge Broker literature, and these descriptions help to inform us regarding the nature of their work and behaviors to be sought as we study the role of the Project Manager in knowledge creation.

2.5 Knowledge Management

To have knowledge implies an ability to manipulate and use it; in other words, to manage it. In their pursuit to manage knowledge, organizations have developed Knowledge Management Systems. Knowledge management is made of three elements: data, information, and knowledge (Goel, et al., 2010). One builds on the other. Data is the raw form, and is made up of facts and events. Information is organized data, based on the meaning or value associated with it. Knowledge comes to the user of information when context is applied to it. The management of this system- from data to knowledge is analogous to organizations' pursuits of competitive advantage.

Although simple in concept, the management of knowledge is complex. Goel, Rana, and Rastogi state it must be supported through strategy, leadership, culture, measurement, and technology; each in alignment and supporting the others. Therefore, as stated by Goel, et al; "Knowledge Management is an integrated, systematic approach to identifying, acquiring, transforming, developing, disseminating, using, sharing and preserving knowledge relevant to achieving specified objectives (2010, p. 107)." However, knowledge management systems deal with the 'explicit' knowledge only (Goel, et al., 2010). This makes sense because the tacit knowledge is internal to the individual. As such, there are various means to capture and manage the explicit knowledge within an organization.

The main vehicle for capturing and managing project based knowledge is in the form of "lessons learned." Also known as post-project reviews, post-mortems, and after action reviews, the capturing of

the lessons learned during a project is an attempt to document what did, and did not, work and why. Lessons learned documentation is the most prevalent methodological attempt at turning tacit team member knowledge into explicit organizational knowledge. When completed, the knowledge, in the form of documents, is archived for retrieval and review at a later date. The purpose is to provide the organization with a usable memory, and learn from past mistakes and triumphs. The biggest issue with this stage of knowledge creation, is that it is seldom accomplished (Ajmal & Koskinen, 2008; Julian, 2008; Newell, Bresnen, Edelman, Scarbrough, & Swan, 2006; Oshri, Pan, & Newell, 2006), and even when it is accomplished, the problem still exists of its retrieval and interpretation.

2.6 Knowledge Management and the Team Environment

A part of this challenge in knowledge management stems from the tacit nature of knowledge and its ties to a particular context (Buchel, 2007). This "tacitness" of knowledge is one reason it is important to have someone responsible for managing and facilitating the flow of knowledge through the team environment

In looking at product teams, Buchel sees the creation and transfer of knowledge as the sole responsibility of the product team in the development of new products. New Product Development team, like other project teams (temporary endeavor, with a specific goal, and identifiable start and stop points) must manage and interact with multiple functional areas. According to Buchel;

> "Dense team networks foster shared understanding that leads to the creation of knowledge within the team, which is necessary to mobilize innovative action and establish communication channels across the team that lead to the implementation of innovative ideas."

This speaks to the team as a single entity, and highlights the importance of the team operating as a single, aligned unit. Without alignment, a team is leaderless, and a leaderless team then becomes dysfunctional and will not be able to fulfill this requirement of knowledge creation and transfer. Buchel calls for a leader to actively push for greater team-building so the links between team members are strengthened (2007, p. 48). Furthermore, Buchel notes that a team leader must "have the skills, and

understand the right timing, to deal with potential conflicts." Issues like opposing views on strategic direction, differing interpretations of data, or something as simple as not receiving meeting information, are examples of conflicts that may arise between team members. If left unchecked and unresolved, team conflicts create barriers to communication and the creation of knowledge. Therefore, the Project Manager's role, as a facilitator, a "valve," for the flow of knowledge within the team is elevated.

2.7 Knowledge Properties

In the preceding discussion, knowledge is associated with certain attributes or properties. It's "creation" according to Nonaka, et al implies some sort of physical, tangible properties. As part of a "systematic approach," Goel, et al, imply it can be controlled and manipulated. While Hargadon's "Knowledge Brokers" concept implies it can be traded or transferred.

The use of metaphors when discussing knowledge is not new, nor is it uncommon. In fact, Dan Andriessen succinctly describes the purpose and reasons why we use metaphors on this topic (Andriessen, 2008). Nor is there any argument made by the researcher countering these above attributes, but rather an acknowledgement to the fact that knowledge is a concept that is best understood through metaphor.

Andriessen provides us with several metaphorical categories used in the discussion of knowledge: Knowledge as 1) Resource, 2) Capital, 3) Assets, 4) Property, 5) Stuff, and 6) Thoughts and Feelings. In each of these categories, knowledge is attributed some form of characteristic, and it is that lens through which authors portray knowledge.

While Andriessen categorizes Nonaka, et al (2008) in the "Thoughts and Feelings" metaphor, their portrayal of knowledge creation as a process implies movement and flow. We can further envision "Knowledge as Water" (2008), and as such attribute the properties of water to knowledge. As we will see below, the "Knowledge as Water" metaphor will allow us to conceptualize a flow of knowledge through a mechanism for distribution in the project team environment.

2.8 Project Management

The organization of work can be traced back to through time. The construction of buildings, bridges, and towns; the cultivation of food and care of animals; the management of governments and societies are all documented throughout history. These adaptations to the environment took, and continue to take, coordination and management. While the ongoing care and maintenance of these examples is not, by definition, a project, their first initiation and start up to the point of continuous "business as usual" is.

The Project Management Institute (PMI) defines a Project as "…a temporary endeavor undertaken to create a unique product, service, or result…" It further defines Project Management as "…the application of knowledge, skills, tools, and techniques to project activities to meet project requirements….(PMI, 2008)." Effectively adapting an organizations process from one state of being is a "project" and by applying specified skills and knowledge, the person or people assigned to the effort are the "project managers."

Until relatively recently, what was missing from the realm of project management was a codified body of knowledge and structured application of that knowledge. This began to change in 1969, with the founding of the Project Management Institute. The development of project management best practices can be found in the form of the PMI "Project Management Body of Knowledge" (PMBOK). Currently in its fourth edition, the PMBOK aggregates PM practices and supplies project managers and project management practitioners with a guide and offers suggested tools to be used for successful project management. The PMBOK outlines steps recognized by experienced PMs in an effort to provide guidance and foster successful project efforts.

These steps are organized into five phases of a project. First is the "Initiating" phase. In this phase, tools and steps are suggested, such as project definition and authorization development. Second is the "Planning" phase. In this phase, PM activities include scope definition, project objective refinement, and course of action definition. Phase 3 is the "Executing" phase. In this phase a PM carries out the processes needed to complete the defined work. The fourth phase is "Monitoring and Controlling," and includes activities such as tracking, reviewing, and regulating project and project resources progress. The

fifth and final stage provided by the PMBOK is "Closing." In this phase the PM conducts activities to formally end and bring closure to a project (PMI, 2008).

As a discipline, project management lacks a firm theoretical base (Koskela, 2008). When compared to other areas of management, operations, and organizational study, the area of project management practice is less academically developed. The academic literature is sparse regarding a broadly accepted theory of project management, and most theories are broad in nature and attempt to explain the whole of project management, and apply either theories of management or operations. Koskela and Howell's analysis of project management theory argues that current theories of project management are obsolete (2008), and the underlying theoretical foundation is actually bi-modal, or often viewed from one of two separate established theoretical subjects . They link the current project management body of knowledge to one of project and one of management.

From a "Theory of Project" view, Koskela and Howell associate project management with operations transformation theory. In essence conceptualizing Project Management as a type of production to be managed and therefore conforming to the transformation view (2008). This is understandable in that projects are, for the most part, undertaken to transform or change something from one state to another.

From a "Theory of Management" view, Koskela and Howell look at three areas of management: planning, controlling, and executing. Each of these areas are represented and discussed in the PMBOK (2008) as vital parts of managing a projects. In their view, "project management seems to be based on three theories of management: management-as planning, the dispatching model and the thermostat model (2008, p. 6)."

Through their analysis of project management theory, Koskela and Howell argue that the theoretical base of project management put forth at the time was lacking, and that complimentary or better theories could be found. The importance of this presentation is that it reinforces the need for substantial theories that can change the project management paradigm.

Contrary to Koskela and Howell is the claim put forth by Jugdev, who claims the theoretical foundation is still in its infancy (Jugdev, 2008). His analysis of the project management literature

provides several dominant themes in project management publications. These themes include examining project management from the temporary organization, the optimization school, network planning techniques and success factors. Additionally, theoretical views include those rooted in engineering, mathematics, and the social sciences.

The fact that projects are short-term and temporary, emphasizes the need to share and convert knowledge. Due to the temporary nature of projects, the project personnel tend to be fluid, as does the knowledge they bring. The fluidity of personnel means the knowledge base of project teams can change, and can be exacerbated in a project-based or matrixed organization (Bresnen, Goussevskaia, & Swan, 2004). This change is not only from project to project, but within the same project as it moves through the various project phases. It is not uncommon for team members to join and leave the project team effort based on the needs of the project and/or organization. PM's who actively seek to capture, share, and create the project and team member knowledge can ease their efforts through the project and position the organization for future success.

Another stream of research marries the theories of knowledge management and the knowledge-based theory of the firm to project management. For the most part, this research focuses on the application of knowledge management and its development in organizations through project management practices. Common among these discussions and proposals of project management is the emphasis on the over-arching project or the different project activities, with the goal to provide a framework for project success and the extension to organizational success. Missing is a theoretical discussion or model of the role of the PM in relation to knowledge creation.

2.9 Project Success

The most common and accepted view of project success is centered on what is known as the "triple constraints" of time, cost, and quality. Projects are often deemed successful if they are completed within the established timeframe (on-time), do not accede the established cost constraints (on-budget), and meet the established quality parameters (on-quality) (PMI, 2008). These constraints, while measured

and discussed individually, are interwoven and rely on each other. The lack or failure of one, impacts each of the other two.

Since a project is defined in terms of time, "a temporary endeavor," the constraint of time is an important aspect. Often other actions are contingent on successfully meeting the time constraint. A road cannot be extended until the bridge is finished; tenants cannot occupy their office spaces until the building is completed; we cannot receive the new flu vaccine until it is developed.

The time constraint also has direct impact on the cost constraint. Missing the time deadline results in the extension of the work involved; more work time is required and costs to all parties increased. Required project personnel may be held over, and increase the labor costs applied to the project, or when the project is ready for new personnel, the desired personnel may not be available, and therefore the quality of the work may suffer.

Project costs are a significant factor in the definition of project success. If cost constraints are not met, then the resulting financial impact to the business could significantly curtail the smooth functioning of the project itself. Required personnel and capital may be held back or no longer available because the price of the attainment cannot be met. This in turn, can result in work delays while an acceptable substitute is found, as well as reduced work quality due to the need to employ a less skilled worker.

The concept of quality when referring to projects is nebulous and comprised of multiple interpretations, and is often dissected into different levels- high, medium, low. However, one person's interpretation of high quality may not meet the same standard as someone else's. For the purpose of this discussion, we will define quality as "meeting the stated project requirements."

Furthermore, it is significantly impacted through the first two constraints- time and cost. But quality directly impacts these two constraints as well. For example, if a builder uses a low quality (less than optimal, but meets the requirement) cement mixture, the resulting failure may very well require re-work for the cement crew, which in turn increases costs and the length of time required to complete the project.

The management of all three constraints during a project is one of the responsibilities of the PM. His or her knowledge concerning the constraints can be the determining factor in project success. Knowledge such as: who to assign to specific tasks, how those tasks should be carried out, and when to apply pressure for their completion are part of the PM's internal knowledge base; gained through previous experiences.

Like much of the project management literature, the literature concerning project success offers and array of perspectives and definitions. What appears to be consistent is the opinion that success depends on a person's point of view. Shenhar, Dvir, Levy, Maltz offer dimensions of project success including project proficiency, customer impact, business success, and future preparations (Shenhar, Dvir, Levy, & Maltz, 2001). In 2003, Westerveld explored the link between success criteria and critical success factors. In this research he identifies five other criteria for success in additional to the traditional project results (time-cost-quality). They are: client appreciation, project personnel appreciation, user appreciation, contracting partner appreciation, and stakeholder appreciation (Westerveld, 2003).

2.10 The Project Manager

Unlike the practice of law, medicine, or dentistry, the practice of project management is not bounded by state regulation or oversight. As such, managers of projects are not licensed, and the practice is not considered an official profession. The practice of project management is more in line with public accounting, financial planning, and engineering. Like these professions, they are governed through certifying bodies that, through defined and accepted standards of practice, provide recognized certifications. Attaining the "Certified Public Accounting (CPA)" designation is not a requirement for the practice of accounting, nor does a financial planner need a "Certified Financial Planner (CFA)" after her name in order to provide such services.

What these designations do provide is comfort and a sense of professionalism to the business environment. Through these designations, businesses receive a sense of assurance the people they have employed have the knowledge and skills to fulfill the tasks they have been assigned. The designations are indications the individual has received education and acquired a certain amount of practical experience.

The certifications indicate the individual recognizes best practices and conducts their business according to a stated ethical standard.

PMs attain the same status by acquiring their PMP (Project Management Professional) designation. It indicates the individual has received education in managing projects. They have years of practical project management experience, and are held to specific ethical standards.

The Project Management Body of Knowledge Guide, Fourth edition, describes the role of the PM as follows:

> "The project manager is the person assigned by the performing organization to achieve the project objectives. The role of the project manager is distinct from a functional manager or operations manager."

Additionally, it provides a list of required characteristics an effective PM must possess. They are:

- Knowledge (what the PM knows about the project),
- Performance (what the PM is able to accomplish while applying knowledge), and
- Personal (the behavior of the PM related to project activities) (PMI, 2008, p. 13).

Therefore, the PMP designation conveys a level of knowledge; knowledge concerning best practices; knowledge of management of (both human and capital) resources; and knowledge concerning the successful management of projects. This knowledge has become coveted in business, and project management continues to grow and become a best practice in its own right. Good project management practices are seen as an essential part of the business environment, and successful project management is recognized as an important factor for business.

As a project progresses, it is the duty of the PM to ensure the required tasks are performed correctly and the quality of the project is maintained. The traditional PM functions concentrate on planning, organizing, directing and controlling resources. The typical perspective of the PM has been to oversee and manage these project activities to achieve goals associated with assuring the project is on-time and on-budget (Disterer, 2002).

The leadership perspective of the PMs role is focused on the human interactions and processes (Kolltveit, Karlsen, & Gronhaug, 2007). Essentially, the PM is the leader of the project. In this role, he uses aspects of leadership, process, communication, change, and team theories to apply tools and methods for project success (2007).

Toor, Arain, and Hong present the role of the PM in regards to Design Management (Toor, Arain, & Hong, 2009). Focusing on construction projects, they present projects as fragmented, and as such, separate the construction effort from design, and specialist skill sets like planning, architectural treatment, interior design, and others are all embodied in different people. These various skill sets then drive the need for the PM to be aware of numerous practices and communicate them to all parties, and therefore embodying the roles outlined by Kolltveit, et al above.

As a member of the Project Management Office (PMO), the PM is an important figure as a controlling mechanism in the capture and creation of project knowledge (Julian, 2008). J.L. Julian explores the role of PMO leaders and their ability to facilitate cross-project learning. From this view, the facilitation of learning by the PM, as one of the PMO leader's, is not only from an inter-project issue, but also one of intra-project concerns.

Whether inter-, or intra-project, social practices and informal networks are vital channels in the transference of knowledge (Nonaka, Toyama, & Konno, 2000). Newell (Newell, et al., 2006) suggests the social practices could be more effective than the capture of lessons learned (a best practice tool recognized among project management practitioner, yet not used to its full advantage). The aspect of knowledge creation occurring though the sharing of ideas and joint work, as presented by Bresnen (Bresnen, et al., 2004), provides additional evidence to support this view.

Eppler and Sukowski describe several tools used in the elicitation, categorization, and aggregation of project team knowledge. These tools include:

- **Team Matrix and Expert Map**: a framework to assess the knowledge level of the team and where it resides.

- **The Pyramid Principle**: a tool to help the PM align and coordinate knowledge development activities
- **The Toulmin Map**: this tool is used to systematically map the teams present knowledge
- **Visual Protocols** or **Meeting Compasses**: these tools are aimed at improving the transparency of issues. Overheads or Flip-charts are used to map the issues against the key meeting agenda items.
- **Case Study**: a team's experiences and insights are captured and made explicit.
- **Lessons Learned Inventories**: team member's central insights are captured and made available to the organization through a common knowledge management database.

We recognize the use of tools to capture and convert tacit team and individual knowledge into explicit knowledge as a success factor in managing and completing projects.

3 CONCEPTUAL MODEL

Based on the foundation developed in Chapter 2, we will now consider a new conceptual model of the role of the project manager. Chapter 3 describes and discusses the concept of the Mixing Valve and its practical use in the control of hot and cold water. Based on this understanding, the concept of knowledge as a type of hot and cold water flow will be introduced, and through this discussion the researcher will examine the role of the project manager. A new model will then be presented from which to view the role of the PM. This discussion will lay the ground work for the research methodology and analysis.

3.1 Mixing Valves

Often referred to as a Thermostatic Mixing Valve (TMV) mixing valves are common devices (Figure 3), used to regulate the mixing of hot and cold water for the purpose of tempering possible scalding water and prevent it from being delivered to a faucet (Honeywell, 2004; Scott, 2003-2012; "Thermostatic mixing valve," 2011). Various configurations of systems using mixing valves can be used, for example; check valves may be installed to prevent hot water from entering the cold water flow, and cold from entering the hot water flow. Another feature of mixing valves includes the ability to select, or adjust, the high and low temperature ranges. Three basic ways to use TMVs is 1) to mix hot and cold water, 2) to maintain a constant supply in a closed system, and

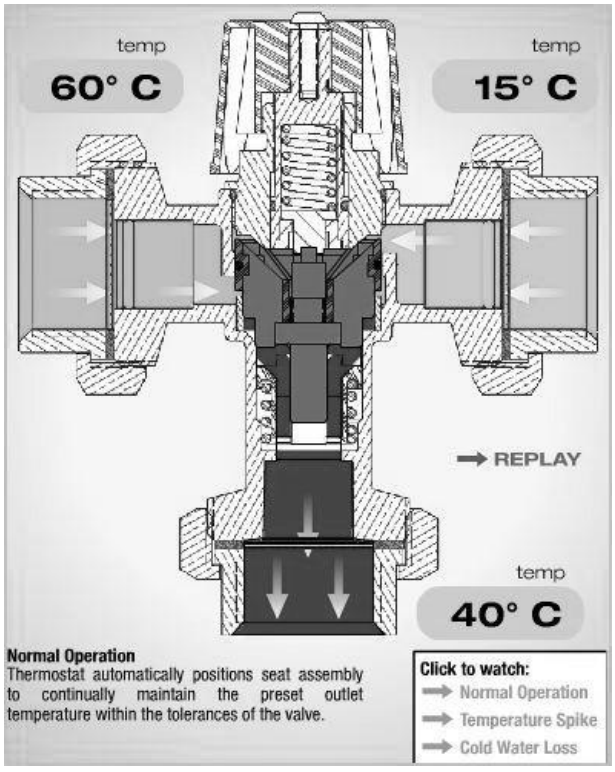

Figure 3: Mixing Valve (Honeywell, 2004)

3) to maintain a constant return temperature in a closed heating system (Honeywell, 2004). Below we examine how a project manager's role can be applied to each of these basic uses.

Mixing Hot and Cold Water- Explicit (hot water) and tacit (cold water) knowledge flow through the organization as they are applied. The PM is in a unique position to control the flow and delivery of the knowledge to the proper resources in the correct temperature mix. By doing so, they provide appropriate context of explicit knowledge so the receiving resource is not overwhelmed (scalded) with too much knowledge. By adding either their own tacit knowledge or knowledge from other sources, the mixture of knowledge is more acceptable and usable when delivered. If the explicit knowledge is delivered to the resource in its raw, high temperature, form, the user must temper it with his/her own tacit knowledge, find another sources of knowledge, or let it sit and wait until the temperature is cooled naturally and the knowledge can be absorbed and used.

The problem with allowing the explicit knowledge to be delivered un-tempered is twofold. First, there is no guarantee the user has the tacit knowledge available to temper the explicit knowledge, or knows where to find additional knowledge with which to mix it. If not, they must either acquire the knowledge or apply their own context. Again, there is no guarantee the application of the user's context will be appropriate or correct. The second is a matter of time. Projects are time sensitive endeavors. Tacit knowledge is acquired through experience. The time to acquire the needed amount of tacit knowledge for proper tempering may jeopardize the project timeline and cause ripples throughout the Work Breakdown Structure.

Maintaining a Constant Supply in a Closed System- In a closed system, knowledge is recirculated within the team. The PM role in this system is to not only to control and contextualize the flow of explicit and tacit knowledge from outside, but also control the flow of knowledge within the team environment. With the aid of knowledge management technology (a pump), the PM feeds and disseminates new and existing knowledge to the team. In this manner, the team is constantly supplied with the contextualization and knowledge from the appropriate source to ensure the needs of the project are met. Further, in a closed loop system, the new knowledge created is recirculated back to the contributing area. In this endeavor, the

PM converts the new tacit knowledge into explicit knowledge, tempered with her existing tacit knowledge and delivered in a form the contributing area can use and absorb.

Maintaining a Constant Return Temperature- By maintaining a constant return temperature in a closed heating system, the mixing valve helps to reduce the energy required in maintaining the systems temperature, and provides cost savings. The PM also helps to reduce project costs, again by providing recirculated knowledge with the proper context to the project team. By recirculating new and existing knowledge the team does not have to search for, or create, knowledge that already exists within the organization.

3.2 The Infinite Knowledge Loop

Instead of a linear perspective, as described above (Nonaka & Von Krogh, 2009), the knowledge continuum can be perceived as an infinite loop (Figure 4). As in Figure 1, the continuum consists of two sides; on one side of the loop is explicit knowledge, and on the other is tacit knowledge. However, in the loop model, knowledge is continuously created as it moves forward along the loop pathway, as opposed to being re-traced along the same linear path.

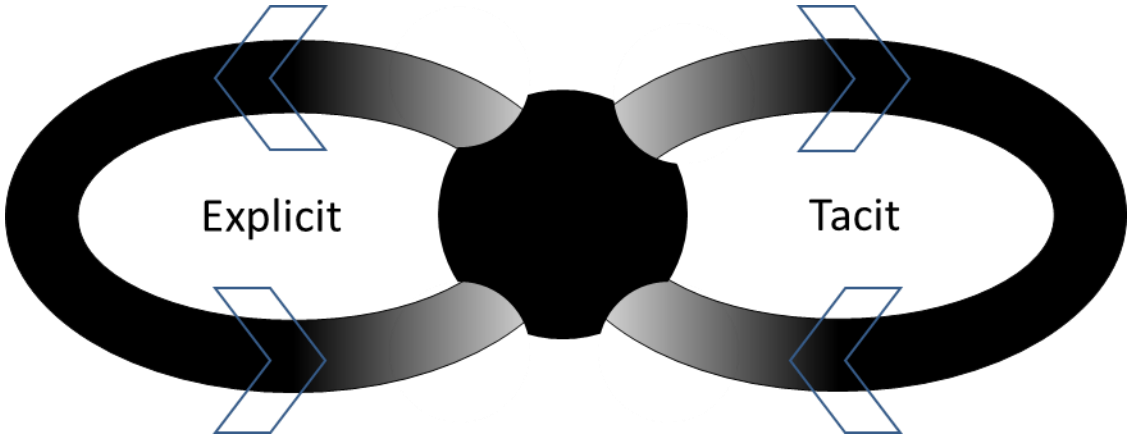

Figure 4: Explicit - Tacit Infinite Loop

If we begin in the upper portion of the tacit knowledge loop, we can envision a situation where we have newly developed tacit knowledge. As we acquire experiences, our tacit knowledge is more fully developed and used more often. As we develop our tacit knowledge, we will eventually reach a point where we can begin to codify it. The codification converts the tacit to explicit, thus moving us to the

explicit loop. Now that our tacit knowledge has become explicit, we can refine and articulate it more extensively. The movement along the explicit loop creates new knowledge as we gain additional experiences. Thus the explicit knowledge is refined and learned and turned into new tacit knowledge, and we begin again with the development of tacit knowledge.

3.3 The PM as the Mixing Valve of Organizational Knowledge

Even from this perspective, the assumption is that this is accomplished in a vacuum, but knowledge cannot be created in a vacuum (Nonaka, Toyama, & Konno, 2000). People are social animals, and the sharing of ideas is central to our interactions with others. Sharing ideas and thoughts fosters or seeds the creation of other ideas. Without the input of others our ideas and thoughts will wither and cease.

Even though we, as individuals, are able to gain experience, develop tacit knowledge, codify it, share it, and refine it without assistance or interaction of others, the laws of physics teach us that a body at rest stays at rest without the introduction of force, and so without the addition of an outside influence; knowledge remains within the confines of its container. Our ideas, thoughts, and knowledge gain energy from others.

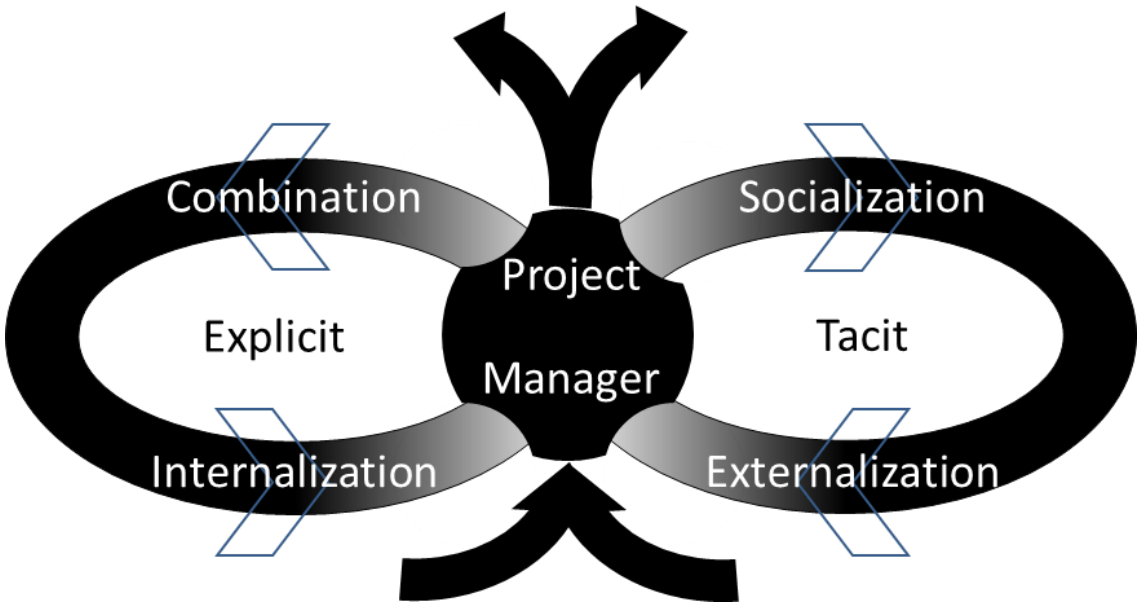

Figure 5: Infinite Loop- PM Nexus

In order to facilitate the advancement of knowledge throughout an organization, there must be some sort of catalytic application. The PM is the personification of energy in the flow of knowledge. We can therefore, position the PM at the nexus of explicit and tacit knowledge (Figure 5). By adding the PM to the model an energy source for knowledge flow and creation to be channeled and combined is now provided.

3.4 The Environment

With the addition of the PM to our view of knowledge creation, we imply a specific environment within which knowledge is created- the project team. It is within this environment the PM has the most significant and important influence. It is through their actions in accordance with their role as the leader that knowledge creation in the environment is directed and enhanced.

If supplying the energy for the flow of knowledge was all that is needed, then the technological aspects of KMS would be more successful. But technology does not provide context, and context is a vital aspect of knowledge creation (Nonaka, Toyama, & Konno, 2000). In Japanese philosophy, this is known as 'ba'; it is context within which meaning is associated, or a "place" as described by Nonaka, Toyama, and Konno. Ba provides the location, or environment, for the interaction of individual thoughts. It is the interactions between the PM and team members, and between team members themselves that creates knowledge. According to Nonaka, et al, the concept of 'ba' and the SECI process of knowledge creation go hand-in-hand:

Originating ba & Socialization: In this space, face to face interactions occur. This is important for the socialization process. Here is where tacit knowledge is shared and joined between individuals. One-on-one coaching sessions between the PM and team member are places where this occurs.

Dialoguing ba & Externalization: This is also a face-to-face interaction space; however, this is a collective, plural space. Individuals share their tacit knowledge with others through dialogue. Team meetings and group presentations are examples of where this occurs.

Systemizing ba & Combination: Like dialoguing 'ba', this is also a collective space, but is focused on the sharing and combining of explicit knowledge. Because of its explicit knowledge focus,

this can be a virtual space, such as websites and shared-drives. Findings and sharing these spaces is a responsibility of the PM.

Exercising ba & Internalization: In this space, knowledge that is created is justified by being compared with reality. This manifests itself in dry-runs of project solutions, data capture, and lesson learned analysis. All of which are common or recognized best practices of the PM.

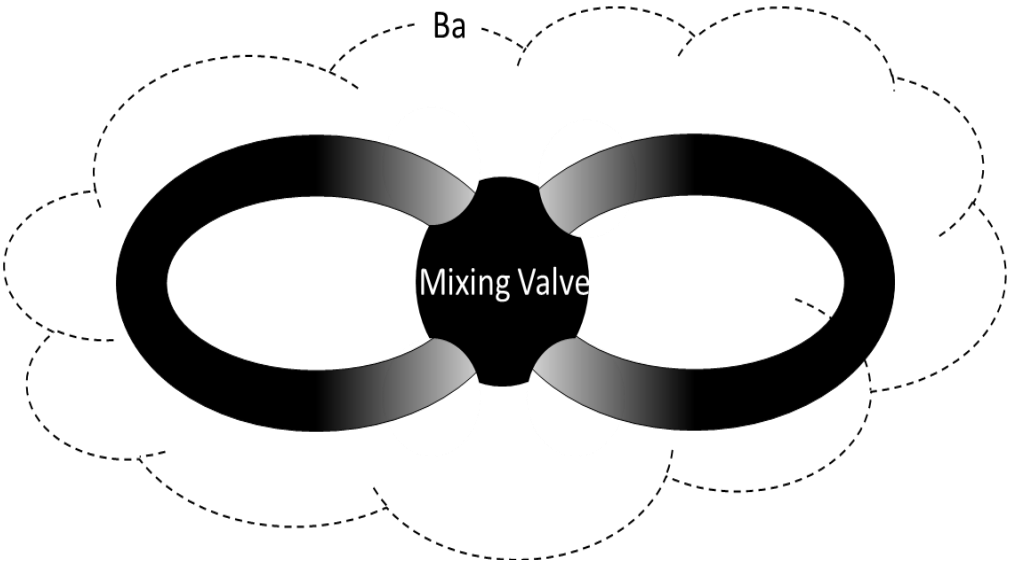

Figure 6: Ba and Mixing Valve

With this in mind, we can further envision how the concepts of a 'mixing valve' and 'ba' can work together (Figure 6). The mixing valve is a tool used so the elements passing through it are combined correctly. Ba is a general place with no structure. It is essentially formless, with no defined boundaries. The two may work together, the mixing valve within Ba, so as to give the interactions of individual thought greater force and direction in the process of creating knowledge. The PM's actions act as the mixing valve in the project Ba. Combined with the interactions of project team members, a defined pathway for the creation of knowledge within the team is provided.

3.5 Valve vs. Broker

It is not only the PM's ability to provide context that is important, but to provide the proper context to team members that distinguishes their role in this model as a "mixing valve" rather than a

facilitator or knowledge broker (Hargadon, 1998a). Mixing valves are internal to their system. They are part of it. They alter the temperature of water delivered to the user by controlling the flow of one source of water, while allowing another source to continue. If the water in the system is not controlled, then the product delivered to the user is not immediately usable, and requires additional action to be applied in order for it to be usable. The same can be said regarding knowledge. If knowledge (tacit or explicit) is delivered to a team member that has not been altered in some way, that team member must search for a usable meaning and context and then apply it so they can begin the process of creating their own knowledge. By acting as a mixing valve, the PM aids in the delivery of both tacit and explicit knowledge. By appropriately altering it or its delivery, they provide the proper context to it and enable the receivers, the project team members, to use it without spending time waiting or searching for meaning. The knowledge received is in such a form that they are able to use it as needed.

Knowledge brokers, as described by Hargadon, "…are modern invention factories; their output consists solely of innovative solutions to novel problems" (1998a, p. 210). By viewing the PM as a mixing valve, we envision them as part of the project management and knowledge creation process within the team. Since they are already part of the project team and already possess a certain amount of knowledge about the area in question, they are uniquely positioned to exploit their already accumulated tacit knowledge. If we view them as brokers, we keep them separate from the team. Their creation and accumulation of tacit knowledge and the availability or location of explicit knowledge requires additional learning time.

Viewed as brokers, the PM's focus would be spread throughout the organization or in other areas outside their project realm. While this may well be an additional role and duty of the PM, the PM's active participation in providing the regulated context to knowledge creation is made more concrete with the mixing valve analogy.

3.6 Creation Barriers

Projects are social activities involving multiple people with various skills and knowledge. When a PM does not have the tacit or explicit knowledge, the void is filled by interacting with others who have

the required knowledge. From this view, a key role of the PM is to transform explicit organizational knowledge into personal (and therefore organizational) tacit knowledge, and effectively apply this knowledge within the framework of the project. But the creation of knowledge within the firm is not an easy task. By situating the PM in the crux of the explicit-tacit loop, organizations can overcome or mitigate the barriers to knowledge creation (Von Krogh, 1998).

Von Krogh describes four barriers to creating knowledge in firms: 1) Legitimate language, 2) stories and habits of, and within, the organization, 3) formal organizational procedures, and 4) organizational paradigms (Von Krogh, 1998). Because of these barriers, the knowledge creation process is fragile. The failure to overcome any one of them can effectively impede, or halt, the process. Within the project framework, the PM is in a unique position to overcome these barriers and actively facilitate the creation of knowledge.

First, the PM is able to provide legitimate language. Effective communications is a cornerstone of good project management practice. Providing the team with the proper language and terms is a key to good communications. At the center of the communication matrix, the PM can also provide adequate translation and interpretation to team members. Thus, through active participation with the team, and a focus on facilitating the knowledge creation process, the PM can be attuned to, and foster, the correct project language. Second, stories of failure, improper or ineffective routines can hamper the creation of knowledge. Understanding this barrier, the PM can actively get to the truth of the matter. What were the reasons behind the failures? What could be done differently to ensure proper and effective completion of tasks? By keeping the knowledge creation hat on, the PM is open and able to deliver the team clarifying information and new routines. Third, by understanding how the organizations formal procedures help or hinder knowledge creation, the PM again can take proactive steps to mitigate the detrimental effects or enhance the positive aspects. Fourth, aligning the strategic vision the project with the strategic vision of the organization is a recognized best practice (PMI, 2008). Through her understanding of the organizations direction, the PM can combine her tacit knowledge of the projects goals and explicit knowledge of the organizations mission to provide a single message to the project team.

Leonard also provides potential barriers to the transfer of knowledge in her article "Knowledge Transfer Within Organizations" (Leonard, 2007). The first is the rigid codification of knowledge which can result in it outright rejection by receivers. The second barrier is when the knowledge is too vague. This can occur when it is ill-organized, ill- or un-structured, or too ambiguous. The third barrier can occur due to the size and nature of the gap between the source and the receiver of the knowledge. While these barriers do not prevent the creation of knowledge, the PM must be aware of inhibitors to transfer otherwise the creation efforts become meaningless as the flow of the created knowledge is reduced or stopped.

Practices that can aid in the transfer include a high degree of explicitness; meaning the more the better. This does not mean the PM is rigid in its development, but rather he should use several means by which to externalize knowledge. Leonard cites physical proximity between the source and the receiver; meaning the closer physically the better. Socialization through face-to-face meetings is one example of close proximity.

Finally, the closer team members are to the culture and context of the knowledge the more easily it will transfer between team members. Ensuring alignment and understanding of the organizations goals and the team's objectives in relation to them is a means by which the PM can help to mitigate this barrier.

3.7 Additional Insight

We find support for this model in the research of Newell, Bresnen, Edelman, Scarbrough, and Swan (Newell, et al., 2006) concerning cross-project knowledge transfer. They found that "the transfer of knowledge from the individual projects to the wider organization relied heavily on social networks." They also found knowledge transfers to occur through individual project members and especially through PMs talking to each other (Newell, et al., 2006).

These findings underscore the influence and importance of the PM in coordinating the transfer of knowledge between team members. Further support from their study is evident as they found senior managers acted as the conduit for knowledge transfer. The reasoning is that senior managers are reviewing multiple projects and able to pass on knowledge to other teams (Newell, et al., 2006).

Newell's 2006 study further highlights the importance of a personal focus, or a role dedicated to knowledge creation. Even though managers circulated from project to project, the cross learning and sharing did not work as well as it could have because teams were focused locally or internally (Newell, et al., 2006), nor was the capture and sharing of knowledge an objective. One of Newell's interviewee's noted that even though they may have captured valuable knowledge, they did not possess the "structure or language to learn from it (2006, p. 177)." Another example from Newell includes a situation when a team member learned through experience how to work with a consultant, but because the technology to capture knowledge does not support the "softer learning," others will likely have to learn the lesson by themselves.

Without the intervention of the PM to find and facilitate the knowledge transfer, two issues arise. First, when the lesson is learned by the new team or team members, it may not be the same lesson. Because the situation will likely be different, the context and meaning applied to the learning will be different. This difference in interpretation can cause communication problems later, or other road blocks. Second, the "learning on their own" scenario causes delays in the project work. How often have we said to ourselves, "If I knew that before I started working on this, I could have saved 'X' number of days?"

Oshri, Pan, and Newell studied an Israeli technology firm. In this study, they describe a slow "learn by incremental doing" (Oshri, et al., 2006) approach where newcomers were given simple tasks to start, and allowed to learn at a gradual pace. In this situation, the learning took place around apprenticeship process activities ("socialization" practices described by Nonaka in the SECI model), which led to social interactions and network development. Becoming an expert in this process is time consuming and costly, and with redundant solution development.

So while the learning, and therefore knowledge created, by the Israeli firm was accomplished, it was socially based. This underscores the social aspect of knowledge creation. Further, the perspective of the PM as an agent in fostering the transfer and creation of knowledge is supported in that Oshri, et al. found the mentoring actions of the engineers applied knowledge sharing (Oshri, et al., 2006).

In phase 2 of their study, the problems described by Oshri, et al. indicate they treated knowledge as a thing; whole unto itself and assumed to be able to be transferred from team to team, or individual to individual. But this view of knowledge excludes the tacit element, the schemata internal to us. As explained, "[Knowledge] were seen by the management as pragmatic objects that could be moved from place to place, provided they were codified and documented on a sheet (Oshri, et al., 2006)." Without contextual insights, the transfer of knowledge is nothing more than data transference. No new knowledge is created.

3.8 An Illustrative Example

To put this in perspective, let's consider the following analogy most people are familiar with: driving to work. The nuance in this situation is the context of this drive. Under familiar, everyday conditions, most of us use the same routine: we get in our car, pull out of the garage and drive way, and make our way to work. Along the way we may talk on the phone, listen to the radio, or carry-on a conversation with a carpool passenger. As we approach various turns, dips in the road, stop lights and signs, and other obstacles, we slow down or stop, we turn the car slightly, change lanes, etc.

Because we have made this drive several times (days, weeks, years) it has become known to us. Our experience provides us with knowledge of the drive: the nuances of the road, when to slow down, what to look for and when; such as when to drive a bit slower through one section because the garbage trucks are making their weekly pickups, or when to change lanes because of the confluence of activities like merging traffic and the need to exit the road. We also know that during certain times of the year we should leave earlier or later to avoid traffic backups due to school buses or the rising of the sun (sunshine slowdowns).

This is all tacit knowledge. The experiences of performing these tasks are embedded in our memory. If we exclude the experience (remove the memory) we then in an unfamiliar situation. For our purposes we will use moving to a new house with a new route to work as the unfamiliar situation. We do not have the exact experiences from before to guide us in the most effective or efficient route and manner, so we must rely on mainly explicit knowledge; in this example, a GPS device.

The GPS device represents the explicit knowledge discussed by Polyani, Nonaka, Spender, and others. It is a set of instructions, images, maps contained in a Knowledge Management System (KMS). When activated, the system determines and maintains a sense of your location. It also finds and maintains a sense the location of your destination in relation to your current location. It then transmits instructions about how to proceed. It tells us the best route according to what our preference. Most often this is based on the shortest time required. Smarter systems may provide updated traffic information and provide route adjustment options.

This explicit knowledge is vital for our ability to get to our new work location- in the beginning. What our KMS does not tell us are the details, the nuances of the drive that will make it faster and safer. It does not tell us to slow down when coming upon a curve. It does not tell us it's Tuesday, so we have to watch out for garbage trucks. It does not have, or provide the tacit knowledge. Only through our own experiences is this achieved, and eventually we are able to make it work without using the GPS (KMS).

The time to develop the appropriate experiences can be shortened with the aid of a passenger. Someone who travels with us and provides guidance and contextual knowledge; someone who combines their own tacit knowledge with the explicit knowledge of the GPS: a Project Manager.

The PM (our passenger) provides additional input to the KMS output. He tempers the knowledge provided with additional knowledge gained through his experiences. Our system may tell us to "exit on the right, in two miles," but what it does not tell us is that around the next bend the road dips and heads back up hill, there is a freeway entrance frequently used by a trucking company, and we should stay in the far left lane until we pass it, otherwise we will be stuck behind a large semi-truck slowly entering the freeway.

In this situation the PM uses his tacit knowledge to augment the knowledge provided. He provides the correct knowledge at the right time. He does not tell us the strategic vision of the trucking company because that is superfluous. Nor does our PM tell us to drive with sunglasses, what speed to travel, or how to operate the vehicle in general, because this knowledge we already possess- tacit knowledge we already bring to the task of driving to work.

What the PM tells us is to stay in the left lane because at this time of day the trucking company is sending out their trucks for their daily deliveries. He also warns us to watch for sun-glare after we get around the next bend, because the sun will have raised high enough to be in our eyes, but the amount of glare will depend on the cloud cover each day.

When questioned about how he knows this, he replies it is part learned experience (having driven the route before) and research. He tells us, he noticed the trucks at the same time each day, so found trucking companies information and the sunrise and sunset times on-line (explicit knowledge) and mixed it with his own experience (tacit knowledge) to come up with the answer. But he tells us this took many months and several near misses with entering trucks and slowing traffic to learn this.

With the proper knowledge shared, we (the new team member) are able to assimilate it with our own tacit knowledge. We tacitly know how our car operates. We know the proper amount of pressure to apply to the breaks to achieve a smooth slowing of the car. We know where the blind spots are and how much time we need to change lanes (i.e. a small car needs less time than a large truck). By mixing the explicit knowledge with tacit knowledge (both the PM's and the driver's) we expect the learning curve to be shortened for the driver, and explicit knowledge to be more easily turned into tacit knowledge.

4 METHODOLOGY

In seeking to answer the research question: How do Project Managers facilitate the creation of knowledge through the conversion from explicit to tacit knowledge, and back, within the project team environment? This chapter presents and discusses the inductive, qualitative case study research methodology used.

4.1 Research Setting

This research used an inductive qualitative case study strategy. The explicit "how" in the research question, guides the research in this direction, as does the nature of building a new understanding of the PM's role in knowledge creation. The rich documentation of the topic understudy and recursive cycling of data analysis provides a strong foundation from which to build and explain the developing model. (Eisenhardt & Graebner, 2007; Yin, 2009). While the unit of analysis is the Project Manager, project team members and the PM's supervisor were also sources of data. The intent of the overall data capture effort was to gather information about Project Manager's practices and behaviors.

4.2 Research Design

In building theory, as described above, case studies are used to create constructs and propositions based in the empirical evidence collected (Eisenhardt & Graebner, 2007). A common tool used in qualitative research is the interview (Myers, 2009). Multiple, semi-structured, in-depth interviews were conducted. The interview participants consisted of Project Managers, Project Team Members, and company executives with project management. In addition to the interviews, the researcher reviewed documents and observed social interactions (meetings and phone calls). Semi-structured and unstructured follow-up interviews with Project Managers served to enhance and/or corroborate the data collected through the initial interviews, direct observation of team meetings, and review of archival documents.

Yin states "Interviews are an essential source of case study evidence because most case studies are about human affairs or behavioral events. Myers also states "interviews are one of the most important data gathering techniques for qualitative researchers in business and management (Myers, 2009, p. 121)."

The interviews, or guided conversations (Yin, 2009), in this research allowed for a focused conversation with the interviewee, and provided rich data from multiple people and roles (Myers, 2009), while remaining within the confines of the open-ended interview protocol (2009).

The semi-structured interview style provides both boundaries and flexibility to the interview process. Boundaries are presented by pre-defining and scripting the interview questions. In this way, the interviewer can guide and focus the interviewee in the topic area. Flexibility is provided through this style because the pre-defined questions are a "guide." They are open-ended, which allows the respondent to provide as much detail as they wish. It also allows the interviewer to adjust the questioning and develop new, ad hoc, questions, or ignore others (Myers, 2009).

Yin provides support for the direct observations used in this research. In this research effort, the opportunity for direct observation was warranted in that the nature of the research sought the relevant behaviors of the participants, and the environmental conditions were available for such data gathering efforts (Yin, 2009). Gathering data through observation also provides another objective view from which the researcher can compare similar data acquired through other means. By observing the interactions of meeting participants, the researcher expected to see and hear practices and behaviors of the PM that lead to knowledge creation.

Like observations, the review of archival data will provide another objective view of the practices and behaviors of the PM in context of the knowledge creation cycle. Archival data consists of documents such as emails and PowerPoint slide presentations. Also referred to as "Physical Artifacts," by Yin (2009, p. 113), they provide physical evidence of explicit knowledge. Myers also exhorts the advantages of using archival data, in that it they can "provide important details of events (Myers, 2009, p. 161)." Myers also describes the disadvantages to this type of data, however these were easily overcome due to the fact the researcher had direct access to the authors and therefore the data provided was easily accessed and authenticated pertaining to their originality, meaning, and credibility (Myers, 2009).

By using multiple data collection elements, as described above, the researcher is able to provide methodological triangulation of the data and findings (Denzin, 1970). Also referred to as data

triangulation (Yin, 2009), this method of data collection provides the corroboration of the same and similar facts, concepts, and phenomena. Additionally, the use of data triangulation provides greater validity in that the multiple sources provide multiple measures of the same thing (2009).

Because the research seeks to answer the "how" question, a qualitative case study methodology was used. This strategy was selected for various reasons. The first reason concerned data access. The sponsoring company in this research effort is very protective of their practices, and therefore reluctant to expose themselves to excessive investigation. A case study approach allowed the researcher to confine the data collection within a defined scope and meet the sponsor's privacy needs.

Second, using the embedded variant (Yin, 2009) of case study design allowed the researcher access to multiple avenues of data collection, as described above. In addition to the interviews with Project Managers', team members and the PMs' supervisor, the researcher also attended weekly project team meetings. By doing so, the socialization, combination, and externalization (Nonaka, Toyama, & Nagata, 2000) aspects of knowledge creation were witnessed and documented.

A third reason for this choice is the revelatory nature of the research. Since this aspect of project management and knowledge management has not been explored previously, the research seeks to reveal a new aspect to the PM's role.

4.3 Sponsoring Company

In respect to the sponsoring company's wishes, they shall remain anonymous, and be referred to as PharmCo throughout this manuscript and any subsequent publication. PharmCo is a worldwide leader in the healthcare industry by providing healthcare solutions that address the evolving needs of patients and societies. Their diversified product offerings include innovative medicines, cost-saving generic pharmaceuticals, preventive vaccines, diagnostic tools, and consumer health products. They research, develop, manufacture and market leading innovative prescription drugs used to treat a number of diseases and conditions, including those in the cardiovascular, central nervous system, cancer, ophthalmics, organ transplantation and respiratory areas.

PharmCo's Pharmaceuticals Division is the largest division within the PharmCo organization and is recognized worldwide for their innovative medicines provided to patients, physicians and healthcare organizations. This growing business develops and markets patent-protected prescription drugs for important health needs. Their current product portfolio includes over 60 key marketed products, while their product development pipeline has more than 130 projects in various stages of clinical development. In order to provide the array of products described with consistency and timeliness, PharmCo has developed, and uses a defined project management approach when launching a drug. Their defined practice provides fertile grounds for research access and data collection.

Additionally, as a means to include other relevant study participants, and in cooperation with the PharmCo Project Manager and Project Director, snowball sampling was used to find additional participants. Snowball sampling is a technique whereby participants aid in identifying and recruiting other participants with the desired skills and knowledge relevant to the research in question. Snowball sampling is particularly applicable when the subject matter under study is sensitive in nature and/or the population of possible participants is difficult to reach (Biernacki & Waldorf, 1981). In so doing, relevant interview participants were identified who could provide insight into the research topic. Snowball sampling allowed the researcher to control the data collection process more easily, and conclude the study when data saturation (the point where no additional, usable information is identified) was achieved.

4.4 Research Participants

The purpose of this research was for the development, and exploration, of a new theoretical view, not in testing or proving it. As such, purposeful, theoretical sampling was an appropriate means for data collection (Eisenhardt & Graebner, 2007). This research used a case study strategy. In this effort, the researcher worked directly with a sponsoring company in identifying and recruiting voluntary participants. While multiple Project Managers were interviewed, a single project was identified, and it is from this project that observations were made, project team members were recruited, and the majority of archival data was collected.

Research participants consisted of four PharmCo Project Managers, five PharmCo project team members, and two PharmCo executives who were responsible for project and/or project management oversight. The Project Managers participating in the study reported directly to the key PharmCo contact, and it was through her, their participation was approved and secured. The key contact also identified the main PM (PM1) and her team, as the most overall representative of the projects undertaken. Likewise, PM1 identified available Project Team Members (PTM) for participation, as being representative of the team, it's knowledgeable, and their actions and interactions across multiple team functions.

Source	Management Years	Participation Years
Project Managers		
PM1	7	17
PM2	25	29
PM3	29	35
PM4	6	11
Sub-total Project Managers	**67**	**92**
Average Project Managers	**17**	**23**
Range	**6 - 29**	**11 - 35**
Project Team Members		
PTM1	10	15
PTM2	N/A	12
PTM3	N/A	27
PTM4	N/A	15
PTM5	N/A	18
Sub-total Team Members	N/A	**87**
Average Team Members	N/A	**17**
Range	N/A	**12 - 27**
Executives		
Exec1	12	12
Exec2	1	10
Sub-total Executives	**13**	**22**
Average Executives	**7**	**11**
Range	**1 - 12**	**10 - 12**
Combined		
Total	**90**	**189**
Average	**13**	**18**
Range	**6 - 29**	**10 - 35**

Table 2: Years of Experience

All participation was on a voluntary basis. While participants were initially identified by the Project Manager; for project team members, or the Project Management Director; for the Project Managers, the overall scope and purpose of the research was first explained and their permission to be interviewed was first obtained before proceeding with any data gathering activities. All participants were provided with copies of the researchers Informed Consent form (Appendix B).

In the case of the Project Team Meeting observations, no one other than the Project Manager or the specific project team research participants, were told of the research. Nor were the actions or comments of the non-participants recorded by the researcher. Team members present during the project team meetings were told the researcher's presence was simply as a "shadow" of the PM in order to learn about the team meetings. This explanation and role was consistent with PharmCo project management practices, and part of their normal operating procedure.

While the Project Managers were each assigned to different projects, their actions and activities were similar in nature, and to a large degree standardized by the organization. The standardization of practices provided a consistent view from which they spoke and allows for reliable comparison between their activities.

Project Manager's experience (Table 2) ranged from 6 to 29 years in managing projects, and 11 – 35 years with overall project experience. Similarly, the project team member's project experience ranged from 12 – 27 years, with one team member also having 10 years of project management experience.

4.5 Data Collection

Data was collected during a three month period, from June through August 2012, and consisted of three elements: 1) Open-ended, semi-structured interviews, 2) direct observation of meetings, and 3) archival data. All interviews were digitally recorded and transcribed by the researcher. The recording and transcription records are kept on a separate, security encrypted electronic storage device.

4.6 Interviews

Data Collection Type	Source	Quantity	Length (min.)	
			Total	Average
Initial Interviews	Project Managers	4	201.3	50.3
	Project Team Members	5	251.1	50.2
	Executives	2	60.3	30.1
	Sub-Total	11	514.6	46.8
Follow-up Interviews	Project Managers	11	132.5	12.0
	Total	22	647.1	29.4

Table 3: Interview Stats

The first, and primary, element of data collection was conducted using interviews. Two types of interviews (Table 3) were used: 1) initial, in-depth interviews, and 2) multiple follow-up interviews. The initial interviews were conducted with four Project Managers, five project team members, and two executives who over-see project managers and project activities. All interviews were private, one-on-one, in-person, and conducted in a private office or conference room on the company campus with closed doors, with four exceptions. Two initial interviews were conducted via phone calls due to the subject's schedule, and two other interviews were conducted in a large open space on the company campus, but

away from others. The general back ground noise of the open area provided additional privacy during the course of the conversation.

Follow-up interviews were conducted with the Project Managers, with the majority conducted via phone calls. These interviews were also open-ended and semi-structured. The interview topics were determined based on the observed meetings or information provided through other interviews. The follow-up interviews were both clarifying and investigative in nature.

Eleven initial interviews were conducted of varying lengths, averaging over 45 minutes in duration. The Project Managers provided 201.3 minutes of recorded interviews, averaging 50.3 minutes; the team members provided 251.1 minutes of recorded interviews, averaging 50.2 minutes; and the PM supervisors provided 60.3 minutes of recorded interviews, averaging 30.1 minutes.

4.7 Observations

The second element of data collection consisted of direct observation (Table 4) of project team meetings. Four, 90 minute weekly Launch Management Team (LMT) meetings were observed. These meetings provided 360 minutes of observed meeting time, exclusive of pre- and post- meeting observations of team member interactions. The LMT was the best representation of team interaction, and provided the most efficient means to observe both PM and team members in a social setting. The meetings were scheduled for the same day and time each week, which allowed for consistent scheduling of team member's time, and consistent deadlines for preparation purposes.

During the course of the observations, the researcher remained silent and non-participative. Due to confidentiality concerns, no digital recordings were allowed during the meetings. Therefore, hand-written meeting notes were taken by the researcher, and later re-typed. Since these notes were for the

Data Collection Type	Source	Quantity	Length
Meeting Observations	Weekly Team Meeting	4	90 (min.)
	Total	4	360 (min.)
Archival	Team Meeting PowerPoint Slide Deck	4	28 – 67 pages
	Emails	10	N/A
	Documents	3	N/A

Table 4: Observation and Archival Data Stats

purpose of the researcher and the research topic, they are focused on the Project Manager and the team's actions regarding the creation of knowledge.

4.8 Archival Data

The third element of data collection included archival data (Table 4). PowerPoint presentation slide decks were a primary means of both presenting information and combining information from various work areas. Four team meeting decks were collected and analyzed, which ranged in length from 28 pages (the initial project kick-off deck) to 67 pages. In addition to the slide decks, ten emails representing pre- and post- meeting communications, and three other documents were collected. These documents (email and other) varied in length, with no significant meaning being attributable to the number of pages or words contained within them.

4.9 Data Analysis

In all, 43 distinct data sources were reviewed and coded: 22 interviews, 10 emails, 3 observation notes, and 8 MS PowerPoint slide decks. The sample size of 22 interviews is consistent with previous research conducted and based on thematic exhaustiveness and data variability adopted to lead the interviewing process (Guest, Bunce & Johnson 2006). Additionally, the sample size is in line with the levels required for exploratory qualitative studies (Kuzel, 1992). The inclusion of archival (emails and other documents) and observation notes developed throughout the data collection period, provide sufficient data triangulation.

Miles and Huberman's discussion of qualitative data analysis breaks the process down into three main areas; 1) Data Reduction: "the process of selecting, focusing, simplifying, abstracting, and transforming the data that appear in written field notes or transcriptions.", 2) Data Display: "an organized, compressed assembly of information that permits conclusion drawing and action", and 3) Conclusion Drawing and Verification: "beginning to decide what things mean…" and "the meaning emerging from the data have to be tested for their…validity" (Miles & Huberman, 1999, pp. 10-11). Using these as

guides, the researcher used the QSR NVivo 10 qualitative analysis software (International, 2010) as the main source of data storage and manipulation.

All interviews were transcribed and coded by the researcher. A non-partisan colleague also coded an interview. When the two coding efforts were compared, there was an overall average agreement of 88.73%, and a Cohen's Kappa Coefficient score of .4276, with the .40 to .75 range considered as fair to good agreement.

The kappa coefficient provides a score of inter-rater agreement and is an indication of the degree to which separate observers agree above what would be expected by chance alone (Cohen, 1960; Rigby, 2000). While the achieved Kappa score of .4276 is within the accepted range of fair agreement, the researcher recognizes it to be at the low end. A factor in the lower kappa score can be attributed to the lack of subject area knowledge of the alternate scorer. In a post-scoring discussion, it was noted that without a thorough understanding of the KM or PM bodies of knowledge, the alternate scorer could only rely on his personal interpretation of the given definitions. It is possible a stronger kappa coefficient may have been attained through greater in-depth training and interaction of the alternate scorer, or using multiple alternate scorers, or a combination of both. Even without in-depth training or interaction, a score within the "fair" range confirms the adequacy of the definitions used and provides an adequate foundation for research replication or extension.

5 RESULTS AND DISCUSSION

In this section we will breakdown and analyze of the data collected. We begin with a breakdown and discussion of the demographics, and then discuss the findings and importance of key word frequencies. The section concludes with a breakdown and discussion of the model processes. Quotes and examples from the interviews, observations, and archival data are used throughout to illustrate and support the conclusions presented.

5.1 Demographic Breakdown

Research participants were grouped according to three categorical areas (Table 5). The first category is their position, or role, in relation to projects. These are: 1) Project Mangers (PM), 2) Project Team Members (PTM), or 3) Project Manager Supervisors (Executives). As mentioned above, there are 4 PMs, 5 PTMs, and 2 Execs. The second demographic category is gender: Male or Female. In this study, the genders were evenly distributed with 5 men and 6 women. The third category is level of education. Given the industry and its professional requirements, it is not surprising to find all participants had college degrees. Furthermore, 7 had a minimum of graduate level education, and 3 had post-graduate education.

Source	Gender		Education		
	Male	Female	College	Graduate	Post-Graduate
Project Managers	1	3	1	2	1
Team Members	3	2	-	4	1
Executives	1	1	-	1	1

Table 5: Demographics

Demographically, there are interesting differences in the responses. The numbers of references to the 4 SECI model processes were approximately equal between males and females. Examples of Socialization were mentioned 34 times by males, and 30 times by females; examples of Externalization

were mentioned 49 times for males and 38 times by females; examples of Combination were mentioned 23 times by males and 17 times by females; and examples of Internalization were mentioned equally 21 times by males and females.

However, it should be noted that while the difference in the number of references is not great, males tended to make more references related to the processes than females, yet there were more female interview participants than males. The greater number of responses, coupled with the lower total number of participants results in a SECI Construct Reference Rate (SCRR) of 25.4 references per male and a SCCR of 17.7 references per female.

Project Manger's and Project Team Members also referred to the processes equally. Examples of Socialization were mentioned 25 times by PMs, and 20 times by PTMs; examples of Externalization were mentioned 38 times by PMs, and 31 times by PTMs, examples of Combination were mentioned 18 times by PMs, and 14 times by PTMs; and examples of Internalization were mentioned 17 times by PMs and 12 times by PTMs. Among these demographics; there is a significant reduction in the quantity of references from the executive participants. The reasons for this reduction is unknown, but may be attributed to the respondents positions in relation to the PM and the team, and therefore their focus when responding to the interview questions. This issue may be the subject of further research, but is beyond the scope of the current research.

The difference in the responses coded to the SECI processes is not an indication of the value or insight of the respondents. While female respondents may have a lower SCCR score than their males counterparts, or the single respondent with a maximum education level of College may have provided an equivalent number responses than each of the other education level categories, we must keep in mind these are responses coded directly to the SECI processes. Other codes were used to help categorize and analyze the data collected, but while additional demographic analysis in line with the above would results in interesting differences, they would not be necessarily relevant to the proposed model.

5.2 Current State of PM Thinking

Before we can envision a new role for project managers, we must first understand how the current role is perceived and thought about. The vast majority of literature concerning project management, whether referring to the PM or the team, focuses on helping project managers complete tasks and projects successfully. This then steers their thought process so they are focused on completing the tasks required to meet the stated objectives in order to be successful; not on creating or facilitating greater team or organizational knowledge. This mindset is evident in the words PMs use to describe their role and how they define project success.

Using the NVivo 10 software, a word count of all responses to questions directed at these topics was conducted. The search parameters excluded words with a minimum of 4 letters, and included all similar words. Similar words in the NVivo software include exact matches, stemmed words, synonyms, specializations, and generalizations. In order to keep the list to manageable size, the list of displayed words was restricted to the top 100. This was also helpful because words out of the top 10 dropped in their frequency and weight.

The results provide both a total frequency count of a word and its weighted percentage. The weighted percentage is significant because it takes into account the frequency of the word relative to the total words counted. Therefore, as words are included in other similar word lists, a portion of their frequency is assigned to each of their groups. So the weight and importance of words which are also used in other "similar word lists" (see Table 6: PM Role Word Frequency- Top 10 count) become greater. The greater the weighted percentage of the word, the greater the importance the word has when compared to others.

5.3 The Role of the PM

One question asked of every interview participant was; *"Describe your role as, or your understanding of the role of, the project manager."* This question began each of the initial interview

sessions. It set up the following questions and the responses guided the interviewer through the interview process.

The word frequency analysis of the responses to the question about the role of the PM clearly shows it is viewed as an action based role. The PMs, their supervisors, and their team members are

COUNT RANK	COUNT	WORD	Weight	SIMILAR WORDS
1	128	Activities	2.17	actions, activities, alignment, application, assist, back, beginning, busy, center, cross, direction, feel, forward, function, gather, gathering, going, help, housekeeping, initiate, issue, keeping, lead, line, logistics, look, market, model, move, order, organization, part, place, play, process, project, review, role, supply, support, supporting, task, timing, trial, union, work, works
2	99	Communications	1.18	agreement, application, brand, communicate, communication, communications, core, details, develop, direction, discuss, gathering, issue, lead, line, more, order, organization, page, picture, place, play, project, style, submit, talk, term, thing, time, understanding, view, word
3	97	Work	1.72	affect, application, assist, bringing, brings, busy, function, functional, help, housekeeping, issue, line, model, move, page, part, place, play, process, processes, product, project, ready, review, risk, role, task, understand, utilize, work, working, works
4	84	Created	1.05	clear, created, creating, cross, develop, establish, facilitate, initiate, lead, model, move, outline, picture, place, plan, play, project, ready, style, support, think, time, track, work
5	83	Think	1.15	agreement, assess, budget, center, feel, focus, gather, identify, know, line, order, place, plan, play, prioritize, process, project, review, submit, supposed, think, thinking, thought, time, value, view
6	80	Organization	2.04	alignment, case, company, consumer, core, corporate, cross, driver, familiar, guide, help, initiate, issue, leader, member, model, order, organization, owner, partner, partnership, plan, regular, simple, stakeholder, structure, team, union
7	74	Move	1.12	affect, assist, center, communicate, company, coordinate, date, delay, develop, forward, gather, intervene, issue, launch, move, order, part, partner, place, play, project, risk, stream, submit, talk, tracking, wheel, work
8	71	Direction	.89	center, direction, focus, guide, guiding, lead, move, navigate, order, organization, path, place, plan, project, style, submit, target, through, ways, work
9	59	Going	1.04	accomplishment, back, becomes, chaperone, clear, cross, function, functional, going, happen, lead, leads, move, play, process, stream, track, well, wheel, work, working, works
10	54	Plan	.63	agreement, budget, organization, outline, plan, play, project, think, thinking, thought, time

Table 6: PM Role Word Frequency- Top 10 count

focused on getting things done. That is to say, the mindset of all groups- PMs, team members, and PM Supervisors is focused on the tasks the PMs do, or should do, in order to move the teams' activities towards project completion. Words describing the concept of "Activities" were used 128 times in the responses to this question. The concept of "Activities" includes, but not limited to, similar words such as: actions, activities, gather, gathering, lead, logistics, process, project, review, support, task, and work. (See Table 6 for the complete list).

The concept of "activities" as the leading view of the PM's role is also expressed in the fact that it received the highest weighted percentage. At a weight of 2.17, “activities” shares more similar words than any of the others and is therefore expressed more often as a concept than the others.

In contrast, the concept of “knowledgeable” does not make the top 10 in frequency (ranking 11th) and is used less than half as often (53). This concepts weighted percentage of .73 is also far below that of the activities concept. The words associated with it (e.g. accomplishment, experience, issue, knowledgeable, mindset, thinking, thought) are not used as often and not combined or associate with other as many other words.

COUNT RANK	COUNT	WORD	Weight	SIMILAR WORDS
1	131	Change	1.40	action, adapt, advance, back, beginning, better, block, bringing, call, career, change, changes, clear, complete, core, deck, decrease, development, elevate, even, event, experience, find, form, foundation, going, hold, impact, implement, improvement, initiative, know, launch, launching, level, line, mark, narrow, open, organization, outcome, part, people, perfect, provide, reaching, right, roll, start, still, think, time, tracking, variety, work
2	123	Event	1.49	action, activity, asking, assessment, beginning, case, change, collaboration, communication, course, decrease, development, direction, engagement, event, example, execution, experience, find, going, impact, implementation, important, last, launch, launching, leadership, line, management, meeting, milestone, organization, outcome, picture, pull, pushing, role, roll, sharing, sign, start, success, supply, time, train, variety, work, works
3	113	Communication	1.22	advise, apply, approval, brand, call, change, common, communication, communicator, core, direction, document, final, form, guess, hand, hold, imparting, indicator, individual, interview, invite, lead, level, line, mark, material, more, opinion, organization, picture, place, project, question, record, report, saying, sharing, side, sign, somebody, someone, start, talk, time, train, type, understanding
4	109	Activity	1.33	action, activity, approval, back, beginning, best, career, change, course, development, direction, engagement, feel, first, going, hand, hold, holding, individual, keeping, last, lead, leadership, line, looking, nimble, open, organization, part, place, proactive, project, pull, review, role, second, somebody, someone, start, supply, task, timing, work, works
5	104	Think	.98	approve, budget, call, change, consider, considered, factor, feel, find, guess, hold, hope, know, like, line, mark, mean, name, place, plan, project, question, review, schedule, survey, think, time, type
6	92	Worked	1.47	action, activity, apply, bringing, create, engagement, form, functioning, functions, going, guess, learning, line, part, picking, place, product, project, pull, review, role, roll, still, survey, task, work, worked, working, works
7	84	Moving	.90	advance, advise, block, career, change, company, date, force, hold, impact, invite, launch, middle, moving, part, place, project, pull, reaching, roll, sign, single, start, tracking, train, work
8	81	Create	.47	action, clear, create, created, facilitate, find, follow, force, form, invite, mark, picture, place, plan, producing, project, start, think, time, track, work
9	80	Happen	1.14	advance, beginning, case, change, decrease, development, engagement, event, example, experience, find, going, happen, happened, happens, impact, improvement, last, material, materials, meeting, milestone, occur, open, outcome, report, roll, sign, start, success, time
10	70	Organization	1.87	activity, beginning, company, core, direction, force, form, foundation, hands, management, member, organization, organized, plan, restructure, side, start, structure, systems, team

Table 7: Project Success Word Frequency- Top 10 count

5.4 Project Success

The same mindset is evident regarding project success. The focus of project success is not on creating or facilitating greater team or organizational knowledge, but rather on completing the tasks

assigned and required to meet the stated objectives. Similar to the role of the project manager, participants were asked how they defined project success; specifically *"How do you define a successful project?"* The concept of project success is relevant to this analysis because it provides a pathway to understand why the PMs are focused on their most prevalent activities.

While not the most frequently used concept, "Activity" is a highly ranked concept (Table 7) on the list with a count of 109. The concept of "Change" with a count of 131 ranked at the top of the list, with "Event" in the second position with a count of 123. The concept of "Communication" rounds out the top 3 positions. It is significant to note each of these concepts (with the exception of communication) share the same first word in their "similar words" list- "action." So here too we see the action based words as the basis of how project success is defined.

Also similar to the view of the role of the PM, the "knowledge" concept does not rank highly; either by word count, or by weighted percentage. In fact, this concept ranks lower on this list, comparatively, than it does on the Role of the PM list. But the concept is present; therefore even though the creation of knowledge is not at the forefront of a Project Manager's thoughts when carrying out their responsibilities, it is present in their actions. If the two (thought and action) were more closely connected, we would expect the knowledge concept to rise in both weight and frequency in both how PMs define their role and view success. The remainder of this chapter more fully explores the actions of the PM and how they are facilitating the creation of knowledge through their current activities.

5.5 Knowledge Creation Process in Team Environment

The following is and analysis of the SECI model and how it manifests itself in the project team environment. We begin this discussion with general observations of the findings, and then proceed with an individual analysis of each SECI model processes.

	Socialization	Externalization	Combination	Internalization
Socialization	69			
Externalization	25	106		
Combination	3	11	36	
Internalization	15	19	4	35

Table 8: SECI Model Crosstab

The main premise of this research model is that Project Managers play a significant role in the facilitation and creation of their team's knowledge, and therefore we would assume to find evidence of these actions within the normal course of their job performance. This research finds strong support for this assumption. This support is found in the coding of responses to the interview questions, observations, and archival data.

The most frequent direct references are those concerning the Externalization process. There were 106 responses coded directly to this process (Table 8), and it outpaced the other process references by as much as a 3:1 ratio. This high reference is not surprising given the nature of the process. By definition, the Externalization process moves tacit and hard to articulate knowledge into the explicit and more easily articulated knowledge area. In doing so, we express that which was not expressed previously. We do this through writing, drawing, and explaining. These are all observable acts and more easily recognized in the analysis process.

With this in mind, it is not surprising to find the Internalization process is the least coded of the processes with 35 direct references. Internalization is the opposite (but no less important) of the Externalization process. In this process, we are taking the explicit and easily articulated knowledge, and combining it internally with our own. Since tacit knowledge is internal to us, and difficult to articulate, it is similarly not easily observed or described. In analyzing the responses, this phase of the knowledge creation cycle is more inferred than directly discussed.

As stated earlier, in the team environment we do not view the SECI model as the sequential process described by Nonaka. Rather, we view the creation process passing through the Project Manager.

This means the PM acts as the conduit for the information needed by team members for knowledge creation. Information received in various forms is channeled, or directed, to team members where it is needed. Since various team members may use or need the same information, the direction of information is also varied and happening simultaneously among the team members, and as such we have various paths through which knowledge is created. We see evidence of these alternate paths in the number of shared references between processes. These shared references are indications that while one team member is creating knowledge via a specific process phase, other team members are creating knowledge from the same information source, but are doing so in another phase of the model.

Nonaka's original model describes a sequential process with knowledge being created in each stage but along a defined path; Socialization to Externalization to Combination to Internalization. Through the interview, observations, and archival data, we find evidence of a more dynamic knowledge creation process.

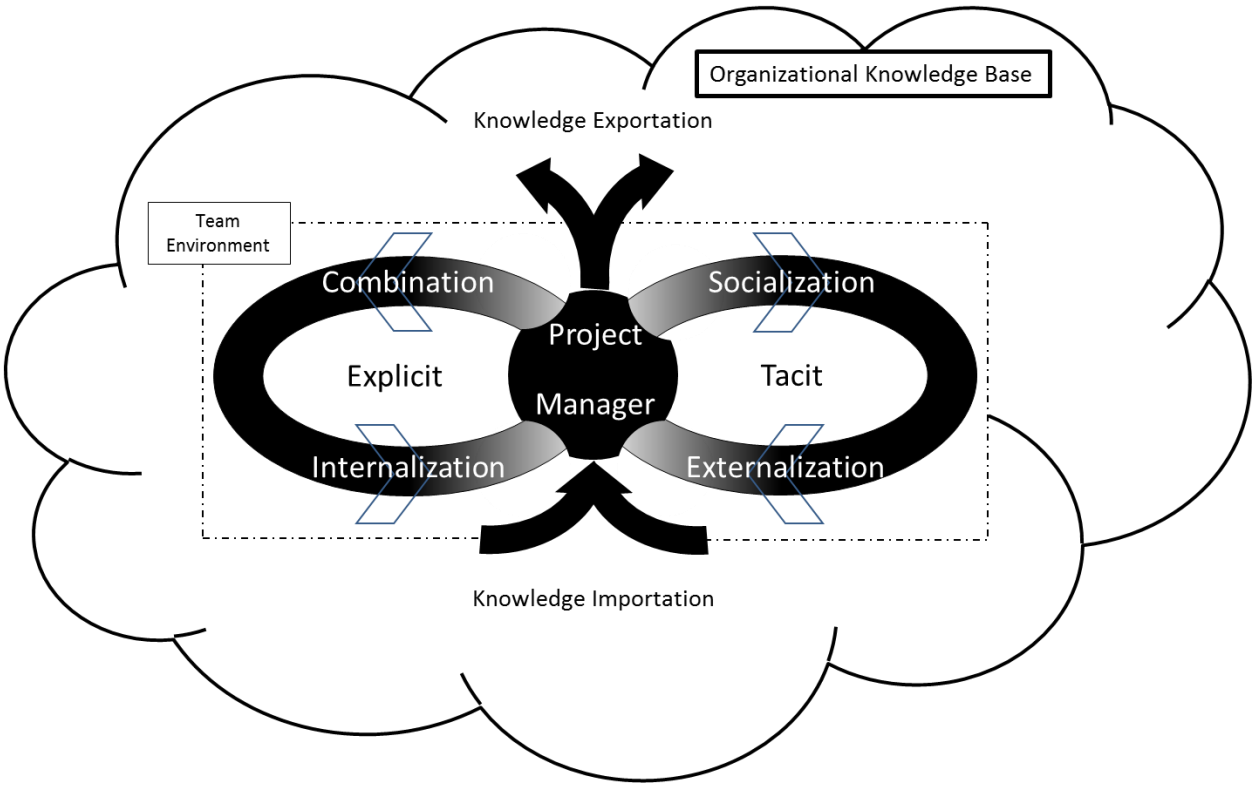

Figure 7: Full Model

Throughout the following discussion, the interview notes and comments, and archival documents, show how the PM influences knowledge creation within the overall project team environment. This environment resides within the organization and draws knowledge from the larger organization knowledge base through the Project Manager and Project Team Member actions. Thus knowledge is imported into the team through actions performed by the PM. In the same vein, knowledge is exported out to the same knowledge base through the PM. However, the knowledge created is done so through the knowledge creation process steps contained within the project team environment.

In the team environment, various combinations and alternate paths emerge from the data, and we observe a more dynamic process of knowledge creation. Moving through the PM, knowledge is moved to the other areas and created simultaneous among the individual team members. In addition to the four original process connections: Socialization to Externalization; Externalization to Combination; Combination to Internalization; and Internalization back to Socialization, the data also provides evidence of two alternate knowledge creation pathways: Externalization to Internalization, and Socialization to Combination. These alternate paths for knowledge creation are unique to the team environment, and are made possible through the intervention and facilitation of the team experience by the Project Manager.

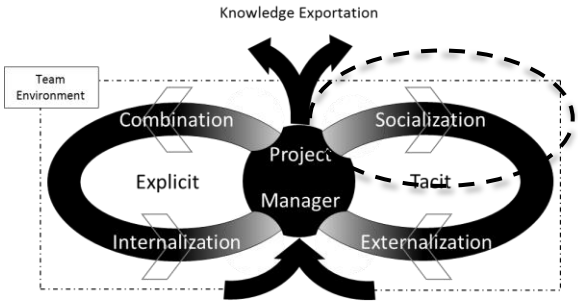

Figure 8: Socialization

5.6 Socialization

Socialization occurs within the team environment in three distinct ways, first as a group in the form of weekly team meetings; second, as individuals in the form of one-on-one meetings between the PM and team members; and third, as, direct interactions between team members, absent of direct or active participation of the PM. The weekly project team meeting is the main social setting in the team environment initiated and overseen by the PM. The one-on-one meetings, also often initiated and controlled by the PM provide for a more intimate knowledge creation experience. Similar to one-on-one meetings with the PM, the direct interaction between team members is also a more personal knowledge creation activity for the participants. While

this activity does not directly involve the PM, the PM's actions do influence their occurrence, timing, significance.

A recognized key element for team success is that of cohesiveness. In a well-formed and functioning team, the lines of communication are open and the flow of knowledge between people occurs more easily. The PM, as the team leader, directly affects this formation and team member interactions. In describing the creation of the team, and the influence the PM has on team member interaction, PM1 says:

> [PM1] When you first form a team, you're not always sure you have the right people on the team in the sense that they are trying to figure out what brand they're working on, are they part of this team or aren't they? Once you can get that dynamic down, in the sense that "ok, do I have all the right people," and that probably takes a couple of weeks. Then what I did was open it up "this is what the LMT is all about" and made the statement "anything you want to talk about, let's talk about it here, but we have to keep it to a minimum. Of course we can off-line discussions and meetings- absolutely, but this is the place where you are going to have everybody together and this is the place where you want to bring those topics that you feel are relevant to the whole team."

We also find team members echo this sentiment in this statement from PTM4:

> [PTM4}…helping ensure we are tracking all of that and helping us as team members- holding us accountable to make sure we are doing our part as part of the team, because I think when you don't have the PM- I mean somebody has to hold everybody accountable. It's hard to find that to happen, so it helps when that person does that, but then again moving us in the right direction and reminding us of key things.

Without the PM, the creation of a safe, sharing place, a place where socialization can take root and flourish would be left to the individuals. This may or may not happen. Levels of trust between individuals would have to be created on an ad hoc basis. The PM, as the leader of the group, is able to be a surrogate for the ad hoc creation process, and create trust collectively, by first establishing trust between him/her and the team. This trust is then extended among the team members through team meetings, and reinforced through one-on-one meeting and encouraging, and providing for, member to member meetings.

These settings are organized and driven by the Project Manager. The weekly Launch Management Team meeting invitees included the entire project team which consisted of approximately 60 people from many areas, and sub-team. These meetings were the core meetings for the project team. While there were various individual and smaller group meetings conducted each week, the weekly LMT meeting was organized and conducted by the Project Manager.

The Project Manager inaugurates the weekly cycle with a meeting reminder/invitation email to the team. In this email, she includes a copy of the meeting agenda, a copy of the PowerPoint presentation to be used, and any other pertinent information. Prior to the start of each meeting, the PM arrives before the assigned time in order to prepare the room and technical equipment. In essence, preparing the place for the meeting by making sure the presentation is running and viewable to all, and opening the physical lines of communication by dialing into an established conference call number. These actions are coordinated, performed by, and are the responsibility of the PM, not another team member. If the PM does not complete these actions, they would not be done, and place for socialization to occur would not come into being.

The emails themselves are a form of the tacit to tacit knowledge combination described in our Socialization definition. The PM does not include instructions regarding how to read it, or that this is the proper way to coordinate project teams, but the fact they are sent to the team members provides opportunity for them to combine what they see with their own internal knowledge-base. Likewise, the actions of the PM in the meeting itself offer this same opportunity. In this regard, PTM4 offered:

> [PTM4] I can think about a particular leader in the organization, who, when she gets in front of her team, just the way she carries herself, I visualize the overall package- I'm like "wow" I'm observing, she's not saying "ok- this is what I do, I get up, I practice." She's not telling me that, I'm just observing the overall.

After a sufficient number of team members arrive, and within a respectable time from the stated meeting start time to keep everyone on schedule, the PM opens the meeting with roll call, introductions, and announcements. Then, by following the published agenda, the PM directs and controls the meetings

by introducing topics and speakers. If a presentation or topic of discussion becomes too long or strays from the main point, the PM guides the team back on track by halting the discussion, suggesting it be concluded later (taking it offline), asking for clarification, or some combination of all three. As the recognized primary leader for the team, the team members look to and depend on the PM to fulfill these tasks so the atmosphere for sharing and knowledge creation is present. PM1 described the meetings as follows:

> [PM1] That meeting is a live meeting; we use LiveMeeting (webinar) because we do have people in the field, or in other areas that do call in. I always send out the deck 24hrs before the meeting. By also using LiveMeeting, if an update does come, I can always state "I did receive an update, your slide does not reflect it, but you can see it" by using LiveMeeting. So I basically start off by doing the introductions, so everyone knows who is in the room and who is on-line. And then from there, we go over what happened since last week. Some people may have gone to Congresses, so let's get an update, and we go through all of that. And then I have various topics that people want to talk about, like REMs- that may be a hot topic, some people may want to talk about patient services. So I've spoken to the leads, and I know they're ready to discuss these types of items. They may send me a deck or we may want to get more details, in the sense of we've heard about it, but give us more details what's going on, when it's going to happen, things like that. So I have particular items, and those people have been notified that they will be presenting or discussing. And then every other week I have workstream updates. Every single workstream lead gives an update as to what's going on within their timeframe.

While PM4 says:

> [PM4] That is a meeting where you are expecting those 60 people. So they will call in, they will attend; there is a set agenda. It's not just a status meeting, but you have alignment, you're keeping lines of communication open, you're telling the team what it is you are doing. If you are behind somewhere; what are some of the critical things we need to take care of. It is not a haphazard meeting- it is a very structured meeting. You have a set agenda; you know exactly what you're going to be talking about. Of course there are things that come up, but it is very regular set agenda.

So the upside for LMT is that this is a formal forum for people to get caught up on other areas where they are not working. Everybody has their own part that their contributing to on the project. LMT

is the forum where they find out what else is happening; how does it fit with my part and what am I doing; how does my part fit in; how does somebody else's part fit in; are we making progress? That is a very important objective of LMT.

In these team meetings, project team members are able to both formally and informally share tacit knowledge with each other. Formal sharing occurs when the team is gathered and the meeting occurs. During the period of formal meeting procedures, the PM sets the stage and guides the team through the meeting agenda. As the agenda items are discussed, meeting attendees hear others' experiences and are then able to combine them with their own.

These interactions, whether live and in-person, or virtually live via a computer connection like LiveMeeting™ (LiveMeeting is virtual meeting service provided by the Microsoft Corporation. Through this service, subscribers are able to see and hear presentations and meetings via a phone line and computer connection. It enables meeting attendees to simulate the face-to-face meeting experience, while their physical presence is in another location) allow the tacit to tacit knowledge creation of the Socialization process. As described by Nonaka, the interaction itself is where the internal, hard to articulate, tacit knowledge of individuals takes place. The knowledge that is created is not readily seen, but is recognized in head bobbing agreement, or increased attentiveness of others in the room.

Sharing occurs informally as well in conjunction with the with the weekly team meetings. We see this in the form of side-bar conversations, and are the third type of meeting interaction described above. These conversations occur before, during, and after the formal meeting. We see it in the chit-chat amongst team members. Sometimes this is not work related, and sometimes it concerns "off-agenda" items, but regardless of the conversation content, these interactions can be helpful in establishing trust and confidence in the PM because it makes them appear approachable. Furthermore, the side-bar conversations are something that can be foreseen and planned for by the PM. PTM3 provides insight to the importance of sidebar conversation, and the role a PM plays in making them occur when he said:

> [PTM3] In my first job, in a manufacturing company, I had a guy who was a mentor and he forces a bunch of people to have a production meeting every at 9am managers, supervisors, all the ops

> department. Everyone thought it was such crap, because all that would happen is it would last 3 minutes and the production managers would just read what we produced the previous day. Everyone thought that was garbage and waste of time, yet when the meeting was over you saw all these sidebar conversations; and this exactly why the guy forced the meeting. He wanted to get everyone together and to communicate, and that is exactly what happened.

So we see here that although the PM is not directly involved in the creation of knowledge through this socialization practice, their actions directly affect whether it occurs. Without a regular, consistent, predictable time for the team to gather, the opportunity for team members to create new knowledge with each other is diminished.

A more intimate form of socialization in the team environment is seen in the one-on-one meetings. These meetings are used by the PM to keep abreast of project activities and progress, gain insights into issues or problems, and plan for upcoming group meetings. We gain an idea of the conversations through the feedback of one of the PMs:

> [PM4] When I sit down, I keep a list of questions for him. … One of the things would be "what do you think of the agenda for the next 2 LMT?" This is what I was thinking? What do you think? And then he will give me his feedback: "maybe we should focus on…" or "let's get a deep dive presentation from 'consumer' it's been a long time."

While they are often planned, one-on-one meetings can also occur at any time. We learned the following from PM4:

> [PM4] The interactions could literally be on the elevator. Sometimes I'm getting three status updates as I'm getting my food in the cafeteria. I see a person, and I remember, I'll say 'hey Joe how are you, this-that-and-the-other, oh by the way…" if I have a question I'll ask him and I'll get the answer. It will save me from sending an email or a voicemail or like a formal kind of follow-up.

PM4's comment also leads us to believe the setting is not important. The sharing of knowledge does not appear to require secrecy or complete confidentiality. Nor does it need to be pre-scheduled and timed. The chance encounter on an elevator or walking through the hall is enough to provide the opportunity. From this perspective, the more a Project Manager is able to physically interact with team

members (management by walking around) the more they will be able to create the conditions needed for knowledge creation through the Socialization process to occur.

Meetings, formal or informal; scheduled or unscheduled, provide a space for personal interaction between the PM and PTM, and individually between PTMs. By gathering in close proximity to one another, PTM's simultaneously share, gather, and create knowledge. The importance, and preference, of these face-to-face interactions was expressed repeatedly by both PMs and PTMs:

> [PM1] I think when you attend in person it's a lot easier to engage with people.
>
> [PM2] It is a much better exchange when you have people there in person.
>
> [PM3] My preference is to have people in the room. My reason is I have people from oncology, GenMed, legal, compliance, etc.; people from various departments. When it comes to conversations, on the conference calls sometimes it is hard for them to hear who is talking and who said what.
>
> [PTM1] For me, the LMT meeting is for the team members to get together so that we continue to be on the same page as far as everyone knows what the key points are.
>
> [PTM3] I think in all cases you should be there face-to-face, because of the benefit of seeing certain people and grabbing them before or after.
>
> [PTM4] There is nothing that surpasses face-to-face interactions; where you can see my mannerisms, and everything.
>
> [PTM5] We say we prefer it to be in person because this is the time we get to see each other, see the body language, see the progress, have the dialogue, and of course it is much better to have the dialogue face-to-face.

Technology has been a contributing factor to the development and proliferation of virtual team and a virtual presence at team meetings. This also fosters the socialization process in knowledge creation, but to a lesser degree, as we observe in the following comments:

> [PM1] When they're on the phone, sometimes it's more difficult to hear them, or you may not see they're body language and the kind of point they are trying to get across. The reason people attend

by phone is one meeting after another, and they may be late and not want to disturb the meeting by coming in late.

[PM2] when people are on a TC (teleconference), you they are multi-tasking. They're working on other things. You can hear it when they are disengaged.

[PTM1] It still about what you read in people's eyes and the body language. If there's going to issues to be discussed, I think you lose some of that over the phone.

Whether it is a physical or virtual presence, at the center of these interactions, is the Project Manager. Without these interactions, either in the group setting or individually in one-on-one meetings, the sharing of knowledge, tacit or explicit, would be difficult. The Project Manager, as the driving force in the team environment, creates the 'ba' for socialization activities by creating a safe place for team members to come and share their experiences; a place where they can express their knowledge.

5.6.1 A Valve for Socialization

As noted above, a major factor in the socialization process within the project team is the weekly team meeting. Without the Project Manager, it is unlikely this meeting would occur. The PM is the organizer, facilitator, and leader of this action. PTM4 sees the importance of this action in her comments:

[PTM4] … providing that foundation that those of us who are brought in from other line functions, we come together and the PM is the glue to. To provide the framework, the structure…

I see the PM as the glue that holds the team together, and in many ways the leader that keeps the team on track and on task. … So to me it is a very important role in helping to make sure the team continues to move forward on everything we are supposed to do.

Many of the project teams I'm on we haven't had a project manager, in that the role has come and gone over time, unfortunately, and I definitely can see a difference between when there is a PM and when there is not a PM; in follow through and follow-up, and the clarity being much, much better when there is a project manager in place.

By organizing and facilitating the weekly team meetings, the PM controls and contextualizes the knowledge for the team by providing the framework and structure, by setting the agenda, and by keeping

the conversations relevant to the topic of discussion. By seeking input to the agenda from team members, the PM establishes and shares the meeting agenda prior to the meeting each week. In doing so, the PM provides focus for the team. The individual team members come prepared to share specific pieces of their own knowledge, and are prepared to learn from others and more easily assimilate the information with their own.

Socialization through the weekly team meetings is important in another way; it provides a ready venue for individual socialization, especially through sidebar conversations. PM1 was asked if she encourages the sidebar conversations at the weekly meetings, her response shows the importance of these actions:

> [PM1] Very much so (i.e. encourage). They (team members) know it is an opportunity, especially if we end a little early and they can grab someone they haven't been able to get a hold of. I absolutely encourage it to happen at the end, or before the meeting begin.

Another form of knowledge creation through Socialization discussed above is the one-on-one meeting. Within the project team environment, the PM is the main driver in this action. PM1 describes the one-on-ones this way:

> [PM1] I basically prepare myself in the sense of what has occurred in the prior week. I write down all the various items in the various emails, communications, things that are going on that I want clarification or that I want to verify. So I go into my team Lead and have a nice general conversation, and then she says "ok, what do we have on for next week?" So I have my agenda all set up for her. We go through it. She agrees; she says "nope, add this", do that. So we go through the whole agenda for the meeting itself, and then I go through my particular items I have, areas that I see, meetings that I'm concerned about. And a lot of times she say's "I agree with you"; "on a one-on-one I heard the same thing." And I'll say "well, how do you want to manage it?" "Do you want me to go back to that individual?" or will she? Those one-on-ones are about 30-45 minutes.

And with other team members she adds:

> I don't go through the large management team agenda, but I do go through particular things that I have concerns or things I've seen, or questions. The process is basically the same.

As the "cog in the wheel," the PM has the most ready access to team members. They become the "go to person" for information and guidance. PM4 puts it this way:

> [PM4] I think the project manager is the one person who has the most interaction with all these different players.

Without PM in the center, the interactions would be haphazard at best and the process of knowledge creation through Socialization within the team would be spotty, disorganized, and less than optimal for the team.

5.7 Externalization

In the project team environment, the externalization of knowledge occurs through various means from the first creation of the project charter, to weekly status reports, to capturing final lessons learned. Each of these examples documents, and others like them commonly found during project, articulate the knowledge of the individual. The sharing of the documents disseminates the knowledge within the team. One of the activities of the PM is to not only create and share their own knowledge in this way, but ensure team member's knowledge is captured and shares as well.

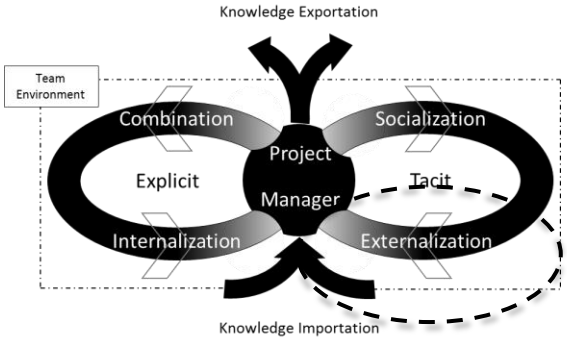

Figure 9: Externalization

As the team is formed, externalization of knowledge for the team first occurs in the form of the project charter. The project charter captures specific information about the project goals and objectives, the team members and other stakeholders, and the overall scope of the project itself. Each of these pieces of information reside within others and finding it and articulating it into a format that can be shared with others, is one of the first actions of the PM. We get an understanding of this first step from this comment by PM1:

> [PM1] I first showed her the Charter, and sat down and talked about the Charter. I said to her, "I know scope changes, I know objective changes, but overall we have to have clean understanding of what our objective is going to be for the team." Who are our stakeholders, and then I went through

> some key milestones with her, that I felt were important in order for us to reach the particular date we had back from the FDA. Then I also showed her various templates of how I would want the team to be formed. How I want the team to be run, and how from the larger team, smaller teams would start to formulate. And they would come back and report into the larger group. So I gave her an overview, and gave her the lay of the land. What the company expectation is, in the sense of the various high level steps in order to have a successful product launch.

Externalization continues throughout the course of the project activities. It is an important aspect of the team environment because the externalization of individual knowledge often results in some form of communication. The Weekly Status Report or Status Update is one of these communications. By articulating the activities, action, and accomplishments of their particular area of focus, project team members not only externalize their tacit knowledge of the topic, but the form they put into is shared with other team members, who then see it, read it, and incorporate it into their own tacit knowledge.

> [PM1] We issue a template, and we ask the workstream leads to send us an update every week. … I have on this one … what was accomplished last week, what the plans are for this week; and then I sit with the workstream leads to layout the milestones and deliverables, and the target dates. They send this to me every week.

> [PM2] I'm asking them to update their status slides because we need to report to the team

> [PTM1] Generally it's my line function providing continuous updates to the team during the whole launch cycle, and ensuring everyone is aware of what I am working on.

> [PTM4] I like that because many of those line functions, I don't interact with on day to day basis. So it goes back to what I said earlier, it helps me to have a more holistic view outside my microcosm, what it takes to bring a product to market in this case; again- I like to learn so I like to be broadening my own knowledge of the overall process.

Another source of externalized knowledge comes in the form of the various PowerPoint presentations. The presentations come from both the PM and from individual team members or sub-teams. The LMT is a representation of the PM externalizing knowledge in this form, while team members may develop and present more specific presentations.

Another predominate form of externalized knowledge, is seen in emails. Emails are used to recap the events of the team meetings. In these emails, the actions, discussions, and decisions, which occurred during the meeting are written down in bullet format and distributed to the project team. In this way, the tacit knowledge acquired by team members during the team meeting, is externalized and then shared with all team members, whether were in attendance or not.

A component of all projects is some sort of closing report. These reports contain, among other things, a summary of the project objectives and outcomes, as well as documentation of the lessons learned. The "Lessons Learned" portion of a project closing report is a valuable source of externalized project knowledge. Not only does it capture in archival form different aspects of the knowledge created through the project team, it is also a key source means by which knowledge is imported and exported. PM3 expressed it this way:

> [PM3] The outcomes of the post mortems1 are logged, captured, tied to the project. As a matter of fact, when I first came here that is the first thing I asked for, a "lessons learned," because that's how I function. … I want to look at everything from a high level, at lessons learned from other projects. [I do that] Because maybe what you see in projects that you are going through and looking at projects, and looking at the life cycle of the project going forward sometimes there are things hidden that you don't see that come out in the post mortem- kind of like the "I got you" that you don't want to repeat. … Without the post-mortem, we would have to do another 5 years of exactly the same thing.

5.7.1 A Valve for Externalization

As we learned above, the externalization of knowledge occurs when we turn the tacit into the explicit; when we write down what we know, so others can see, read, or hear it. A major source of this knowledge in the project team comes in the form of the status updates. The PM is the driver of this action. PM's 1 and 2 shared the following why they ask for status updates:

> [PM1] I've developed a workstream slide, and they provide me with what their scope is, what their deliverables will be- as they know them for that particular timeframe [3 mos., 6 mos.].

[1] "post-mortem" is an alternative term meaning "lessons Learned." The term was borrowed from the medical profession in which an "after death" analysis is performed. Its use has declined in preference to the more positive "lessons learned" title.

> [PM2] I'm asking them to update their status slides because we need to report to the team, it's a good way to check your work (did you do everything?); just like I would on Friday's; the way I would wrap up my week I would plan for the next week; but a lot of people don't work like that. I'm a PM, I would do that; a lot of people would not. So your hoping to ground people on the specifics and what their goals are, and then you want to keep them communicating to the rest of the team; because there are interdependencies.

The PM also drives the externalization during team meetings. His position as the meeting coordinator situates him so he has access to, and control of the content. As the guide for the team, he not only influences what is discussed, but also pulls the thoughts from team members who may or may not have volunteered information. PM1 discusses provides insight into this aspect when she said"

> [PM1] Initially when I kick it off, I kick it off with all the PMO assets; what we are going to bring to this team so they all have an understanding of what my role is. And then from there, every agenda, I try to have insights from another team member. So even though we do workstream updates, I always try to have a couple of members of the team share their insights. Because I find it's not about me, it's not about the brand team; it's about the whole team about everyone. That's kind of how I start off a lot of my meetings; and people would stop me in the meeting and say "can I present this?" [Referring to a team member asking about a topic to present to the larger team]- "absolutely, how much time do you need?" So I open it up, and say to people, if it's in a team meeting, I might say "this is something you might want to present to the broader team." That's how I do it so that everybody's involved. I modify the agenda and tell people we have a limited time, and think high level, rather than get down in the trenches. If people want to get down in the trenches, they can talk to you off line.

A third source of externalized knowledge that comes from the PM is the meeting recap in the form of emails. As we noted above, this knowledge is disseminated to the project team by the PM. The PM's access to others, their facilitation of the team meetings, and their position as the overall communication leading for the team positions them as the actor in this knowledge creation action. As the sender of the recap email, the PM controls the content and the form of the externalized knowledge. This allows them to provide the right amount of information so it is read and accepted by team members. Too

much or too little information may result in it being ignored by, or losing relevance for, the team. PM4 describes the reasons for the recaps below:

> [PM4] I don't do a recap at the end. I do the recap- not of the meeting necessarily- because they are not going to get much out of a recap because the recap would be if there is a meeting where a particular topic discussed and there were certain points that were discussed that I need to emphasize for the team. Whereas the LMT you are usually asking different workstream for updates of where they are. It is like across the board with topics all over the place. Sometimes even if it is a deep dive, it is a long 40 minutes presentation with questions. The recap I provide, which I usually do at the beginning of the meeting, is a recap of "ok guys, we are meeting after one week, (and if we don't have time to go through all the workstream updates for today, and let's we only have a deep dive of 40 minutes). I try recap what happened in that 1 week. What were some of the key accomplishments across all workstreams? Maybe 5 – 6 things that happened. I would give a very high level of what happened that week.

5.8 Combination

Figure 10: Combination

The combination of explicit knowledge with other explicit knowledge, known as the Combination process, is most prevalently seen in the form of the weekly project team meeting. For the project under study, this meeting was known as the Launch Management Team meeting (LMT), and the weekly PowerPoint presentation was simply referred to as the "LMT deck" or "the deck." We also see Combination in the form of emails wherein the email author externalizes some knowledge, and then combines it with some other form of externalized knowledge such as PowerPoint slide attachment. A third source of knowledge creation through combination occurs in the Knowledge Management System (KMS). The primary KMS used was SharePoint.

The weekly LMT deck consists of several sections, some of which were updated regularly, while others were not but remained a part of the overall for backup and record keeping purposes. Sections in the

deck included: 1) The Introduction and Agenda. In this section, the PM outlines each week's discussion topics and any relevant and important pieces of information or announcements. 2) The Current Weeks' Discussion Topics. The knowledge content for this section changes from week to week, and is often comprised of several different PowerPoint slide decks developed and submitted by team members. These slide decks are expressions of the explicit knowledge of the team. They are created by different team members each week, but combined into a single expression of explicit knowledge by the PM. It is the PM's responsibility, and through their direct action that this knowledge is collected and combined into this single source. 3) Workstream Updates. This section contains another source of explicit knowledge; specifically, the externalization of each team workgroups knowledge. This comes in the form of their weekly status reports, and are updated and added to the overall combined knowledge each week. While the format used in this section is common and constant for each team and each week, the knowledge content is not. The weekly updates help ensure new knowledge is available for access from this single sources. 4) Core Project Information. This section seldom (if at all) changes during the course of the project. Within this section is the core project team knowledge; the structure of the team, the team members, the Project Charter, where to store and how to access team documents (knowledge), etc. This section makes up the beginning template for the Weekly LMT slide deck, and is a common format across various projects in the greater organization. In this way, the combined explicit knowledge captured is more easily imported or exported from or to other teams and other areas.

The LMT deck is the main source and vehicle of knowledge retention, sharing and management. In the sense that it is used to retain team knowledge, the deck originates with the PM. The PM begins with a template which contains the basic beginnings of team knowledge. PM4 explains it this way:

> [PM4} We have a standard methodology. … so what people do is there are certain slides that are kind of mandatory slides- of course you tweak them according to your project needs, but there are a few things that are common across all of us, and then there are a few things that we kind of add depending on the nature of the project. … We will always have a team wheel. You have your project charter- what is the scope of your project, what are the key dates, milestones, who are the sponsors, who is the PM, Brand Lead- that information. Then you have a deck, where you identify 10

> to 12 key areas for your project. And then you identify who are your stakeholders, the key people who are leading those workstreams. … There are certain basic slides, which are more or less out of the deck, then as you go along your LMT- the deck I would have to say about 4 months into the LMT looks like a different deck than I would have at the kick-off meeting. Sometimes slides are dropped along the way, and additional slides are added, so it depends on where you are. … The individual workstream slides more or less stay the same and then we build around it …

We also see how the deck is used in knowledge management. As knowledge is developed, created, and shared in the team, it is added to the deck. Likewise, as some knowledge becomes obsolete or erroneous, it is deleted from the deck. A project team member describes how their knowledge is combined with others.

> [PTM1] We're all working on different workstreams, and just providing our updates through the PM, through the slides, putting it all together in terms of the LMT slide deck. Everyone has their own work centers and that's where they are keeping all there project information.

The deck itself is distributed via email, and past and present copies are kept on within designated folders on the projects SharePoint site. In this manner, the combined knowledge of the LMT deck is

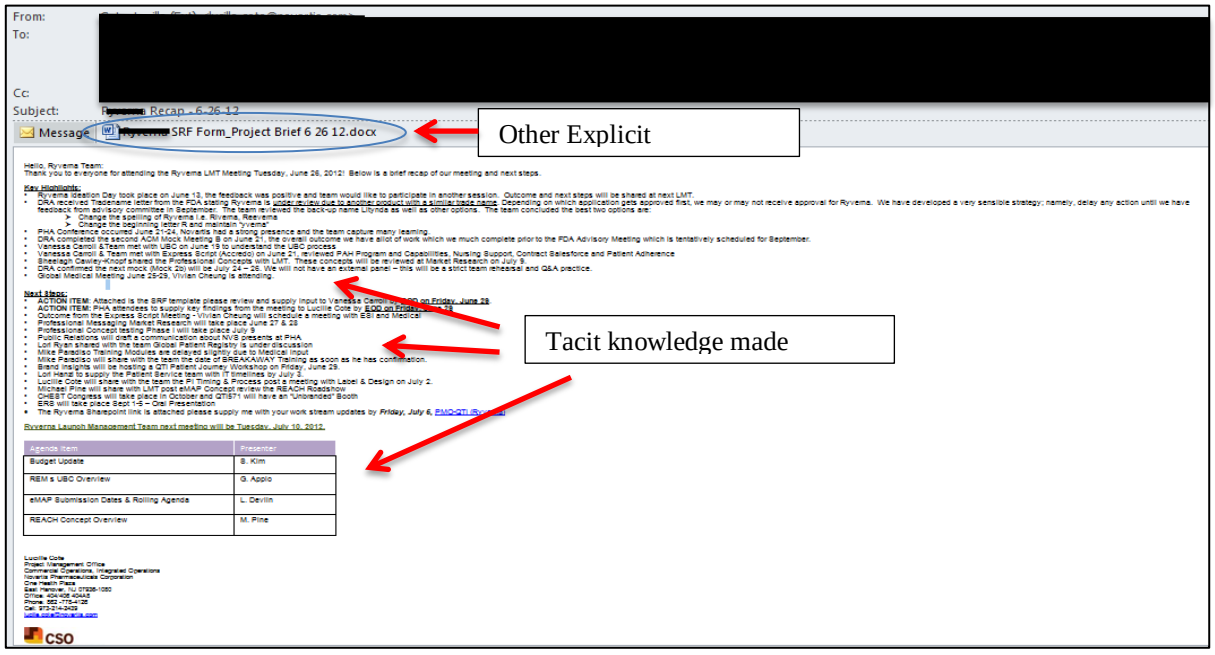

Figure 11: Sample Recap

further combined with other explicit knowledge in the form of previous LMT decks, and other explicit knowledge kept on the website or distributed via email.

But knowledge is not only combined and shared through the LMT deck, as mentioned above; the externalized, explicit knowledge is combined and shared through emails. There are different forms of this combination. A common form is the weekly meeting recap email (Figure 11). In this email we see how the actions and discussions are written and communicated to the team in the form of bullet points. Each point is a separate piece of tacit knowledge from the team meeting. By making them explicit and combining them in the body of the email, the writer (in this case the Project Manager), takes the team to the Combination phase. Included with this email sample as an attachment is an MSWord document, and it is also a form of explicit knowledge and adds to the combination of explicit knowledge and the knowledge created through this action. For a larger format copy of the email in Figure 11, see Appendix I.

Combination occurs in the SharePoint site used by team. SharePoint is a document management system that allows users to share documents. Users can upload newly created documents, download and edit documents created by others, and upload them again; or users may simply view documents that have been uploaded to the system.

When documents are uploaded, they are combined with existing documents to create new knowledge. In the case of the project team, these documents include copies of the Project Charter, Project Team List and contact information, weekly reports, various copies of the weekly LMT deck, and other PowerPoint presentations. Additionally, the SharePoint site may also have links to other websites or directories, as well as a calendar or project events. Each of these forms or explicit knowledge is available for viewing, sharing, and editing by project team members.

Unlike general knowledge databases available to all PharmCo employees, project SharePoint sites are often restricted to team members only. In this way the knowledge contained and shared within the team is controlled. The combination of explicit knowledge is focused on the team needs and helps to provide the right context from which team members can view and digest it. The control of context therefore aids in the speedier assimilation and benefits the team more directly.

5.8.1 A Valve for Combination

The PM is the conduit for the Combination of knowledge. As articulated, codified knowledge is given to the PM; he combines with others' knowledge provided to create a single space from which team members can access the new knowledge. We previously discussed how knowledge is combined in the LMT slide deck, in the meeting recaps and pre-meeting emails, and in the SharePoint sight. These actions are channeled through and driven by the Project Manager.

The LMT slide deck is the main tool used by the PM to communicate and present team knowledge. Even though many pieces are developed by other team members, those pieces are submitted to the PM for inclusion and the PM decides the sequence and importance of each of them. In this regard, PM1 said:

> [PM1] Every single workstream lead gives an update as to what's going on within their timeframe. And then I also intervene with various slides that I've done which shows at a high level the timeline as to what I understand what some of the things are, and I've gotten agreement before the meeting; and they all agree, the all see what we are marching too; if things have shifted little bit.

For PharmCo, SharePoint is a weak link in the Combination knowledge creation process. As a new space for combining explicit knowledge, it is not readily used by all teams or team members. But it is here where the PM is probably the most influential in driving the use of this tool. As the driver for this tool, the PM is directing people to the site, and ensuring various forms of explicit knowledge are posted, if not specifically by them, then by team members. PM's 1 and 3 shared the following:

> [PM1] We used; I used, I'm trying to get my team to use it, for their open topics. I'm trying to get them to go into the system, enter it directly into the system when they have an update. That's kind of difficult. They'd rather still it in spreadsheets, do it in excel, then give me the update, and then I go back into SharePoint and I update it in SharePoint. So I'm trying to get them to use it that way. SharePoint can also be, which I found useful, is I need bi-weekly updates on their workstream. So I send them an email; I say to them "time for you to update your slide." And all I do is send them the link. So they go into SharePoint, they update it, and I get an alert their update is done. So all I have

to do is pull their slide out and put it into my deck. So THAT is very useful, it saves so much time now.

They're getting there. It's much easier to pick up the phone or send [the PM] an email and say "do you have this?" And I say yes; it's on SharePoint and here is the link. And most of them are like "oh - (exasperated sigh)" because most people just forget to save the link in their "favorites" and they can't find the link. Then it's "got it; perfect; thank you." It depends in the person, and how computer savvy they are. There a still people who are intimidated by it.

[PM3] In my case, on a weekly basis I have a governance team meeting with all the key stakeholders. That deck that I provide, that has all the statuses on it, I upload that to SharePoint on a weekly basis. The project plan is in MS Project, and I upload a pdf version of the MS project. I post the pdf version not for my cohorts, because we all have MS Project, but I also post those to the invitation for all of the team members because not all of them have MS Project, so they can look at it in pdf version. It's not that I am going to over that in the meeting; I go over those specific areas with them in MS Project and we go through dates, activities, and deliverables and make adjustment as needed.

5.9 Internalization

The nature of the Internalization process (taking explicit knowledge and turning it into tacit knowledge) does not lend itself to overt, explicit, and demonstrable displays. However, through observation of actions, and discussions with team members, we can infer how and when this process occurs.

Figure 12: Internalization

PM1 states:

[PM1] A lot of times they take the slides and use them for other things. We will have discussions in the meetings as it affects people. As timelines get closer we might have discussions on it to get a sense of things.

By using slides from other sources, in this case the LMT meeting, project team members must internalize the knowledge contained in the slides in order to use them in needed context. They mix their tacit knowledge of another topic with the explicit knowledge provided in the form of the PowerPoint slides.

Knowledge is internalized through the review of documents in preparation for meetings or the start of the project. Before beginning a project PM4 looks to existing knowledge in the form of "Lessons Learned" documents. He states:

> [PM4] when I first came here that is the first thing I asked for "Lessons Learned," because that's how I function. I want to look at the lessons learned. I want to look at everything from a high level, at lessons learned from other projects.

He explains his reason for this action:

> [PM4] Because maybe what you see in projects that you are going through and looking at projects, and looking at the life cycle of the project going forward sometimes there are things hidden that you don't see that come out in the post mortem- kind of like the "I got you" that you don't want to repeat.

Team members benefit from the team environment to internalize knowledge and combine it with their own tacit knowledge. PTM1 states:

> [PTM1] When we are ask to prepare a new LRR for a different project, people are sending us previous ones, so we are trying to use some tribal knowledge from previously executed things.

PTM1 in this statement uses the term "tribal knowledge" as a synonym for tacit knowledge. It is the knowledge held within the team or individual, but also internally known by others. From this statement, we can infer the knowledge gained from the team, either through Socialization, Externalization, or Combination stages, is combined with their own tacit or tribal knowledge; and it is through the Internalization process that this occurs.

The weekly team meeting is a fertile ground for the internalization process to occur. During the observed meetings, the "side-bar" conversation was a common activity prior to, during, and after the

meeting. In these conversations, team members reinforced their understanding of information provided by asking clarifying questions. PTM1 provides the following insight:

> [PTM1] For me, the LMT meeting is for the team members to get together so that we continue to be on the same page as far as everyone knows what the key points are.

"Being on the same page" implies a need and drive to fully understand the knowledge that has been shared. This comes from clarifying what was provided by asking questions and interacting with other team members. PTM5 described the importance of the weekly meeting in this respect by stating:

> [PTM5] LMT is the forum where they find out what else is happening; how does it fit with my part and what am I doing; how does my part fit in; how does somebody else's part fit in; are we making progress? That is a very important objective of LMT.

5.9.1 A Valve for Internalization

A first internalization aiding action by the PM comes in the form of the Project Brief (Appendix J). This document is created by various people in association with the PM in the beginning of the stages of the project. In doing so, the essence captures of project is captured for all stakeholders, and in sharing it with team members, the PM establishes a baseline understanding. This first action provides the initial contextual lens through which the team members can then filter and measure project knowledge as it is received.

As knowledge is directed through and by the PM, he must also ensure it is accepted and internalized by the team. We have mentioned before how the Internalization process is both difficult to observe directly due to its tacit nature, it is also this nature that prevents the PM directly forcing understanding or acceptance of this knowledge. As a team member receives information, they must internalize it themselves, but the PM can, and we see how, they are able to facilitate and contextualize the knowledge so it can be more readily accepted and understood. Their actions directly aid the Internalization process.

Throughout each week, the PM works with team members to develop the meeting agenda. We have previously discussed the Socialization aspects of the meeting, but it is also in this preparatory phase where the beginnings of the Internalization process begin. In describing her preparations, PM1 said this:

> [PM1]… And then I suggest the workstream lead meet with the brand lead, so the brand lead can get an understanding of how it is interconnected …

While the Project Direct said this:

> [Exec1] They are asked for topics, and it is also an open forum so as you go through people will ask questions; and then it is making sure people understand what it is, and then based on other peoples experience that have gone through it they will pitch in.

Through these two statements, we can see how the PM (a Project Director is simply a PM of PMs) actively seeks to ensure team members are positioned to accept and understand aspects of the knowledge being channeled their way.

We also get a sense of how the PM directs activities during the meetings themselves. PM1 also shared:

> [PM1] We will have discussions in the meetings as it affects people. As timelines get closer we might have discussions on it to get a sense of things.

And when discussing a specific incident, she provided the following insight:

> [PM1] I start with an introduction, then say, "let me show you what other brands have done. Some pain points, some positives." Response is "hmmm, I've to remember that."

Meetings, team or individual, are not the only way the PM helps to facilitate the Internalization process. The recap emails are a powerful tool used in this area. The recap emails provide a static format from which the PM can convey the same message to multiple team members at the same time. Below is an excerpt from a recap email:

- DRA received Tradename letter from the FDA stating *[Project Product name]* is under review due to another product with a similar trade name. Depending on which application gets approved first, we may or may not receive approval for *[Project Product name].* We have developed a very

sensible strategy; namely, delay any action until we have feedback from advisory committee in September. The team reviewed the back-up name *[Alternative name 1]* as well as other options. The team concluded the best two options are:

- Change the spelling of *[Project Product name]* i.e. *[Alternative name 2],* [Alternative name 3]
- Change the beginning letter *[Product name letter]* and maintain *"[remaining product name letters]*"

In the above excerpt, the PM is positions the topic for acceptance by team members by first reminding the team of the discussion (since this was part of an email recapping the contents of the previous meeting), and second providing the reason and alternative previously discussed and accepted by others. In this action, the PM reminds meeting attendees of the discussion, but also informs non-attendees of the discussion, and in this way can mitigates surprises and misunderstanding regarding the topic by team members.

5.10 Acting as the Valve in the Regulation of the Flow of Knowledge

As noted earlier, knowledge within the team flows from individual to individual; from individual to group; and from group to individual; but unlike the flow of knowledge and knowledge creation we experience independently, in a project team environment, this process is directed and facilitated by the Project Manager. PTM2 says this about the PM:

[PTM2] She's storing our knowledge and experiences within our LMT; "oh, heard about blah-blah-blah from the workstream in another brand, PM can you check?" And she would reach out to other project managers or the workstream and get the information and share with the brand team and later with the entire LMT. She is very connected to the entire company.

Now let's examine how the PM acts in this manner through the lens of the SECI model processes.

5.11 Importing Knowledge

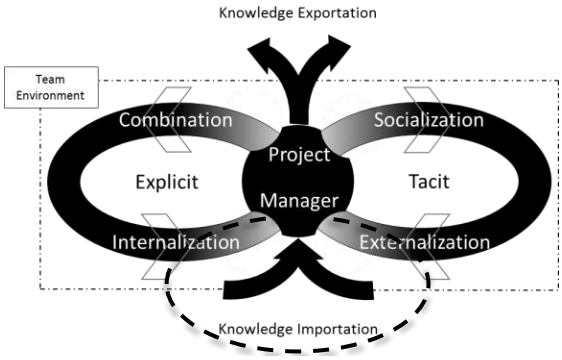

Figure 13: Importing

As the main control mechanism of knowledge within the team environment, the PM also influences and controls knowledge that is imported into the team from other areas. With their overall view and knowledge of the team, PMs are able bridge the gap between team members and provide a conduit for mixing seemingly disparate sources of knowledge. In PTM3's words:

> [PTM3] They have the full view. They have a full picture; they have all the workstreams. They know all the strategies and the accompanying tactics to that, or they should know. They also know where the touch points are and where the critical milestones are.

And PMT4 added:

> [PTM4] I think the PM oversees that whole process, and if she hears something in a conversation she's always very good about following up to make sure we all do that. She always has her ears perked for "oh, great you've got this." And I think she has a good understanding of the different functions.

The broader view of team needs means they must prepared broadly. In their preparations, PM's search for other pieces of knowledge and bring this knowledge from outside sources to the team. Regarding her preparations PM2 shared:

> [PM2] If I start a project I haven't work on before I would go to the intranet or I would go to the PMO SharePoint and I would look for the documents for the same type of project.

Because of their involvement in other projects, the PMs are able to import knowledge created from previous projects. PM4 comments on this:

> [PM4] A couple of things I learned from my last project, when we came to that stage here doing the same things, I reached out to my brand lead and said 'hey- heads up; this is what we did in my previous project, and these were some of the pitfalls, these are some of the things we learned, I would advise not to do that in this situation; we are facing the same circumstances, so let's keep in

mind the experience from another project." Or "this we did on another project that helped us at this point, how about looking into that here."

A helpful tool used in this respect is the "Lessons Learned" documentation. When talking about it, PM1 shared the following:

[PM1] To the PM, it's amazingly useful, because when we go onto another launch, that's the first thing, I start with. I start with an introduction, then say, "let me show you what other brands have done. Some pain points, some positives." Response is "hmmm, I've to remember that."

We can see how the PM's involvement in other areas positions them to seed new teams with knowledge from these other areas. Without importing knowledge, the knowledge created in other areas would not be used, and new teams would be forced to start from scratch in their knowledge creation, most likely reinventing the wheel as the do so. PTM2's comments demonstrate the importance to team members:

[PTM2] Our project is launching a product in a certain timeline, and there are so many workstreams going on, we were not aware of some of the workstreams, but she brought that in: "have you talked about this one, have you thought this one…"

5.12 Exporting Knowledge

Through their facilitation and direction of the knowledge created and flowing within the team, the PM also has a strong influence on the knowledge that is exported out of the team, as well. The LMT deck is a useful tool in this respect, as PM1 shared:

Figure 14: Exporting

[PM1] A lot of times they take the slides and use them for other things.

Through the externalization and combination of project knowledge, the PM creates a means for the knowledge created within the team to be exported out. But not all knowledge that is created within the team is available for, or should be exported. As the valve for the team, the PM also controls not only

what, but if knowledge is allowed to be exported. Issues such as regulations or confidentiality are among some of the things that may influence what, or when, the PM allows knowledge to be taken out of the team environment, as we learn through PM4's comments:

> [PM4] Only if there is something that is confidential information. There are times when I may know something about the project that I am working on that I am not supposed to share with other people. If it is something that may hurt rather than help the company; you don't want things leaking out also, so you want to keep it confined to specific people until things are sure or certain. That is one area where I would withhold information. Where it would do more damage than good. Other than that, I'm sharing it.
>
> You may not want to share it with the rest of the team because the information could leak out as significantly impact your drug and the stock price. That's one example of "let's withhold that information; let's no share it with everyone under the sun until we have 100% confirmation of it going this way or that way." So there are times when you need to take a step back and decide if you really need to share this with the team at this time. That is the only time I would see regulation of knowledge.

In each of the above areas, Socialization, Externalization, Combination, Internalization, and the importing and exporting of knowledge, the actions are driven and controlled through the PM and through their efforts the team benefits by receiving regular feeds of information to aid in the overall team knowledge creation process. In the team environment, it does not matter the direction of flow. The PM contextualizes and directs the knowledge dynamically and not necessarily in the sequential flow of the SECI model as discussed by Nonaka. This is how the knowledge creation activities on the team level differ from knowledge creation on the individual level. It is also why the Project Manager, as the leader of the project team, is vital and uniquely positioned to ensure that as knowledge is created it flows to the right area or person, and in the right manner. PM3 summed it up this way:

> [PM3] I have witnessed projects without a project manager, and what I've witnessed is that when a PM is not involved you have skewed effects on having the right stakeholders, you have skewed effects as far as what the total requirements are, you'll have partial applications that start being developed without a clear consensus of what the scope is.

5.13 Limitation of the PM in Knowledge Creation

The PM, however, is not unlimited in her ability to act as a valve in the knowledge creation process. PM's are not all powerful, nor is their purpose always to fix what is wrong. As PM2 stated, they are not "Superman:"

> [PM2] We're no "superman" flying in and saving the day, but you need to gather the team and make sure they are aligned.

There are limits and restrictions to what they can accomplish. PM2 further reminds us that more times than not, the PM is not the deciding factor in team decisions, but rather is operating from a base of power without direct authority when she says:

> [PM2] … We're in the position of "influence without authority", because the workstream leads do not directly report to us so we can only be so forceful, but it is obviously unproductive if the workstream lead will not join- so you can suggest it.

The lack of direct authority adds to the limitations. Without direct authority, PM's must rely on the team members to follow-up and fulfill their individual task. But that is not always the case, as PTM1 points out when asked about reading the pre- and post-meeting emails, he stated:

> [PTM1] No. I do a quick perusal when she sends them out. I'll open them up, scan through to make sure nothing pops out, there are no surprises. Just make sure nothing significant has changed, and nothing I'm responsible for has fallen off the radar, and that's it.
>
> I'll look at it; It's like you say, I'm not throwing it away, I'm not sharing- it's more making sure that I haven't dropped the ball on anything.

Recognizing these limitations is important for the PM. If he believes his authority level is greater than it actually is, his expectations of the team and what he (and the team) can accomplish will be overstated. A false sense of authority can lead to actions detrimental to the team, as well as contrary to the team knowledge creation. This false sense could easily lead to demands of meeting attendance or contribution, which could lead to team member resentment and constricted participation.

When team participation is constricted, the flow of knowledge and its creation is also constricted, thus hampering team progress. When the PM recognizes the restricted level of authority her actions become more accommodating to team member needs. Coercion is replaced with persuasion, and the team works together thus opening the flow to knowledge and its creation to greater team member participation and progress.

6 SUMMARY

Finding competitive advantages in business is a hard fought and constant struggle. The search for insight in gaining advantages is evident in the wealth and growth of the literature aimed at helping management in this regard. In particular are the areas of knowledge management and project management. This research spanned the scope of both areas by applying Knowledge Creation Theory to the practice of project management. Using the work of Ikujiro Nonaka and his colleagues in the area of Knowledge Creation Theory, this research explored the actions of Project Manager in managing team activities, and in the process a new understanding of the role of the Project Manager was derived. The process model of Socialization, Externalization, Combination, and Internalization (SECI) was reviewed in accordance to its relationship to the tacit and explicit knowledge continuum, and how the PM is uniquely positioned to facilitate and drive the process of creating knowledge within the project team environment.

The literature review in the area of knowledge, knowledge management, and knowledge creation

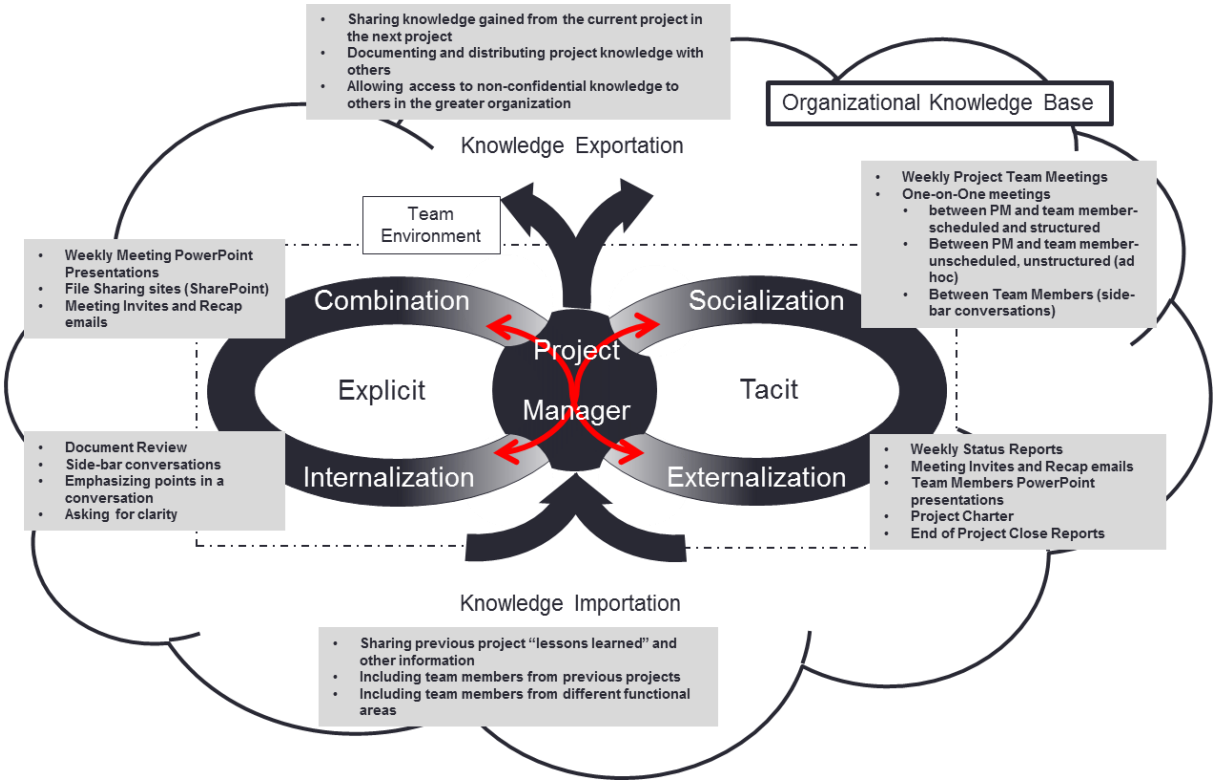

Figure 15: Full Model and Examples

clearly ties the needs of the business to the importance of knowledge, and its use and manipulation, in order to succeed. On the other end of the spectrum lies the literature in Project Management, which is less organized around any central, unifying theory, but rather is ripe with multiple theories. However, there is overlap of the two topics, and it is in this area this research was focused. This research fills a gap in literature with respect to knowledge and project management by assigning responsibility for knowledge creation within the project team specifically to the Project Manager.

By focusing on the role of the Project Manager, this research provides an answer to the question: "How do project managers facilitate the conversion of knowledge from explicit to tacit, and back, within the project team environment?" In answering this question, the research followed a case study methodology. The rich documentation of the topic and the recursive cycling of data analysis provided the foundation from which the proposed model was built (Eisenhardt & Graebner, 2007; Yin, 2009).

Through the use of direct quotation of participant interview responses, analysis of archival data (emails and other documents) and notes from direct observations, this research was able to achieve methodological triangulation of the data and findings (Denzin, 1970). Additionally, the use of data triangulation (Yin, 2009) provided greater validity in that the multiple sources provided multiple measures of the same thing (2009).

The results presented in this manuscript outline the actions and activities performed by Project Managers in relation to the SECI model processes. The SECI model, as presented by Nonaka, et al, outlines a sequential, four block process of knowledge creation. When combined with a linear view of the tacit-explicit knowledge continuum (Nonaka & Von Krogh, 2009) we can envision the SECI processes along an infinite loop path so that knowledge is continuously being created. Along this path, and positioned at the center of the loop where the two sides (tacit and explicit) cross, we place the Project Manager. In this position, the PM acts as a mixing valve that influences, controls, and facilitates the mixing of explicit and tacit knowledge, and directs it to the required knowledge creation process.

A key finding from this research is that the SECI process model, which espouses a continuous, sequential, spiral through the four phases (Nonaka, 1994; Nonaka, et al., 2008), is a more dynamic and

non-sequential process for project teams (Figure 15). The creation of knowledge in the team environment occurs between any two aspects of this model. Knowledge is created along Socialization-Combination path, by-passing Externalization and Internalization, when facilitated and driven through the valve that is the Project Manager. The efforts of the PM also create knowledge along the Externalization-Internalization path without necessarily passing through Socialization or Combination.

This is in part due to the nature of the team environment. The original SECI process model (2008) is focused on the individual and how we create knowledge through our interactions with others. In the project team environment, the individual's efforts are enhanced when paired with other team members. This creates simultaneous pathways of interactions and directions in which knowledge creation flows may proceed. In this way multiple people are creating knowledge at any point in the loop, and the team as a unit is creating team knowledge dynamically with no single direction of process phase steps.

PMs facilitate the Socialization process by organizing and directing team and one-on-one meetings with project team members (PM-to-PTM, and PTM-to-PTM), and by doing so create an environment in which the sharing of tacit knowledge between team members is focused for the benefit of the team. The Externalization of knowledge is facilitated by the PM in the form of written weekly status reports and their presentation, and in the culminating project close out reports. Through these activities, the PM draws out the tacit knowledge from team members and influences the articulation of knowledge into an explicit form. The explicit knowledge drawn out by the PM is further developed in the Combination process. Tools such as weekly MS PowerPoint slide decks, which contain various status reports, bring together the explicit knowledge previously captured. Additionally, the use of document storage and management software such as SharePoint provides a space for the combination of various knowledge elements. Finally, the PM helps with the Internalization of explicit knowledge by providing context of the various forms of shared knowledge. The context provided aids PTMs in their process of converting the acquired explicit knowledge into their own tacit knowledge.

The PM also facilitates the flow of team knowledge by directing its inflow and outflow. As the recognized leader of the project team and coupled with their broader interaction with the larger

organization, the PM position is able to filter and direct knowledge both into and out of the team environment. By filtering imported knowledge, the PM can control the amount and context of the knowledge so that it is of value to the team. By controlling the exportation of team knowledge, the PM protects the team and the larger organization from untimely, and possible harmful knowledge leaks.

6.1 Contributions to Theory

The literature concerning project management is most often centered on the project or project team level. This research provides a contribution to theory in several ways. First, this research provides a new understanding of role of the Project Manager different than the task oriented leader. Currently, the PM's role is understood to be first one of "management;" i.e. getting things done. As such, PM research has been focused the technical aspects of project management; the tools and practices used to meet project constraints and achieve project success (PMI, 2008). While research concerning project management and knowledge is concerned with the extraction and distribution of knowledge from the project or project team (Newell, et al., 2006; Newell & Edelman, 2008), to other projects or the greater organization (knowledge transference), it has not explored how the PM fits in the knowledge creation process. With this view of the Project Manager, we envision them less as a "Task Manager" and more as a "Knowledge Creation Leader."

By applying Nonaka's Knowledge Creation Theory, this research contributes to the expansion of the theory by applying it specifically to the Project Manager. While KCT has been widely discussed in Knowledge Management literature, along with management practices, this research contributes to theory development by directly applying it to specific actions and persons. Current Knowledge Creation Theory is focused on general management practices, and as such does not assign or indicate a responsible party. By directly assigning responsibility of knowledge creation to the PM (Nonaka, 1994) in the team environment, a new perspective of the project manager is established (Newell, et al., 2006).

Like-wise, this research contribution to theory through the specific application of KCT and the SECI model to roles and areas of study (Nonaka, et al., 2008). While previous literature has discussed the process steps in relation to the business environment, these discussions have been general in nature and

use broad examples in order to highlight when or where the processes occur. The application of the theory to the area of Project Management, an established and recognized practice, and the Project Manager, a role recognized to be distinctly separate from functional or operations, provides more detailed descriptions and examples.

The research also contributes to theory by showing how knowledge is both tacit and explicit at the same time (Von Krogh, Ichijō, & Nonaka, 2000). There will always be the interplay between the two sides of the model, and as soon as you make the tacit explicit, it is simultaneously tacit and explicit. Externalizing our knowledge (moving from the tacit to the explicit) does not diminish the tacitness we hold. This research highlights how even though knowledge is made explicit, it is still tacit to the person who made it explicit. In the team environment this becomes more distinct as several individuals may at different points along the tacit-explicit loop continuum.

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6.2 Contributions to Practice

This research also contributes to the body of knowledge in the practice of project management in several distinct ways. First, it contributes to practice by providing a new way of thinking about the role of the Project Manager. The role of the PM is currently viewed and understood to be one that is centered on action; getting things done; meeting objectives within defined timeframes and under specific constraints. By developing a new understanding of the role of the PM as a 'mixing valve' in the flow of knowledge, this research provides project management practitioners (and in a broader sense, managers in all areas of an organization) new ways of conceptualizing their work with peers, subordinates, and superiors. By understanding their role as one more focused on facilitating and driving the creation of knowledge, Project Managers can then focus on enhancing the paths and tools of knowledge capture, that until now have been, at best, underutilized.

This research contributes to the practice further by providing a view of the PM which requires a shift in our thinking of project management, project managers, and how we go about assigning, staffing, and managing the people involved. By focusing on the knowledge creation process, the steps within that

process are highlighted, as are the tools and means by which step completion is achieved. Active, purposeful, knowledge creation through the Socialization process means direct involvement by Project Managers. Project meetings (group or individual) are not solely focused on the task completion percentage, but structured so all team members are provided an opportunity to expand the knowledge base. Active, purposeful, Project Managers seek to ensure they match team members together, even though the match may be counter intuitive. They seek to enhance the inter-personal interactions of the team. Face-to-face meetings are elevated and enhanced so their agendas and purpose include the promotion a knowledge creation activities. This means interaction and involvement of all team members beyond just reporting accomplishment. Time is accommodated for before or after meetings to allow for side-bar/off agenda discussions among team members. Meeting agendas are developed to include team members in the discussion, while the PM actively establishes and drives the context for understanding. Absent of the PM's direction and involvement, the Socialization knowledge creation process would occur, but it would be unfocused and the benefits to the team (and organization as a whole) would be lost among competing individual priorities of the team members.

The third contribution to practice from this study is that it highlights and emphasizes the importance of Externalization tools like Status Reports and Meeting Minutes. When PM's understand the importance of their role in the knowledge creation process, externalization tools are positioned so all team members understand their importance in gaining knowledge. They are shared and discussed. Their combination with other externalized knowledge is purposeful, and made accessible. Further, PM's are concerned with team members' understanding their content and the application of the knowledge to the team member's roles within the team. They seek to ensure understanding, and extract that understanding so it is shared with the team.

In this respect, and from this viewpoint, every project is a knowledge creation opportunity, and as such, the Project Manager is a "Knowledge Creation Leader." The team itself is not just a team, but a resource in the knowledge management arsenal, on par with file cabinets and databases. Knowledge Creation Leaders would then be measured on the effectiveness and efficiency of the knowledge created

and the process used. Project success is measured not only by achieving time, cost, and quality goals, but also knowledge goals (a future research topic).

By highlighting the Project Manager as a facilitator, controller, and driver of team knowledge, this research contributes to the practice of project management by showing the need to change how we train new Project Managers. We must still meet the bottom line objectives, the project constraints, but in order to meet the new knowledge requirement, PMs must be adept at managing the different aspects of knowledge creation. For example; meeting organization and effectiveness is not merely important as a time management issue, it also becomes important in achieving the correct place for socialization and the exchange of ideas. Proper meeting content becomes important in order to establish the correct context for knowledge creation.

By accepting this model, PM's have to be more personally involved with project team members. They have to work with them to extract what they know, to make their tacit knowledge explicit; and put it into acceptable formats so other team and organizational members can learn from, understand, and make it tacit to themselves. We must still adhere to the "traditional" constraint measurement when defining success, but this research also shows we must work with our teammates and colleagues more effectively.

This research reinforces the role of the PM, PM practices, and the PMO within an organization. If you are not holding consistent team meetings or if you are not getting and sharing status reports on a regular basis; then the team and project are not operating as effectively as possible. This research shows we need to practices these behaviors and by doing so we will elevate the teams effectiveness.

6.3 Limitations and Future Research

The research presented was an inductive, qualitative case study. While case study research provides rich context from which to draw conclusions, it lacks generalizability (Eisenhardt & Graebner, 2007; Myers, 2009; Yin, 2009). Generalizability refers to the extent by which the research can be applied to the general population. Additionally, this research was conducted with a single organization, whose structure and practice of project management aided in the research design and data gathering process. However, as this research is focused on exploring a new theoretical view of the PM's role, the

explanatory nature of case study research was appropriate for the purpose. There is value in these limitations, specifically the need to continue research in this area for the purpose of building upon what has been discussed and offering greater insights.

In the course of the research process, the proposed model was presented and explained to the interview participants. The purpose of this was to gain their feedback and insight from a practitioner's perspective. Overwhelmingly, the feedback was positive and supportive. They recognize that this is not the only way to look at the role of the PM, but also realize the actions they perform fit the model described. PM4's sums up the feedback when she said:

> [PM4] I don't think we even realize we are doing that, but I think we are doing that. I'm not making a conscious effort take this knowledge from this team and give it to this team, but I think the way you describe it, it is happening. It kind of like you are cooking something and the recipe requires ingredients from 10 different people and you're not realizing it, but you collecting those ingredients and then you are cooking something at the end of the day, which involves help or input from different players.

To be fair, even among the supportive comments, there was some dissent. PTM5 recognized that the creation and flow of knowledge is not the sole responsibility of the PM. All team members play a role, whether it is actively helping others create knowledge or aiding the PM in his or her facilitation. PTM5 provided the following insight:

> [PTM5] I think that's not the sole responsibility of the PM. I see that as being my job as well. And we facilitate each other making sure the team gets the knowledge and information. That's the partnership we talked about. We also talked about making sure the right people are in the seat for certain meetings so get the expertise. After that, the PM and me are in the meeting so it becomes our responsibility to proliferate that to other team members as if relates to their function.

Additionally, the complete research findings were review with the research participants (practicing Project Managers and members of a formal PMO). While they agreed the results and conclusions validate their work and importance of their role in the organization, there are still questions about how to measure their actions and establish themselves more concretely as vital to the greater

organization. These limitations and questions are indications of the need and direction of future research in this area.

The research conducted and presented in this manuscript has been for the purpose of establishing a new and different way of perceiving the role of the Project Manager. It does not purport to say which practices are best used, how to measure them, or prove conclusively it is correct. As a new and open viewpoint, this research leaves open many avenues for future research, both qualitative and quantitative.

Qualitatively, future research may focus on some of the demographic aspects of this research. Is there a difference in the way male and female PM's facilitate and drive knowledge creation in their teams? If so, what are those differences? Likewise, does the amount of experience matter, or the level of education matter? In each of these, first understanding the differences in behaviors through observations and interviews will help establish a greater understanding, and highlight specific actions that may be measured quantitatively.

Since this research was conducted with a single organization (a limitation noted above) further research should be undertaken to ensure these findings hold true in other settings with less formalized project management practices. Also, do the practices described in this research hold true in other industries where time constraints are more, or less, rigid? Does the degree to which the team is more or less virtual impact the knowledge creation process and practices. This research brings these questions to mind, and future research with other industries and other company structures my shed light on them.

Quantitative studies are normally designed to focus on the testing and verification of theory. In the area of Knowledge Management, this task is difficult due to the nature of "knowledge." However, by focusing on the separate knowledge creation steps and the tasks that are controlled by the PM, the possibility of finding which methods are more useful and effective is more attainable. By looking incrementally at the tasks and tools, quantitative research in the area of knowledge management and creation would provide a means for measurement of both the process and the practitioner. If we are to accept this model in the practitioner's world, there must also be a means by which to measure it. Without

a form of measurement, management of the process is less viable for Project Managers. Additional research is needed in this area so that viable measures and measurement practices can be established.

6.4 Closing

In closing, the research conducted, and all the people involved, have provided immeasurable insight, cooperation, and support. This effort has opened my eyes to new ways of looking at how we create knowledge and the things we do to help ourselves and others in the process. I also realize this is just the tip of the iceberg, and there is much more to learn and know as I journey along my own path in acquiring knowledge.

7 REFERENCES

APPENDIX A: Interview Guide

Dissertation Research
Towards a New Understanding of the Project Manager as the 'Mixing Valve' of Organizational Knowledge: A Case Study Approach

Doctoral Candidate: Ted Bibbes
Doctoral Advisor: Dr. Wesley Johnston

Interview Protocol for Project Manager
Introductory Protocol:
To facilitate my note-taking, I would like to capture our conversation electronically. For your information, only I or designated representatives for the research project (for language or logistical reasons) will have access to the recordings. All recordings and other records from this interview will be kept in separate, and password protected hard drive. This hard drive will only be accessible by me.
As part of my research protocol, I sent you a copy of my Informed Consent Form. This document states that 1) all information will be held strictly confidential, 2) your participation is voluntary and you may stop the interview at any time if you feel uncomfortable, and 3) there is no intention to inflict any harm. By signing and returning the form to me, you indicate your understanding the terms of the research and your rights. Based on your consent, we have contacted you. Thank you for your participation.
The interview is planned to last no longer than 90 minutes, but if we need more time and schedules permit, we will continue. If schedules do not permit exceeding the scheduled time frame, I will schedule a follow-up interview. During this time, I have a series of questions that I would like to cover. In order to keep to my commitment to time, I may interrupt you in order to continue to complete the line of questions.
Introduction:
You have been selected to speak with me today because of are currently in a project management role, or have been in that role previously. My research project focuses the role of the project manager. Specifically, the actions and behaviors project manager's use in the fulfillment of the job. There are three parts to the overall questionnaire guide. Part 1 concerns your general thoughts and ideas about project management and the practices, behaviors, and actions you practice. Part 2 concerns a specific view of the project manager role. So as to not influence your answers in part 1, I will explain this view when we reach part 2 of the interview. Part 3 of the overall questionnaire are some simple demographic questions. My intention is not to judge any thoughts or actions taken, but to comprehend their contextual nature in order to better understand the decisions made and actions taken while managing a project.
The questions are open-ended. This means there is no right, or wrong, answer. I am interested in your thoughts, the more information you are able to provide the better. Although I have ordered the questions for my own ease, there is no set order. You answers may dictate a new flow to the questions, or new questions to ask. I may also probe for greater understanding during the questioning period.

Section I – Personal Perspectives on Project Management

1. Describe your role as a project manager.
   a. Alternative: Describe your understanding of the role of the project manager.
2. Tell me about you relationship with your project manager/team members
3. How do you define a successful project?
4. Tell me about a "typical" project.
   a. Who does what?
   b. What is your role?

5. Would you agree or disagree with the following statement:
"When I know how to do something, it is easier to do it and it gets done more quickly."
If yes: please give me a descriptive example

If no: Please tell me why you disagree

6. What do you think are the most important aspects a project?
7. How often do you communicate with your project team?
   a. As a group
   b. As Individuals
   c. With Clients
8. What methods of communication do you use with project team members?
9. Does your organization have a knowledge management system or defined knowledge management practices?
   a. Tell me about the KMS;
      i. How do you use it?
      ii. What are the pros and cons?
   b. Tell me about the practices
      i. How do you use it?
      ii. What are the pros and cons?
10. What method do you use to capture project lessons learned or other new knowledge?
11. How do you share this information with team members
   a. If Not- Why Not?
12. How do you share past knowledge attained with new teams or team members?
13. If you are faced with NOT knowing something:
   a. Where do you find the information?
   b. What do you do with it?
   c. How is it shared with team members?

Section II – Perspectives on Knowledge Management
(Introduce the model to the subject)

1. What do you think of this view of the role of the project manager?
2. What might keep you from sharing knowledge with your team?
3. Would you be more incline to share one form of knowledge (explicit vs. tacit) over another?
4. Is there anything that would keep you from fully sharing explicit or tacit knowledge?
5. What do you think regulates the flow of information/knowledge?
6. Based on your experience, what are the best practices used when sharing knowledge?

APPENDIX B: Informed Consent Form

Georgia State University
Department of Executive Doctorate in Business

Informed Consent

Title: Towards a New Understanding of the Project Manager as a Mixing Valve of Organizational Knowledge: A Case Study Approach
Principal Investigator: Wesley Johnston, Faculty Advisor P.I.
Ted Bibbes, student P.I.
Sponsor: PharmCo Pharmaceuticals

I. Purpose:
You are invited to participate in a research study. Your participation is completely voluntary, and all responses will be kept strictly confidential. The purpose of the study is to investigate the practices and behaviors of project managers. You are invited to participate because you have been identified as a project manager, project team member, or supervisor in project management. Participation will involve approximately 60 - 90 minutes of your time for the initial interview.

II. Procedures:
If you decide to participate, you will be asked to meet with the researcher for an information gathering interview. The meeting may be in-person or by phone. During the interview, you will be asked a series of open ended questions. Your answers will be recorded electronically and in written form. The researcher may alter the questions slightly based on your answers, but will remain within the question protocols established for this research.

All interviews will be conducted in a private session, either in the participants' office or other setting suitable for private conversation, and not subject to arbitrary interruptions or eavesdropping. Interview sessions will be scheduled and conducted according to the participants' and researchers' mutual availability. The researcher will make every effort to give preference of time and location to the participants needs when possible.

From time to time the researcher may ask you to repeat your answer. The purpose for this request will be for clarity and understanding. Before concluding the interview, the researcher will review his notes with you to ensure your responses have been accurately captured.

III. Risks:
In this study, you will not have any more risks than you would in a normal day of life.

IV. Benefits:
Participation in this study may not benefit you personally. Overall, we hope to gain information about the business community and the practice of project management.

V. Voluntary Participation and Withdrawal:
Participation in this research is voluntary. You do not have to be in this study. Your selection for participation, and whether or not you decide to participate, will not be shared with your employer. If you decide to be in the study and change your mind, you have the right to drop out at any time. You may skip questions or stop participating at any time. Whatever you decide, you will not lose any benefits to which you are otherwise entitled.

VI. Confidentiality:
Your records will be kept private to the extent allowed by law. Dr. Wesley Johnston and Ted Bibbes will have access to the information you provide. Information may also be shared with those who make sure the study is done correctly (GSU Institutional Review Board, the Office for Human Research Protection (OHRP)). We will use a coded study number rather than your name on study records. The information you provide will be stored electronically on a firewall and password-protected computer. Your code identification will be kept in a separate, password protected file. Your name and other facts that might point to you will not appear when we present this study or publish its results. The findings will be summarized and reported in group form. You will not be identified personally.

VII. Contact Persons:
You may contact any of the researchers in connections with this if you have questions about this study.

Contact Information:
Ted Bibbes, tbibbes1@student.gsu.edu, 770-846-6759
Dr. Wesley Johnston, mtkwjj@langate.gsu.edu, 404-427-4368

If you have questions or concerns about your rights as a participant in this research study, you may contact Susan Vogtner in the Office of Research Integrity at 404-413-3513 or svogtner1@gsu.edu.

VIII. Copy of Consent Form to Subject:
We will give you a copy of this consent form to keep.

If you are willing to volunteer for this research and be audio recorded, please sign below.

_____ _____
Participant Date

_____ _____
Principal Investigator or Researcher Obtaining Consent Date

APPENDIX C: Contact Summary Form

CONTACT SUMMARY FORM

Contact Type:		Site:	_____
Visit:	_____	Contact Date:	_____
Phone:	_____	Today's Date:	_____
Name:	_____	Written by:	_____

1. What were the main issues or themes that struck you in this contact?
2. Summarize the information you got (or failed to get) on each of the target questions you had for this contact.

Question: Information:

3. Anything else that struck you as salient, interesting, illuminating or important in this contact?
4. What new (or remaining) target questions do you have in considering the next contact with this site?

APPENDIX D: Document Summary Form

DOCUMENT SUMMARY FORM

Document Type: _____ Site: _____
Document No.: _____
Today's Date: _____
Date Recv'd: _____
Name or Description of Document:
Event or Contact associated with document:

Significance or importance of document:

Brief summary of document contents:

APPENDIX E: Sponsor Company Information

Sponsor Company Information

PharmCo International AG
PharmCo provides healthcare solutions that address the evolving needs of patients and societies. Throughout the years, PharmCo and its predecessor companies have discovered and developed many innovative products for patients and consumers worldwide. Focused solely on healthcare, their diversified portfolio includes innovative medicines, cost-saving generic pharmaceuticals, preventive vaccines, diagnostic tools, and consumer health products. Through their diversified, yet focused, product offering they hold leading positions in each area.

PharmCo Pharmaceuticals Corporation is a subsidiary company of the overall PharmCo International group. They research, develop, manufacture and market leading innovative prescription drugs used to treat a number of diseases and conditions, including those in the cardiovascular, central nervous system, cancer, ophthalmics, organ transplantation and respiratory areas.

PharmCo Pharmaceuticals
The Pharmaceuticals Division of PharmCo is the largest division within the PharmCo family. They employed 49% of the full-time associates. They are recognized worldwide for the innovative medicines they provide to patients, physicians and healthcare organizations. This growing business develops and markets patent-protected prescription drugs for important health needs. Their products are concentrated in major therapeutic areas including:

- Cardiovascular and Metabolism
- Oncology (including Hematology)
- Neuroscience and Ophthalmics
- Respiratory
- Integrated Hospital Care

The current product portfolio includes more than **60 key marketed products**, many of which are leaders in their respective therapeutic areas.

The **product development pipeline** has more than 130 projects in various stages of clinical development, including potential new products as well as potential new indications or formulations for existing products.

They are also committed to developing and commercializing evidence-driven diagnostic tests that improve physicians' ability to optimize patient outcomes.

Source: PharmCo website; http://www.PharmCo.com, (AG, 2011)

APPENDIX F: Letter of Agreement

To:	[Executive 1 Name] [Executive 1 Title] PharmCo Pharmaceuticals Corp. Filed & Marketing Services [Street Address] [City, ST ZIP]	**From:**	Ted Bibbes EDB Candidate Georgia State University J. Mack Robinson College of Business
Cc:	[Executive 2 Name] [Executive 2 Title] PharmCo Pharmaceutical Corp.		Wesley Johnston, PhD Dissertation Committee Chair Georgia State University

Re: Agreement to partner in doctoral dissertation research

Please consider this our Letter of Agreement to proceed in partnership for the purpose of conducting academic research in the field of project management.

The proposed research is focused on the Project Manager. Although the proposition being explored can be applied to all levels and areas of management, the Project Manager will be our focus because of their unique position within an organization. The proposition to be studied is that the Project Manager acts as a "mixing valve" in the continuum of organizational knowledge.

The purpose of the research is twofold. First, in fulfillment of the researcher's doctoral dissertation, and second, to more fully explore and understand the Project Manager's role in facilitating and leading project team members to develop both ends of the knowledge continuum for themselves and the organization.

There is no monetary investment or remuneration directly associated with this agreement for either party.

This letter does not obligate either party to immediate project start, but is a commitment to begin discussions and share information for the purpose of planning. A Project Charter will be developed which will specify the project scope and obligations of both parties.
We tentatively expect the research project start mid-May, 2012.

RESEARCHER
Ted Bibbes
Signature: _____
Date:_____

PHARMCO PHARMACEUTICAL CORPORATION
Name: _____
Title: _____
Date:_____

APPENDIX G: Dissertation Research Project Charter

Dissertation Research Project Charter

Towards a New Understanding of the Project Manager as a Mixing Valve of Organizational Knowledge: A Case Study Approach

I. Statement of the Purpose

The purpose of the research is twofold. First, in fulfillment of the researcher's doctoral dissertation, the researcher is required to complete an independent research project. This research should conform to the engaged scholarship form of academic research. Engaged Scholarship is defined as "a participative from of research for obtaining the advice and perspectives of key stakeholders." What this means is that we strive to bridge the gap between the practitioner (real) world and academic world by applying academic rigor to real world problems by engaging with practitioners and focusing on business issues. In this way, we advance both the scientific and professional disciplines.

The second purpose of this research is to more fully explore and understand the Project Manager's role in facilitating and leading project team members to develop both ends of the knowledge continuum for themselves and the organization. This research seeks to understand how PMs interact with their project team and facilitate the conversion of knowledge. By applying the Knowledge Creation Theory, the research will attempt to construct a view of the PM as an individual uniquely situated to aid and drive the development of knowledge within an organization by appropriately controlling and converting the organizations explicit knowledge into tacit knowledge within the project team, and vice-versa. In this role the PM acts as a "mixing valve" in the flow of knowledge within an organization.

II. Project Scope

- **Area of Concentration**

The proposed research is focused on the Project Manager. Although the proposition being explored can be applied to all levels and areas of management, the Project Manager will be our focus because of their unique position within an organization. The proposition to be studied is that the Project Manager acts as a "mixing valve" in the continuum of organizational knowledge. Knowledge can be viewed as flowing from its explicit form; the codified, written, imaged version such as manuals, maps, and guidelines into its tacit form; the internalized things we "know" but find difficult to articulate. As the mixing valve, the PM sits at the crux between the explicit-tacit creations. By viewing themselves in this capacity PMs can then focus on helping team members absorb organizational knowledge by providing context so it becomes tacit more easily, and therefore provide the organization with greater dynamic capabilities. The organization also benefits by converting the team members tacit knowledge into sharable explicit organizational knowledge.

- **Research Question:**

Based on the above stated purpose, the proposed research will seek to answer the following question:

- *How do Project Managers facilitate the creation of knowledge through the conversion from explicit to tacit knowledge, and back, within the project team environment?*

- **Research Strategy**

Because the research seeks to answer the "how" question, a qualitative, single case study methodology will be used.

Using this strategy, the researcher will engage with a single Project Manager. The researcher would be embedded within the project team. Where possible and prudent, he will attend meetings and act as a silent observer. The observations will be of the project manager's interactions with the project team. The researcher will also conduct interviews with project team members. The interviews can be via phone/teleconference, but in-person is preferred. Additionally, other communications (emails, memos, etc.) and documents used in the course of managing a project will be analyzed.

- **Research Timeline**

Research activities will begin in mid-May, 2012. In order to collect sufficient, appropriate, and in-depth data, research activities are planned to run through the end of August.
The researcher may terminate or extend the research timeline to suit the needs of the project.
If the researcher determines additional time is required for the purpose of data collection, he will first seek consultation and permission from the sponsoring company, PharmCo Pharmaceuticals Corporation.
If the researcher determines the stated timeframe is not required, and wishes to terminate the formal data gathering phase of the research project, a one-week notice will be given via email.

- **Researcher-Sponsor Engagement Assumptions:**

The following are assumptions made by the research for engagement:

- **Confidentiality**. In return for access to company personnel for the purpose of completing the proposed research, the research will comply with the PharmCo' needs for confidentiality. A Non-Disclosure Agreement will be signed by the researcher, and copies kept by both parties.
- **Anonymity**. If PharmCo (or any of its employees) wishes to remain anonymous regarding participation in the research, the researcher will remove all references from the written copies.
- **Voluntary**. Participation in the study is completely voluntary. All research participants will be provided with an Informed Consent form prior to engaging in the research. If any participant, or PharmCo as a whole, wishes to withdraw from participation in the study, they will be allowed to do so without prejudice.
- **Right of Review**. PharmCo will be allowed to review and provide editorial comments of any manuscripts prior to their submission for publication.
- **Research Control**. The researcher shall maintain control of all research activities and data. The researcher will not attempt to inject or control any part of the PharmCo project efforts. Acceptable research activities are outlined below in § III.
- **Research Schedule**

Participant interviews will be scheduled by the researcher. Participant's availability and location preference will be maintained as the priority factor when scheduling.
Other meetings and participant interactions will be scheduled through the PharmCo Project Manager.

- **Scope Controls**

Changes to the research project scope will be reviewed and decided by the researcher, in consultation with the researcher's dissertation committee.

III. General Approach

One-on-one, in-depth interviews with the Project Manager and project team members will constitute the main sources of data collection. Additionally, the researcher will be a silent observer on selected team meetings and/or phone calls.
All interviews will be conducted in a private session, either in the participants' office or other setting suitable for private conversation, and not subject to arbitrary interruptions or eavesdropping. Interview sessions will be schedule and conducted according to the participants' and researchers' mutual availability. The researcher will make every effort to give preference of time and location to the participants needs when possible.
From time to time the researcher may ask interviewees to repeat an answer. The purpose for this request will be for clarity and understanding. Before concluding the interview, the researcher will review his notes with the interviewee to ensure responses have been accurately captured.

IV. Communication:

Communications will be conducted through all available means:

- **In-person:** For research purposes, meeting in-person is the preferred means of communication. This allows the researcher to more easily adjust read body language and other physical cues during interviews and meeting.
- **Email:** This vehicle will be the main method for initial contact with study participants and written communications. Fax and postal mail are also acceptable means of communicating written documents, especially when copies or original documents are required with signatures.

- **Phone:** This vehicle will be the main method for interactive communication when it is not feasible or economical for study participants to meet in person

It is desirable that phone and email messages be answered promptly. In the context of phone (voicemail) and email messages, "promptly" will be defined as within 24 hours from when the message was received. Messages sent or left at the end of the day, or after hours will not be expected to be reviewed or responded to until the next normal business day.

V. Resource Commitment

Participation in the study is completely voluntary. All research participants will be provided with an informed Consent form prior to engaging in the research. If any participant, or PharmCo as a whole, wishes to withdraw from participation in the study, they will be allowed to do so without prejudice.

VI. Contact Information

For the purposes of this research project, the key contacts will be as follows:

Ted Bibbes	[Executive 1 Name]
Researcher, Georgia State University	[Executive 1 Title]
770-846-6759	[Executive 1 Phone]
tbibes@gmail.com	[Executive 1 Email]

APPENDIX H: SECI Model Coding Inter-Relation

The Socialization – Externalization Connection
Unsurprisingly, the Socialization-Externalization connection is the most frequently referenced connection among various options. There are 25 references that are coded both as Socialization and Externalization indicating the shared aspect of these phases. This frequency is not surprising because individually, these two SECI phases were the top two coded of the individual SECI phases.

The Externalization – Combination Connection
The Externalization and Combination is another main pathway in the knowledge creation process. These two phases share 11 references, indicating the strength of the connection.

The Combination – Internalization Connection
The combination to internalization connection is also one of the main four connection pathways, but due to the highly tacit nature of the internalization phase, it is difficult to observe directly. This difficulty is reinforces by the relatively few shared references for the two phases. However, we do find evidence of the connection in 4 references.

The Internalization – Socialization Connection
The internalization – socialization connection is the fourth step in the SECI model. It is also the third most referenced shared connection, with 15 references sharing both codes. The number of coded references is somewhat surprising given the nature of the Internalization phase mentioned above, but it conceivable that the highly observable nature of the Socialization process elevates the visibility of this connection.

The Externalization – Internalization Connection
The connection from Externalization to Internalization is one of the alternate paths from the Nonaka sequence. With 19 shared references, it is the second most frequently referenced connection, and indicates where the PM is facilitating the internalization and externalization of knowledge outside of the socialization or combination sequence steps.

The Socialization – Combination Connection
A second alternate path connection is between the Socialization and Combination processes. We see evidence of this connection with these processes sharing the same 3 references.

APPENDIX I: Recap Email Sample

From: Project Manager
Sent: Wednesday, June 27, 2012 8:10 AM
To: Project Team Members
Subject: [Project Name] Recap - 6-26-12
Attachments: [Project Name] SRF Form Project Brief 6 26 12.docx

Hello, [Project Name] Team:
Thank you to everyone for attending the [Project Name] LMT Meeting Tuesday, June 26, 2012! Below is a brief recap of our meeting and next steps.

Key Highlights:

- [Project Name] ideation Day took place on June 13, the feedback was positive and team would like to participate in another session. Outcome and next steps will be shared at next LMT
- DRA received Tradename letter from the FDA stating [Project Name] is under review due to another product with a similar trade name. Depending on which application gets approved first, we may or may not receive approval for [Project Name]. We have deve oped a very sensible strategy: namely, delay any action until we have feedback from advisory committee in September. The team reviewed the back-up name Litynda as well as other options. The team concluded the best two options are:
  - Change the spelling of [Project Name] i.e. [Alt Name 1], [Alt Name 2]
  - Change the beginning letter R and ma ntain "[product spelling]"
- PHA Conference occurred June 21-24. PharmCo had a strong presence and the team capture many learning.
- DRA completed the second ACM Mock Meeting B on June 21, the overall outcome we have alot of work which we much complete prior to the FDA Advisory Meeting which is tentatively scheduled for September.
- [Project Team Member] &Team met with UBC on June 19 to understand the UBC process
- [Project Team Member] & Team met with Express Script (Accredo) on June 21, reviewed PAH Program and Capabilities, Nursing Support, Contract Salesforce and Patient Adherence
- [Project Team Member] shared the Professional Concepts with LMT. These concepts will be reviewed at Market Research on July 9.
- DRA confirmed the next mock (Mock 2b) will be July 24 – 26. We will not have an external panel – this will be a strict team rehearsal and Q&A practice.
- Global Medical Meeting June 25-29. [Project Team Member] is attending

Next Steps:

- ACTION ITEM: Attached is the SRF template please review and supply input to [Project Team Member] by EOD on Friday, June 29
- ACTION ITEM: PHA attendees to supply key findings from the meeting to [Project Manager]by EOD on Friday, June 29
- Outcome from the Express Script Meeting - [Project Team Member] will schedule a meeting with ESI and Medical
- Professional Messaging Market Research will take place June 27 & 28
- Professional Concept testing Phase I will take place July 9
- Public Relations will draft a communication about NVS presents at PHA
- [Project Team Member] shared with the team Global Patient Registry is under discussion
- [Project Team Member] Training Modules are delayed slightly due to Medical input
- [Project Team Member] will share with the team the date of BREAKAWAY Training as soon as he has confirmation.
- Brand Insights will be hosting a QTi Patient Journey Workshop on Friday, June 29.
- [Project Team Member] to supply the Patient Service team with IT timelines by July 3.

1

- [Project Manager] will share with the team the PI Timing & Process post a meeting with Label & Design on July 2.
- [Project Team Member] will share with LMT post eMAP Concept review the REACH Roadshow
- CHEST Congress will take place in October and GTI571 will have an 'Unbranded' Booth
- ERS will take place Sept 1-5 – Oral Presentation
- The [Project Name] Sharepoint link is attached please supply me with your work stream updates by ***Friday, July 6.*** PMO-GTI ([Project Name])

[Project Name] Launch Management Team next meeting will be Tuesday, July 10, 2012.

Budget Update	[Project Team Member]
REMs UBC Overview	[Project Team Member]
eMAP Submission Dates & Rolling Agenda	[Project Team Member]
REACH Concept Overview	[Project Team Member]

[Project Manager]
Project Management Office
Commercial Operations, Integrated Operations
PharmCo Pharmaceuticals Corporation
[Address]
Office: [redacted]
Phone: ### ###-####
Cell: ### ###-####
Email

APPENDIX I: Project Brief

Project Brief: [Project Product Name] Service Request Form (SRF) Folder

Client/Brand : PharmCo/[Project Product Name]	**Date: June 18, 2012**
H4B Job Number: TBD	**Art Director: Name 1, Name 2a**
Client Job Number: TBD	**Writer: Name 3, Name 4**

Project Description

The Service Request Form (SRF) serves as a patients' prescription to **[Project Product Name]** and initiates enrollment into the **[Project Product Name]** Support Program. The form must be signed by both the HCP and patient and faxed to the **[Project Product Name]** Support Center (RSC) along with the REMS Patient Prescriber Agreement (PPA) so that the benefits investigation and triage to the Specialty Pharmacy (SP) can begin.

Background

[Project Product Name] prescription will be dispensed through the Specialty Pharmacy with certification of REMs, signed PPA, and completed SRF. Key steps in the **[Project Product Name]** prescription flow are:

- HCP enrolls in **[Project Product Name]** REMs program/physician registry
- Completes SRF for **[Project Product Name]**
- Faxes SRF to RSC
- If aware of PA requirements, complete PA form and submit to RSC at same time as SRF
- Monitor patient blood levels as directed by REMs program (TBD)

In order to streamline the prescription process, the RSC will provide a single point of contact to facilitate financial support and access to treatment, ensure delivery of **[Project Product Name]**, and follow up as needed. The RSC also collaborates with other key stakeholders along the patient journey, including SPs, nurses, office staff and payers.

Project Objective(s)

Develop a clear, easy to understand SRF folder for **[Project Product Name]** to ensure accurate completion by the HCPs

Target Audience

- Targeted HCPs (Cardiologists, Pulmonologists, Nurses at the Centers of Excellence)
- **[Project Product Name]** Patients/Caregivers
- RSC

Strategic Rationale

Launch with effective and clear communication on the benefits of **[Project Product Name]** across all communication platforms

Copy Platform

- Folder that houses the following materials:
    - Laminated annotated SRF with instructions on how to fill out the form in its completion
    - HCP checklist for all materials that need to be sent to the RSC
    - RSC brochure – overview of support services and key contacts
    - SRF TearPad – Form with spaces for the following information to be filled out by the HCP and signed by both the HCP and patient/caregiver:
        - Patient & insurance information
            - Name
            - Female/Male
            - DOB
            - SSN
            - Address
            - Phone
            - Time to call
            - Email
            - Insurance, beneficiary, and ID/group #
        - Prescriber information
            - Name
            - License #
            - NPI #
            - Practice name and address
            - Fax
            - Email
            - Office Contact
        - Rx Information & Physician Authorization
            - Prescription information – *discuss language with Medical*
            - Voucher program information?
            - Refills
            - Prescriber signature
        - SP Contact Options
            - In-home visit
            - Phone call
        - Patient Authorization
            - Space for Patient/Legal Guardian signature
        - Patient Marketing Program consent signature box
        - Patient Marketing Program legal information
        - ISI and accompanying PI

Clinical Support

NA

Tone • Informational • Non-promotional
Executional Guidelines • PI, ISI and "Please see" line to be included • Use client-selected RSC branding • Include **[Project Product Name]** logo
Format & Final Deliverable • Folder & Templated Forms
Budget Pending approval

Preliminary T&E Schedule

Action/Steps	**Date**
Project Kickoff	7/2
Development	7/2 – 7/13
Client & Key Stakeholder Review #1	7/16 – 7/20
Consolidated Comments to Agency	7/23
Refinement	7/23 – 7/27
Client & Key Stakeholder Review #2	7/30 – 8/2
Refinement & eMAP Preparation	8/2 – 8/7
1st eMAP Submission	8/7
1st eMAP Review	8/16
2nd eMAP Submission	8/28
2nd eMAP Review	9/6
Hold for ISI & PI	September - December
Launch	January 2012

APPENDIX J: Coding List and Definitions

Code List	
Name	**Description**
Alignment	This code is used when the interviewee directly or indirectly discusses team alignment, or action intended to achieve alignment. Team alignment references may include actions by the PM to ensure all team members are "on the same page", understand the same things, or are working towards the same goals.
Combination	This code is used when and interviewee directly or indirectly discusses examples of knowledge creation through Combination of two or more types of explicit knowledge in the project team environment. Combination refers to the creation of "explicit knowledge into more, complex and systematic sets of explicit knowledge." It is the combining of explicit knowledge with other explicit knowledge.
Communication	This code is used when an interviewee directly or indirectly discusses examples of communications that help in the creation of knowledge or the flow of knowledge within the project team.
Context	This code is used when the interviewee directly or indirectly discusses examples of the PM applying context to a piece of information or knowledge.
Enhancing Flow	This code is used when the interviewee directly or indirectly discusses examples of the PM enhancing or helping in the flow of knowledge within the project team.
Expert Map	Like the Team Matrix, this is a tool used to assess the knowledge level of the team and where it resides
Explicit	This code is used when the interviewee directly or indirectly discusses representation of Explicit knowledge. Knowledge is recognized to explicit when it is codified; when we coherently articulate our personal, internal (or tacit) knowledge. In this sense, we put structure and form to it. This occurs when we write things down in reports, create images (drawings, photos, etc), Examples include (but not limited to) PowerPoint presentations, status reports, and lists.
Exporting	This code is used when there are examples of exporting knowledge to other teams or areas. That is when knowledge or information is taken out of the team environment and given to another- different team or work area.
Externalization	This code is used when an interviewee directly or indirectly discusses examples of knowledge creation through the externalization of knowledge. Externalizing knowledge is understood to happen when a person's internal tacit knowledge is articulated, or expressed in an explicit form. This mode of knowledge creation occurs when tacit knowledge is moved to explicit knowledge
Face-to-Face	This code is used when and interviewee directly or indirectly discusses the need or importance of face-to face meetings, or physically attending a meeting.
Flow Regulation	This is a parent code regarding the regulation of the flow of knowledge. This code is used when the interviewee directly or indirectly discusses how the flow of knowledge is or can be regulated.
Flow Regulation - Flow Enhancement	This code is used when the interviewee directly or indirectly discusses how the flow of knowledge is or can be positively regulated or enhanced.
Flow Regulation - Flow	This code is used when the interviewee directly or indirectly discusses how the flow of knowledge is or can be negatively regulated or restricted.

Restriction	
Helpful Information	This code is used when and interviewee provides information that does not appear to be directly associated with specific codes, but may be determined to be insightful or helpful in other ways to this study.
Important Project Aspects	This is a general code used to group the important aspects of projects as described by the interviewees
Importing	This code is used when there are examples of importing knowledge from other teams or areas. That is when knowledge or information is brought into the team environment and taken from another- different team or work area.
Internalization	This code is used when an interviewee directly or indirectly discusses examples of knowledge creation through the internalization of knowledge. Internalizing knowledge is understood to happen when a person's accepts explicit knowledge and combines it with their own internal knowledge. This mode of knowledge creation occurs when explicit knowledge is moved to tacit knowledge. It may not be directly observable, but we can make inference of its occurrence, or situation in which its occurrence can be expected.
Knowledge Acquisition	This code is used when the interviewee directly or indirectly discusses the acquisition of knowledge
Knowledge Creation By Direct PM Action	This code is used when an interviewee directly or indirectly discusses examples of when the PM directly contributes to knowledge creation process through direct actions or activities.
Knowledge Creation By Indirect PM Action	This code is used when an interviewee directly or indirectly discusses examples of when the PM indirectly contributes to knowledge creation process through actions or activities. These actions may not be directly observed, but they may be inferred.
Knowledge Management System	This code is used to indicate the use of knowledge management systems- technological or non-technologically based
Knowledge Management System - Technological	This is a sub-code for Knowledge Management Systems. It is used to indicate the use of existence of technologically based Knowledge Management Systems. Examples of technological based systems are: computers and computer storage devices, the internet or intranet, in-house databases and database retrieval systems or services.
Knowledge Management System -Non-Technological	This is a sub-code for Knowledge Management Systems. It is used to indicate the use of existence of non-technologically based Knowledge Management Systems. Non-technological systems include, person-to-person communication, paper-based storage and filing, etc.
Knowledge Sharing	This is a parent code used when the interviewee directly or indirectly discusses the sharing of knowledge
Knowledge Sharing - Best Practice	This code is used when the interviewee discusses "Best Practices" in knowledge sharing
Knowledge Sharing - Enhanced	This code is used when the interviewee directly or indirectly discusses when or how the act of sharing knowledge is enhanced or positively impacted.
Knowledge Sharing -	This code is used when the interviewee directly or indirectly discusses when or how the act of sharing knowledge is prevented or negatively impacted.

Prevention	
Limits of the PM	This code is used when an interviewee directly or indirectly discusses possible limitations of the Project Manager in the creation of knowledge and/or their role in managing or relating to the project team.
LMT Negative	This code is used when the interviewee cites something negative about the LMT (Launch Management Team) meeting
LMT Positives	This code is used when the interviewee cites something positive about the LMT (Launch Management Team) meeting
Model Feedback	This code is used when the interviewee gives direct feedback regarding the proposed model
PM as a Valve	This code is used when an interviewee directly or indirectly discusses the PM acting as a valve or conduit of information and or knowledge creation.
PM Role	This is a parent code used to indicate when the interviewee directly or indirectly discusses the role of the Project Manager.
PM Role - Strategy	This code is used to indicated when the role of the PM is indicated as strategic or non-task/activity oriented in nature
PM Role - Task	This codes is used when the role of the PM are described as task or action oriented
Project Success	This code is used when the interviewee directly or indirectly discusses project success
Relationship	This is a parent code used to group different types and indications of relationships between the PM and the team members.
Relationship - Negative	This code is used when the relationship between the PM and the team member is indicated to be negative in nature, or when the PMs actions can be perceived as negative or detrimental to the PM-team member relationship
Relationship - Positive	This code is used when the relationship between the PM and the team member is indicated to be positive in nature, or when the PMs actions can be perceived as positive or beneficial to the PM-team member relationship
Socialization	This code is used when and interviewee directly or indirectly discusses examples of knowledge creation through Socialization in the project team environment. Socialization is described when one person's (person A) own Tacit knowledge to is combined with another person's (person B) Tacit knowledge through some form of interaction or observation by person A. In this manner new knowledge is created for person A.
Strength of the PM	This code is used when an interviewee directly or indirectly discusses possible strengths of the Project Manager in the creation of knowledge and/or their role in managing or relating to the project team.
Suggested Changes or Improvements	This code is used when the interviewee directly or indirectly discusses suggestions or ideas of possible changes to PM behaviors and practices that could help enhance their role in the knowledge creation process or how they manage the project or project team.
Tacit	This code is used when the interviewee directly or indirectly discusses representation of Tacit knowledge. Tacit knowledge is recognized as knowledge that is internal to us. It is NOT easily articulated or codified. This is the personal, internal knowledge we have gained through experience and observation. Our personal mental model of the world is comprised of our tacit knowledge base.
Tools	This is a parent code used to capture the tools used by PMs in their management of the project. This code is used when the interviewee directly or indirectly discusses examples and indications of the tools, skills, techniques used to help in the knowledge creation process and/or project management activities.

Tools - Case Study	This tool is used to capture a team's experiences and insights and make them explicit
Tools - Lessons Learned Inventory	This tool is captures the central insights of team members and makes them available to the organization through a common knowledge management database (e.g: SharePoint)
Tools - Meeting Compass	Like Visual Protocol's, this tool is use to improving the transparency of issues. Overheads and flip charts are used to map the issues against the key agenda items
Tools - Pyramid Principal	This tool helps the PM align and coordinate knowledge development activities
Tools - Team Matrix	This is a tool used to assess the knowledge level of the team and where it resides
Tools - Toulmin Map	This tool is used to systematically map the teams present knowledge.
Tools - Visual Protocols	Like Meeting Compass', this tool is used to improving the transparency of issues. Overheads and flip charts are used to map the issues against the key agenda items

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VITA

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Ted's publications include articles for the American Society for Quality- Government Division newsletter and a position paper titled "Towards a New Understanding of the Project Manager as a Mixing Valve in Organization Knowledge" included in the International Project Management Associations'26th world Congress proceeding.

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