Official Knowledge: Validation Mechanisms for Knowledge Management Systems

by

Jennifer H. Watkins

B.A., Mechanics of the Mind, Kalamazoo College, 2005

THESIS

Submitted in Partial Fulfillment of the

Requirements for the Degree of

Master of Arts

Organizational Learning and Instructional Technology

The University of New Mexico

Albuquerque, New Mexico

May, 2009

Dedication

To Jack Bauer

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ABSTRACT OF THESIS

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Abstract

One of the most important roles of a knowledge management system is as a filter to verify, authenticate, or justify the knowledge of an organization. The knowledge that passes this filter and is retained or otherwise deemed valuable by the system is official knowledge, the knowledge sanctioned by an organization. In this study, twenty-two articles that describe typologies of knowledge management systems were reviewed for their insights into knowledge validation. The articles were reviewed in the context of intellectual parentage with each article belonging to one of ten lines of inquiry spawning from five preeminent knowledge management articles. The results of this metastudy identify epistemology, knowledge transfer, the application environment, and the social process of sensemaking as valuable considerations for the design of validation mechanisms. A checklist of these considerations serves as

the primary contribution of this study. Implications for future work in the design of validation mechanisms for knowledge management systems are discussed.

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Chapter 1

Introduction

1.1 Research Perspective

The following work is an exploratory study into the ways in which organizations validate their knowledge. Rather than begin with a note, as many authors have, regarding the difficulty in defining the key terms of knowledge management, this section will present a research perspective from which all essential definitions of the study fall. To begin, it is the view of this study that knowledge management is the study of the ways in which organizations use knowledge and the ways in which these uses can be improved upon. Given this definition, it is clear that the primary unit of analysis is the organization. Thus, one must have a clear sense of the properties of an organization.

The essential property of an organization claimed in this study, is that organizations have knowledge. This is the first of three controvertible premises that compose the research perspective of this study. There are two ways that the statement that organizations know can be understood. An organization can know in the sense that given a certain goal, an individual within the organization can achieve that goal.

In a stronger sense, an organization can know in the sense that it can complete a goal regardless of the specific people who are employed in the organization. It is this stronger sense that is the connotation intended. This does not appear to be the default position of researchers in knowledge management. The default position seems to be that people know and that organizations make it easier for isolated individuals to share what they know with each other. Given the definition of knowledge management presented and this property of organizations, it can be said that the challenge of knowledge management is to translate the concept of knowledge, which is an individual phenomena, to the organization level.

If the premise that organizations know is accepted, the problem of knowledge management necessarily requires the consideration of a system. It is with a system in mind that one is able to translate the concept of knowledge to an organization without running into errors of anthropomorphizing. As a human with knowledge refers to a collection of specifically assembled neurons, an organization with knowledge refers to a collection of specifically assembled humans. The humans and their assembly compose the system.

Given these premises, it can be concluded that the purpose of knowledge management is to understand and manage how organizations know and that a knowledge management system is the combination of people, technologies, and techniques that facilitate an organization's use of knowledge (Bhatt, 2001). This definition of knowledge management systems (KMS) is more broad than definitions in much of the literature, as they often focus solely on information technology. The definition used for this study is purposefully broad to encompass validation mechanisms that may not require information technology at all.

1.2 Research Framework

Given these definitions of knowledge management and KMS, the first logical question to ask regards the nature of the knowledge of the organization. In this study, organization level knowledge is called official knowledge. Knowledge, when it is shared within the auspices of an organization, becomes official knowledge—that which is deemed accurate, approved, or more exemplary than other knowledge. Official knowledge is studied under a number of different guises including formal knowledge (Freidson, 1986), working knowledge (Davenport & Prusak, 1998), common knowledge (Dixon, 2000), and simply as conventional wisdom. Official knowledge increases the problem-solving capacity of the organization by preventing mistakes from those who aren't expert enough to realize the organization-wide effects of their local actions.

To become official, knowledge must be validated, even if through passive acceptance. Validation can refer to the verification, authentication, endorsement, or legitimized state of knowledge. The ways in which organizations engage in the typically human process of knowledge acquisition determines the ways in which knowledge is made official.

1.2.1 Validation of Personal Knowledge

In epistemology, there are three theories of knowledge acquisition. These theories each result in unique methods for knowledge validation. The validation of knowledge refers to the determination of truth. In individuals it is the process by which knowledge enters one's world model. This process is a personal one because the barrier that is breached is that from the external world to the internal mind. The first type of validation follows from the empiricist theory and holds that knowledge is validated through experience. The second type of validation corresponds to the rationalist theory and holds that knowledge is validated through logical deduction.

The third type of validation corresponds to the constructivist theory and holds that knowledge is validated through the social formation of belief.

Epistemology	**Conclusions**	**Validation**
Empiricism	Objectivity	Experience
Rationalism	Objectivism Objectivity	Logic
Constructivism	Relativism Inter-subjectivity	Belief

Table 1.1: Validation requirements based on underlying epistemology

Knowledge validation is inextricably tied to the definition of knowledge under which the system is operating because each epistemology has its own conception of truth and its own means of acquiring knowledge. Table 1.1 summarizes these differences. Objectivism is the product of rationalist thought from the Age of Enlightenment. The rationalist theory of knowledge holds that knowledge is discrete. It can be encoded and transferred. This is in opposition to relativism which holds that knowledge is context-dependent and action-oriented.

In science, the term objectivity refers to a perspective in which an object of interest can be studied without any dependence on the subject doing the studying. Acceptance of this impartiality has a number of conclusions. One conclusion is that disputes regarding the object can be contained to the object itself. This means that knowledge can be evaluated without considering whether the evaluator is biased in their judgement. Because the scientific process strives for objectivity, other processes gain legitimacy by also claiming objectivity. Processes may strive for a scientific-like measurement of the environment. Both Empiricist and Rationalist epistemologies hold this perspective. Objectivity is in opposition to inter-subjectivity, which holds that the observer and the observed are intertwined.

1.2.2 Validation of Official Knowledge

When knowledge is validated at the organization level, the process necessarily changes. Rather than validation crossing the barrier from environment to mind, organization level validation requires that the knowledge management system act like a cell membrane, letting certain knowledge through and restricting other knowledge. It is the design of the validation mechanism that determines which knowledge will permeate.

Official knowledge refers to knowledge that has been validated at the organization level such that it is accepted into the organization's model of thinking. Individuals that compose the organization hold a suite of knowledge, only a part of which is pertinent and accepted by the larger organization. It is the role of the organization to articulate and amplify the relevant knowledge of its constituent individuals (Nonaka, 1994). The mechanism by which personal knowledge is transformed into official knowledge in KMS has been left largely unexplored. The goal of this study is to identify the multiplicity of ways in which knowledge is validated in KMS. KMS are defined as encompassing people, technologies, and techniques; therefore, this study is not limited to purely technological validation mechanisms, rather, it focuses on how a mechanism touches all three elements of a knowledge management system.

In this study, the validation of official knowledge is parsed into three research problems. The first problem is the initial validation of knowledge to determine that it should become official knowledge. This may be part of a deliberate program to develop official knowledge or the result of other organizational processes. It may be the responsibility of managers or of knowledge workers to determine what is official knowledge. The second validation problem is the protection or review of official knowledge to determine that it is not outdated. It may be possible to design official knowledge in a flexible manner such that it is not readily prone to obsolescence. In other circumstances, it may be preferable to develop a process of reviewing and

replacing official knowledge once it fails to apply to the organizational realities and those of the external environment. The third validation problem is the transfer of official knowledge throughout the organization. Once knowledge has become official knowledge, some mechanisms will inhibit and some will assist the transfer of this knowledge to those in the organization who need to know it.

1.2.3 Importance of the Study

Although an unconventional framing, the purpose of knowledge management can be stated as the design of KMS that validate official knowledge appropriately. It is often noted that for knowledge to be effectively shared within an organization, there must be a shared context. This context refers to the knowledge that individuals assume to be valid, and it differs from one organization to the next. One goal of this study is to understand how that context is generated.

Validation is commonly believed to require evidence, logic, intellectual examination, and facts. While this sort of scrutiny may be the ideal, most knowledge in organizations is likely to become official without such explicit review. Bhatt (2001) defines knowledge validation as "a painstaking process of continually monitoring, testing, and refining the knowledge base to suit the existing or potential realities" (p. 71). It is an empirical question to determine the extent to which organizations engage in this continual validation process. This study presents a first step to guiding research in bringing the validation process to the forefront of knowledge management implementations and to suggest means to make the process less painstaking. If the validation process is made more efficient, the amount of usable working knowledge in an organization will increase.

Additionally, the knowledge validation process is important because individuals likely use knowledge in KMS without understanding the provenance of its validation.

It is here that official knowledge can become poor assumptions. By developing better knowledge validation mechanisms, the role of misinformation, rumor, and misapplied assumptions diminishes.

The preceding presentation of the research philosophy and research framework employed in this study has presented a definition of KMS and their role in comporting individual level characteristics to the organization level. With this framework, one can adapt the knowledge acquisition theories for individuals to organizations. Empiricism, rationalism, and constructivism all provide theories of knowledge and together form a breadth of validation methods for organizations. Within this framework the existing studies of knowledge validation in organizations are placed and areas for new studies are suggested.

1.3 Research Questions

The research on validation mechanisms in KMS tends to be specific to a particular type of system and applied in nature. The objective of this study is to provide a broad understanding of the validation of official knowledge that can serve as the foundation for future work in this area. Table 1.2 displays the research questions that guide this study.

The general research questions are pursued in the following chapter as the literature is reviewed. The three validation questions correspond to the three validation problems for official knowledge—initial validation, obsolescence, and the transfer process. These questions are addressed as results of the study.

General Questions
RQ1: What are the ways in which KMS can be classified?
RQ2: What can be learned from the literature on KMS regarding validation?
RQ3: What perspectives underly the classifications?
Validation Questions
RQ4: How is knowledge translated to official knowledge?
RQ5: What are the mechanisms to determine if or prevent official knowledge from becoming obsolete?
RQ6: How is official knowledge transferred throughout the organization?

Table 1.2: Statement of research questions

1.4 Approach

To address the research questions presented in Table 1.2, this study employs a metastudy research approach. The sparseness of the research on knowledge validation for organizations requires an indirect approach to the metastudy. The study is composed of a collection of articles that each present a novel taxonomy of KMS. The articles are reviewed in the context of intellectual parentage so as to track the evolution of perspectives regarding the landscape of KMS.

Based on the philosophy of knowledge management that opened this chapter and the research framework presented, the metastudy serves as an exploratory study into the features required of a validation mechanism for each validation problem. A primary goal of this study is to identify common trends and categorizations within the knowledge management literature to provide a foundation for further work.

Chapter 2

Literature Review

2.1 The Design of Official Knowledge

Within the knowledge management literature, perhaps the most familiar example of official knowledge is the best practice. Best practices refer to the approved and ideal procedure or outcome for specific organizational tasks. The development of best practices results in the routine use of knowledge. Szulanski (1996) provides a number of reasons why best practices are not transferred well within an organization. Causal ambiguity refers to a lack of understanding regarding the features that lead to a best practice's success. If knowledge does not have a record of successful transfer then unprovenness is an issue. It is difficult to legitimize the knowledge in this case. One may not be properly motivated to share their knowledge or to receive knowledge from others. This resistance can stem from a variety of causes. The perceived reliability of the knowledge depends upon the trustworthiness and expertise of the knowledge source. Absorptive capacity refers to the knowledge receiver's ability to assimilate the new knowledge and is based on their preexisting knowledge. The receiver must also be able to retain the knowledge once it is transferred. Barren organizational context

refers to the structure and attribute of the organization that hinder or help knowledge transfer. Knowledge transfer is helped by having an intimate (nearby and effortless communication) relationship between the source and the receiver of knowledge. The features that matter most are absorptive capacity, causal ambiguity, and an arduous relationship.

The transfer of best practices is an excellent summary of the issues involved in official knowledge. This section reviews the literature on the initial validation of official knowledge, its obsolescence, and its transfer. The questions of concern are as follows: How is official knowledge assigned as such? How is official knowledge kept updated and how does it avoid becoming a self-sustaining bureaucratic requirement? How is official knowledge transferred? There is very little research that examines these questions in terms of the interplay between the technology, techniques, and people.

2.1.1 Initial Validation

Hargreaves (1999) believes knowledge is validated when it is used as a practice that repeatedly works. He outlines four mechanisms for validation: ipsative, independent, judicial, and scientific. The ipsative mechanism is where the individual chooses between the best of two options subjectively. The independent validation mechanism refers to an expert declaring certain knowledge a good practice. The judicial mechanism is validation by determining the best option through evidence that supports the claim. Scientific validation refers to choosing the best method after formal research demonstrates that it is superior. Hargreaves applies these methods specifically to teachers in schools, but the work could be extended to include individuals in organizations.

The Hargreaves article was the only comprehensive framework of the means to

initially validate knowledge found in the knowledge management literature. The remaining research found on validation was specific to a particular technique of validation or a particular KMS. Recall from the Introduction the three means to acquire knowledge—validation through experience, validation through reason, and validation through social processes. While the meaning of experience, reason, and social processes are clear for the individual, they are less clear at the organizational level. The following is a review of the organizational-level validation research in the knowledge management literature organized by these three epistemologies.

One definition of knowledge holds that knowledge is experience and nothing else. With this in mind, there are ways that organizations pass on experience. In knowledge management, there are a number of techniques that focus on the sharing of experience. Job shadowing is one such method that captures experiential learning (Johnson, Lorenze, & Lundvall, 2002). To train employees in a new job, an effective technique is for the employee to shadow an experienced employee. Here, the shadowed employee can explain what they are doing, and the trainee gets first hand experience in the job. Sharing stories and the reuse of documents are other ways to pass on experience within an organization (Dixon, 2000). These are techniques that allow one person to learn from the experience of another (Kolb, 1984). Thus, official knowledge can be tacitly created when experienced employees pass along their knowledge to the less experienced.

Rationalist knowledge management approaches to official knowledge have centered around expanding the knowledge base through automated reasoning. The goal of this research is to represent knowledge within a repository in such a way as to allow algorithms to generate new knowledge that logically follows from that within the database (Mengschoel & Delab, 1993). A great deal of the research in knowledge validation has been conducted for specific knowledge representations (see Santos Jr. & Dinh, 2008; Fensel, 2003). Validation is an important part of the automated rea-

soning research agenda where trust is placed in knowledge generated by a computer instead of by a colleague. The heart of this research is in the difficulties of properly representing knowledge within information technology. The type of knowledge handled by these systems is primarily fact-based as facts conform most easily to a traditional notion of truth and can be most easily handled computationally. This research makes a number of assumptions about the knowledge management system. For one, the work on automated validation assumes a technology-based knowledge management solution rather than a human-centric system. Thus, official knowledge is that which resides within the knowledge repository.

A large focus of recent knowledge management research is on the role of culture within an organization. Organizational culture serves as an interpretative framework for the acquisition of new knowledge through constructivist means. Knowledge, in this case, is a belief justified by the surrounding culture (McDermott & O'Dell, 2001). There are a number of methods in knowledge management that take advantage of the constructivist perspective through the mediation of authority. Authority is used as a means to validate knowledge in a company. If an authority of some kind approves the knowledge, then it is official knowledge. One method used by organizations is the hierarchical approval process. Here, work is approved by a higher level manager. This method is supported by the conferring of titles in organizations (Freidson, 1986). The peer review process is another means of granting approval through social means such that if something is peer reviewed, it is believed to be more valid than knowledge that is not peer reviewed. These methods refer to systems that manage people who hold knowledge, rather than systems that manage the knowledge itself (Alvesson, 2001).

2.1.2 Obsolescence

Once knowledge has been initially validated to become official knowledge, the validation process is not over. Official knowledge should be continually reviewed and revised to be certain that the knowledge remains valid. There are two things that may invalidate official knowledge. One is if the organizational environment changes. The other is if the external environment in which the organization operates changes.

The obsolescence of knowledge can be viewed in the context of the knowledge lifecycle (Birkinshaw & Sheehan, 2002). The lifecycle of knowledge recognizes that the value of knowledge, even organizationally validated knowledge, can decrease over time (Benbya & Van Alstyne, 2008). The dynamic nature of validation is perhaps even less studied than the initial validation of official knowledge. Elroy (2000) describes the process of obsolescence as one of tension between the official knowledge and what some individuals in the organization believe to be true. The resolution of this conflict often requires management intervention to validate or reject the subversive knowledge through authority structures. The attitude to ensure that official knowledge remains valid is to frame the validation of knowledge as a temporary condition rather than as a permanent achievement.

2.1.3 Transfer Process

In the description of best practices that opened this section, Szulanski describes the hurdles in transferring knowledge that is already deemed official to those in the organization. By far, the majority of research in the knowledge management literature refers to the transfer of knowledge within an organization. If the initial validation of official knowledge is framed as the conveyance of individually held knowledge to the organization, then the transfer process can be viewed as the conveyance of organizationally held knowledge to the individual. Rather than separately review the

research on the transfer process here, the next section heavily discusses knowledge transfer in the course of reviewing taxonomies of KMS.

From this review, it is clear that research already exists in the areas of initial validation, obsolescence, and the transfer process for official knowledge. However, none of the research refers to the validation of official knowledge that spans all three topics. Because the work on validation has been developed as separate capabilities instead of as part of a larger research framework, it exists without a context. The design of official knowledge requires the examination of the breadth of the validation task. In order to provide this context to the research in validation, the remainder of this chapter describes the literature that classifies KMS. From the patterns found in these classifications, the landscape of validation mechanisms can be explored.

2.2 Classifying Knowledge Management Systems

There is little research that directly connects KMS to validation; therefore, the approach of this paper is to survey the multifarious KMS that exist today to identify any and all features that are related to knowledge validation. As knowledge management is a nascent field, numerous articles have been written that search for general principles or useful patterns in previous work. This research often manifests itself in the form of taxonomies of KMS. Every author, in compiling these taxonomies, assumes a particular perspective that is used to organize the KMS into categories relevant to the perspective. The purpose of this literature review is to examine the ways in which knowledge validation is handled in each article and relate it to the taxonomic perspective of the article. The review is divided into five sections that loosely describe divergent branches in the knowledge management literature. These five branches split into ten lines of inquiry total, where each line contains multiple articles. The development of these lines of inquiry is described in Chapter 3.

2.2.1 The Polanyi Branch

In 1967, Michael Polanyi unwittingly laid the foundation for the classification of knowledge in the field of knowledge management with the publication of *The Tacit Dimension*. Polanyi emphasized the importance of tacit knowledge in science during a time when the empiricist perspective of objective knowing through the scientific process dominated. He argued for the personal and contextual nature of knowledge such that universal validity cannot be assumed. In knowledge management, his arguments are often reduced to the conclusion that an articulation of knowledge necessarily relies on knowledge that is not articulated. The implications of this work for knowledge validation are that knowledge is not universally applicable, that explicit knowledge is dependent on the tacit knowledge of the knowers, and that the validity of knowledge is in flux as individuals pursue truth by following the consequences of their beliefs.

A single line of inquiry in the taxonomy of KMS literature extends from Polanyi. This line begins with a 2001 article by Alavi and Leidner. Alavi and Leidner utilize a process view of knowledge management to identify classes of information technology that will assist each process. Their four knowledge management processes are creation, storage/retrieval, transfer, and application. The authors match specific types of technology (e.g., expert systems, intranets, group support systems) to each of the processes. In keeping with the work of Polanyi, the Alavi and Leidner taxonomy is based on a constructivist perspective. For the authors, organizational knowledge is created through the interplay of explicit and tacit knowledge and is necessarily a social process. Knowledge that is stored is only partially complete and requires tacit knowledge to complete it.

Of the four processes the authors delineate, it is only during the transfer process that validation is required. The authors believe validation is about making knowl-

edge relevant to those that will encounter it within a technology-based knowledge management tool. To this end, they propose two essential characteristics of knowledge validation. One, the knowledge must be transfered between individuals with a shared context. The term shared context is synonymous with Polanyi's description of tacit knowledge. Two, the authors contend that knowledge will not be accessed and applied if the originator of the knowledge is not known to the person accessing the knowledge. Thus, the development of trust is an important part of KMS and their implementing technology.

Maier and Remus (2003) attempt to take the work of Alavi and Leidner a step further by developing an implementation strategy. They also follow the process view of knowledge management, which they describe as a bridging orientation between the techno-centric and human-centric knowledge management approaches described by Hansen, Nohria and Tierney (1999). Techno-centric approaches to knowledge management may fail to realize the importance of tacit knowledge. On the other hand, human-centric approaches may miss the efficiency benefits provided by technology. While there is no explicit handling of validation within the taxonomy, the authors do suggest tools that will lead to the success of a techno- and human-centric bridging strategy. These tools include knowledge maps and personal profiles to connect knowledge elements to the people most familiar with that knowledge and recommendation systems that personalize the organization's knowledge base. Implicit in this list is the notion that individuals are required to validate what is stored and that the tools suggested ease this validation.

Malhotra (2005) also emphasizes bridging the gap between the two knowledge management approaches. He adopts the terms mechanistic to replace techno-centric and sense-making to replace human-centric. To bridge these approaches, Malhotra emphasizes a strategy-pull model where sense-making is emphasized, but technology is also utilized. Malhotra's sense-making is related to Polanyi's tacit knowledge.

Both recognize that new information must be assimilated with existing knowledge. Although validation is not mentioned in the article, the use of the term sense-making suggests that validation occurs individual by individual when presented with new information. To be validated, the new information must make sense in the context of what the individual already knows.

2.2.2 The Nonaka Branch

Ikujiro Nonaka's development of a theory of organizational knowledge creation (1994) was heavily influenced by the work of Polanyi. Nonaka believes that all knowledge creation is an interplay between the tacit dimension of knowledge and the explicit dimension. This interplay is made explicit in his knowledge creation spiral which describes the processes by which knowledge is transformed between the explicit and tact dimensions. By defining knowledge as "justified true belief" (p. 26), he allows the standards of justification to be set by the context. In other words, quality knowledge creation could be defined by how well it eventually serves the organization rather than by some pre-determined standard of validity. This constructivist view of knowledge requires that the standards for the validation of knowledge be set by the demands of the organization.

The Nonaka article influenced the line of inquiry headed by Alavi and Leidner and described above. The article also spurred two other lines of inquiry. The first line starts with an article by Hahn and Subramani. Hahn and Subramani (2000) classify KMS according to where the knowledge in the system resides and the degree of structure of that knowledge. These two dimensions make up the axes of a four-quadrant framework. According to the framework, knowledge can reside in artifacts or individuals and that knowledge can be either structured according to some pre-configured scheme or unstructured. This quadrant echoes the knowledge

creation spiral posed by Nonaka in that it mixes knowledge that can be codified with knowledge that is best transferred between individuals.

The authors do not refer explicitly to validation in the article, but they do discuss the challenges in maintaining the content in KMS. Maintenance is important so that knowledge that was once valid is not rendered invalid by changes in the environment or organizational context through time. The authors believe maintenance challenges can be overcome through appropriate incentives. Monetary incentives often produce quantity in a knowledge management system without quality. On the other hand, if social norms are developed that bestow prestige on the contributors, high quality contributions can be expected. In addition, the contributors will be motivated to update their contribution to maintain their status. Therefore, the incentives for entering knowledge into the system may play an important role in the validity of that knowledge over time.

Bera and Rysiew (2004) take a unique approach to their classification. The authors unabashedly believe knowledge is a social process and thus subscribe fully to the constructivist school. Using veritistic social epistemology, Bera and Rysiew develop a framework of KMS to indicate which types of systems are more likely to be used based on their perceived credibility. Veritistic social epistemology is the study of how well a practice encourages the acquisition of a true belief. Adopting the quadrant model set forth in Hahn and Subramani, the authors determine that knowledge housed in structured artifacts is more likely to be viewed as credible and, therefore, is more likely to be used. Assuming the same degree of credibility among the sources and equivalent trust in the technology used, the authors believe that unstructured, individually-held knowledge is less credible than structured artifacts because the seeker has to find the owner of unstructured knowledge and the transfer process from owner to seeker is precarious. Bera and Rysiew place structured artifacts and thus, structured explicit knowledge as a key feature promoting ease of validation.

The second line of inquiry branching from Nonaka's article comprises two articles by Bhatt. In the first article, similar to Nonaka's knowledge creation spiral, Bhatt (2000) develops a knowledge development cycle delineated by creation, adoption, distribution, and review/revision phases. In the first lengthy handling of knowledge validation presented in this review, Bhatt defines validation as the "extent to which [the] knowledge-base produces socially accepted solutions [to] problems" (p. 22). The author's emphasis on social acceptance places his perspective within the constructivist view of knowledge. Knowledge validation is an important part of his knowledge adoption phase, which closely echoes Alavi and Leidner's transfer process. Bhatt provides five sophisticated requirements for knowledge validation. One, the knowledge must be easily adaptable to changing environmental circumstance. Two, the knowledge base must contain a variety of perspectives on organizational issues. Three, knowledge must provide detailed solutions to detailed problems. Four, the knowledge base must be robust to problems at a variety of levels in the organization. Five, the knowledge must be modular. The author provides two additional features of note with respect to how knowledge is conveyed. In order for knowledge to be adopted, the knowledge seeker must be, one, assured of the authenticity of the knowledge source, and, two, the seeker must feel that the meaning of the knowledge is clear, not ambiguous. The second feature relies on the knowledge belonging to a clear and shared context.

In the second article, Bhatt (2001) emphasizes the importance of learning by doing. This change in focus adds the empiricist theory of knowledge to his repertoire. In this article, Bhatt's handling of validation shifts to the problem of obsolescence. He argues that organizations face a continual battle against knowledge obsolescence and that it must be fought against at all three levels of KMS—in the technologies, in the techniques, and in the people. He believes monitoring, testing, and refining the knowledge base is essential and that it is a comprehensive process that does not apply only to that which is stored within a knowledge repository.

2.2.3 The Blackler Branch

In 1995, Frank Blackler provided an early review of the foundations of knowledge management. Blackler explores five of what he calls "images of knowledge" within organization studies. As originally suggest by Collins (1993), Blackler splits knowledge types into embrained, embodied, encultured, embedded, and encoded. His constructivist definition of knowing (rather than knowledge) is as something that is mediated, situated, provisional, pragmatic, and contested. In addition to assembling prior research on knowledge and knowledge work, Blackler presents his own classification of KMS along two dimensions creating a quadrant. One dimension is divided into a focus on familiar problems and a focus on novel problems. The second dimension is divided into an emphasis on key individuals and an emphasis on collective endeavors.

Two lines of inquiry branch from Blackler's article. In the first line, Choi and Lee (2003) present a quadrant of four knowledge management styles—dynamic, system-oriented, human-oriented, and passive. The dimensions of this quadrant are low and high tacit-oriented and low and high explicit-oriented styles. The placement of these dichotomous features on separate dimensions instead of along a single continuum suggests that the authors believe an emphasis on both tacit and explicit knowledge within the same organization is important. In fact, the authors find that the dynamic style, which occupies the cell of the quadrant with both high explicit orientation and high tacit orientation, leads to the highest organizational performance. Predictably, the passive style, which is low on both dimensions, was found to be the least effective. The other two cells represent the techno-centric knowledge management strategy (high explicit orientation) and the human-centric strategy (high tacit orientation).

While the article does not refer to validation, it does present two new knowledge management strategies—the dynamic and the passive. The passive style refers to organizations where very little knowledge is maintained at the organizational level.

On the other hand, the dynamic style refers to organizations that bridge the gap between the knowledge management strategies as suggested by Maier and Remus (2003) and Malhotra (2005). Additionally, the descriptions of organizations for every cell in the quadrant are very similar to organizational descriptions for the cells in Blackler's (1995) quadrant. This suggests that novel problems and an emphasis on collective endeavors, as described by Blacker, require heavy use of both tacit and explicit knowledge.

Presenting an uncommon perspective, Yang and Yen (2007) take a cybernetics viewpoint that emphasizes the ability of an organization to be self-sustaining. According to the authors, a viable organization is composed of subsystems that are themselves viable and relate to each other like a nervous system. Using this viable systems perspective, based on the work of Beer (1981), the authors classify organizational knowledge into four categories—entrepreneurial, transactive, bureacratic, and constructive. They place these categories into Nonaka's (1994) knowledge creation plane where the epistemological dimension split into tacit and explicit and the ontological dimension split into autonomous management and conscious adaptation. Entrepreneurial and constructive knowledge types are both tacit and are autonomous and conscious, respectively. Transactive and bureaucratic knowledge types are both explicit and are autonomous and conscious, repectively. Yang and Yen focus on the role of top and middle managers in an organization. Following Choi and Lee, the authors believe managers should emphasize both the explicit and the tacit dimensions of knowledge so as to maintain a viable organization.

In terms of knowledge validation, the viable systems perspective has a unique viewpoint to contribute. The validity of knowledge is dependent upon the skill with which the organization creates knowledge as well as the environment in which that knowledge will be enacted. This article suggests the importance of validating knowledge against the external environment to ensure the adaptation of the organization

to its surroundings.

Heading the second line of inquiry branching from Blackler is an article from Kakabadse, Kakabadse, and Kouzmin (2003). Beginning with a review of theories of knowledge which includes Blacker's images of knowledge, Kakabadse et al. derive five knowledge management perspectives. Each perspective is defined by its underpinning theory of knowledge. All other facets of the perspective fall logically from the theory of knowledge. For example, the authors' community model is based on the constructivist theory of knowledge. In KMS where knowledge is socially constructed, technology plays a supporting role, commitment and trust are essential, and the aim is to share knowledge. These logical conclusions of the epistemology are also the conclusions of the authors. There are a number of implications of the concordance between the underlying epistemology of the system and the predominant features of the system. For knowledge validation, it suggests that a successful validation mechanism can be related only to the epistemology of the system and to no other features. Thus, a validation mechanism for the community model need only ensure that the members of the community believe the knowledge to be correct.

In order to develop their model, Kakabadse et al. presented a flow of knowledge that progressed as follows: data, information, realization, action/reflection, and wisdom. As a variation, Hicks, Dattero, and Galup (2006) present another five-tier hierarchy. The authors extend the traditional data-information-knowledge pyramid by adding two additional tiers. The foundation of the authors' pyramid is individual knowledge contained within the mind of a person. The fifth and topmost tier of the pyramid is innovation, the exploitation of knowledge-based resources. The authors also define the middle three levels of the hierarchy in terms of the technology that supports them. The data tier, the second level of the pyramid, represents facts that can be contained within documents, databases, and data warehouses. The third tier, information, refers to data that has been contextualized as in decision support sys-

tems, learning systems, yellow pages, and reports. The knowledge tier, the fourth level, represents solutions with supporting technology including intelligent systems and best practices.

The five-tier model encompasses a large landscape of potential KMS. Each tier would require a unique knowledge validation solution as the purpose of each tier is unique. However, the authors would deem only that in the knowledge tier "official knowledge". This tier contains knowledge that represents the organization-preferred solution to a specific task. The knowledge is considered verified for a generic context. A specific decision-making instance can be identified as an example of that context based on local data. More than any other tier, it is difficult to justify deviating from the solution presented in the knowledge tier.

2.2.4 The Nonaka & Takeuchi Branch

In 1995, the same year that Blackler presented his review of knowledge and knowledge work, Nonaka and Takeuchi published a comprehensive model of knowledge creation in their book, *The Knowledge-Creating Company*. By further developing Polanyi's tacit dimension of knowledge, Nonaka and Takeuchi present a framework in which both explicit knowledge and tacit knowledge have important roles. By taking a holistic stance, Nonaka and Takeuchi's framework maintains the application-based facets of knowledge management including the codification and storage of knowledge, but also embraces the elements of knowledge that are personal and lead to creativity and innovation. Nonaka and Takeuchi also present a geographically comprehensive review of the domain by examining the differing knowledge management approaches of the US, Japan, and Europe.

Nonaka and Takeuchi's book influenced three lines of inquiry. The first line begins with a review of the field of knowledge management by Grover and Davenport

(2001). In this review, the authors develop two frameworks along which the domain is progressing. The process framework refers to the processes that develop in an organization that move knowledge from generation to codification to transfer. Although the process view has been described in articles already reviewed, the authors add one dimension pertinent to knowledge validation. Grover and Davenport divide knowledge processes into those that are deliberate and those that are emergent. Deliberate knowledge processes are the result of conscious management choices. Emergent knowledge processes are a byproduct of the work processes of an organization. For knowledge validation, the implication is that some validation will be the result of explicitly designed mechanisms within a purposeful process, but other means of validation will emerge from a well-designed work process. It also suggests that although validation may not be specifically designed into KMS, it is likely taking place at the emergent level.

The second framework developed by the authors is the market framework based on a transactive knowledge management perspective. Here, the acceptance that knowledge resides within individuals leads to the conclusion that people will expect to receive something in exchange for sharing their knowledge. Like the conclusions from Hahn and Subramani (Hahn & Subramani, 2000), the market perspective underscores the importance of the proper motivations and incentives within KMS to improve knowledge validity.

Baskerville and Dulipovici (2006) completed a review of knowledge management related articles from 1995 to 2005. The goal of the taxonomy that resulted was to reveal the purpose of knowledge management research. The authors outline four classes of theories that define the knowledge management process. The theories come from organizational culture, from organizational structure, from organizational behavior, and from artificial intelligence. The authors believe the purpose of these process theories is to handle the messiness inherent in the human qualities of knowledge.

This messiness refers to the tacit qualities of knowledge that Nonaka and Takeuchi believe are the most important to innovation. In declaring tacit knowledge difficult to manage, the authors place knowledge management as a necessarily collaborative endeavor. Without using the terms, the authors advocate a human-centric knowledge management strategy that adheres to the constructivist view of knowledge. The messiness of the knowledge process must also apply to validation, suggesting that validation is a process of negotiation.

The second line of inquiry begins with Argote, McEvily, and Reagans (2003). The authors develop a two-dimensional framework with knowledge management outcomes as one dimension and knowledge management context as the other. Each dimension is divided into three sections. The outcomes dimension is divided into phases of the knowledge management process, specifically creation, retention, and transfer. The context dimension is divided into the properties of units (where units can be individuals, groups, or organizations), the properties of the relationships between units, and the properties of knowledge.

Rather than place existing research within this framework, the authors use the framework to discuss each cell. The cell of most interest for knowledge validation intersects the "transfer" outcome and the "properties of knowledge" context. The authors claim that any difficulty in transferring knowledge is a function of the ambiguity of the knowledge being transferred. Therefore, successful knowledge transfer is directly related to the degree to which the context for the knowledge is shared between the knowledge source and the knowledge seeker. Both the transfer phase and a shared context have been identified in the articles reviewed thus far as important for knowledge validation. This article reiterates the importance of both. Additionally, the authors emphasize status as an important predictor of the success of knowledge transfer. Both expert status and high social status, whether at the individual, group, or organizational level, increase the success of the transfer. While the authors do

not speculate on the reason for the correlation, it is perhaps because status of either kind serves as a proxy measure for trust in the knowledge conveyed. Rather than independently verifying knowledge, one can simply trust that the expert or otherwise respected individual vouches for its veracity.

Llohria (2008) reviews the literature to reveal three approaches to knowledge management—measuring, managing, and creating knowledge. Following Nonaka and Takeuchi's description of the global differences in knowledge management approaches, the author assigns the measuring, the managing, and the creating knowledge approaches to Europe, the US, and Japan, respectively. Like many authors, Llorhia divides the managing knowledge approach into techno-centric and human-centric emphases. The author describes this dichotomy as one between the computational paradigm and the organic paradigm. The computational paradigm focuses on "identifying empirically validated facts and managing them through technology" (p. 85). The organic paradigm focuses on group dynamics, social networks, and culture. Thus, Llorhia reiterates a distinction captured by many authors already reviewed between validation in a techno-centric system and validation in a human-centric system. Techno-centric validation revolves around facts or empirically grounded truths. However, human-centric KMS are not suited to such objective veracity and thus require alternative validation standards.

The third line of inquiry influenced by Nonaka and Takeuchi's book is headed by Earl. Earl (2001) influenced Llohria in the identification of three main approaches. Earl deems these approaches technocratic, economic, and behavioral. These three approaches are further divided into schools of thought. Each school is defined by a unique philosophy and aim and by multiple critical success factors. Earl's three-approach taxonomy combines the techno-centric/human-centric duality articulated in the Hansen et al. article (1999) and reiterated in many articles reviewed thus far, with Grover and Davenport's (2001) process versus market frameworks. Additionally,

Earl goes further than any article in this review toward dissecting the types of systems toward which knowledge validation mechanisms must be designed. By presenting seven schools, each with different philosophies, he outlines seven KMS in need of unique validation standards and solutions.

Blackman and Henderson (2005) provide an extension of Earl's taxonomy by supplementing each of the seven schools of KMS with an epistemological foundation. This foundation rates each school along four dimensions. In the development of these dimensions, the authors present four potential outcomes of an individual's interaction with a knowledge management tool. In one outcome, the required knowledge is transferred to the seeker such that a problem is solved. Because the knowledge solves the problem, the knowledge suggested by the tool is validated by the seeker through experience. This is a positive outcome. In a second outcome, the seeker believes that they know what they need to know and gains that knowledge through the knowledge management tool, but that knowledge may solve the local problem while causing larger problems in the organization. This outcome occurs when the seeker is not expert enough to realize the implications of their actions. This is a poor outcome. A third outcome refers to cases where knowledge is sought for ill-structured problems. The knowledge obtained may be misleading and the seekers may be blamed for the poor application of a technique rather than the tool blamed for recommending a technique that is unsuitable to the context. This is a poor outcome. The final outcome refers to cases where a poor solution is presented in a poor manner. This outcome is obviously poor, but it does offer opportunities to improve the knowledge management tool and thus can become positive.

The authors' focus on outcomes of interactions with a knowledge management tool provides some important insights for knowledge validation. One poor outcome resulted from valid knowledge in one context being applied without further validation to another context. This lack of shared context is a familiar conclusion in this

review. Another poor outcome was the result of the tool containing invalid knowledge. These failures suggest two instances when knowledge validation is necessary. One, knowledge must be validated before it becomes accessible to knowledge seekers in the system. Two, knowledge must be reevaluated when it is applied to a new context. However, the most interesting outcome described by Blackman and Henderson is when a knowledge management system solves a local problem, but causes another problem elsewhere in the organization. When the seeker of the knowledge finds that it solves their problem, that knowledge will be validated by experience. However, it is the role of official knowledge to designate these solutions as less desirable than those that do not result in additional problems.

Russ, Jones, and Fineman (2006) build their taxonomy around six dilemmas they believe are of strategic importance to an organization as it attempts to manage its knowledge base. The authors' approach is to use the existing culture of the organization to determine the most fitting solution to each dilemma. Once a solution is chosen, the organization should take additional steps to create the environment in which the solution will succeed. For the purposes of this study, the dilemma of most interest is that between an organizational focus on codifying knowledge or on using that which is left tacit. The authors outline three features that are important to solve this dilemma—the technology in the organization, the use of employees, and the use of IT and data. In other words, these three factors are the key to determining which knowledge management strategy is emphasized, and therefore, which validation standards are important. Russ et al. emphasize the systemic nature of these solutions. For example, the deliberate choice of codification over personalization requires implementing supporting decisions such as expenditures in information technology rather than in employee travel (so as to share knowledge face-to-face). These supporting decisions entail additional choices such as in the design of an incentive scheme to motivate participation in the knowledge management tool.

2.2.5 The Davenport & Prusak Branch

Davenport and Prusak in their book *Working Knowledge* (1998) present a guide to implementing knowledge management initiatives. For them, the role of KMS is to provide decision makers with the knowledge they need to do their jobs. The authors review case studies of initiatives at twenty organizations most describing the creation and population of knowledge repositories. From these studies, the authors derive a number of key factors for successful implementations. They emphasize a market perspective of knowledge where individuals must be properly motivated and incentivized to share their knowledge. More importantly, the authors underscore the importance of matching the knowledge management implementation to the culture of the organization. Rather than focus on technology first, the successful implementations considered the social networks through which knowledge already flows in an organization. The authors believe that a knowledge management implementation should compliment the existing reality in the organization rather than require a fundamental transformation of the firm.

Davenport and Prusak influenced the line of inquiry headed by Earl and presented above. In addition to this line of inquiry, the authors influenced two other lines. The first line of inquiry, headed by Gallupe (2001), classifies KMS into four types based on the function the systems are designed to serve. The four functions are encouraging serendipity, knowledge creation, mentoring and training, and knowledge acquisition. KMS that encourage serendipity include tools such as chat rooms, web searches, and messaging systems. The goal of these systems is to support problem recognition for novel problems. Gallupe found little research on these KMS. KMS that provide knowledge creation include knowledge forums and communities of practice. The goal of these systems is to support problem solving for novel problems. KMS that support mentoring or training must help knowledge dissemination and sharing through formal or informal training. The goal of these systems is to support

problem recognition for previously solved problems. KMS that provide knowledge acquisition include tools such as knowledge repositories or maps that help with codification and storage. The goal of these systems is to support problem solving for previously solved problems. Like Earl's seven schools, this typology suggests that a unique validation mechanism is required for each of the four functions. In this case, the validation depends on whether the problem has been solved or is novel (much like Blackler's (1995) dimension) and whether it is problem recognition or problem solving that is desired.

Bernard (2006) develops a unique quadrant related to KMS in that it explicitly handles the social processes involved in knowledge transfer. Bernard's quadrant suggests the quality of the interaction an individual will have with a knowledge management tool based on whether the team is experiencing a rapid rate of change or is in a period of stasis and the level of psychological safety provided by the team. His conclusion is that the most high quality interactions with a knowledge management tool will come when the team is in stasis and if the team provides high levels of psychological safety. Psychological safety is rooted in mutual respect and trust among team members. It refers to the willingness of a team member to err if the error sprang from well-intentioned and legitimate beliefs. The notion of legitimate beliefs is particularly relevant to knowledge validation. Bernard argues that a team refers to a group with shared beliefs. These beliefs result in adherence to the cultural norms of the group and implies that the group uses the same standards to grant legitimacy to knowledge. Thus, Bernard provides a definition of official knowledge based on the social processes that create legitimate beliefs.

The second line of inquiry is headed by Binney (2001). Like Earl's (2001) seven schools of thought, Binney attempts to distill the landscape of knowledge management approaches into six elements arranged along a spectrum. The author goes a step further than Earl by assigning applications to the elements of the spectrum

for which they are most useful. Binney uses "applications" as a catch-all term that includes specific approaches such as case-based reasoning, decision support systems, and document management as well as human actions such as teaching, training, collaboration, and networking. Based on the supporting applications, each element of the spectrum is also assigned enabling technologies. The term technologies is general in nature as well and refers to classes of tools such as search engines, voice mail, intranets, and decision trees. Each element of the spectrum is a class of knowledge management system to which a validation mechanism must be designed. The association of each element with enabling technologies also suggests the implementation in which these mechanisms must be applied.

Keen and Tan (2007) seek to redefine the goals of knowledge management by drawing the field away the realm of information technology. The authors seek a new term, knowledge mobilization, for the personal aspect of knowledge and leave the term knowledge management to the information technology applications. The authors vehemently oppose the "corpratist" knowledge management regime. Their polemic against the current practice of knowledge management provides some useful insight into knowledge validation at the organizational level. Keen and Tan draw attention to the fact that every set of validation standards necessarily excludes some knowledge. The authors wonder how organizations can "avoid being so locked into their knowledge regimes that they exclude information and knowledge that may later turn out to be relevant to their success and even survival" (p. 11). To avoid excluding knowledge that may prove useful to the organization, validation standards should permit a diversity of views including dissenting knowledge to enter the organization. If this is not feasible, the validation standards should be updated often enough so as to reflect changes in the organization's external environment.

The preceding review of the literature discussed the findings of a number of articles with regard to taxonomies of KMS and knowledge validation. These articles were arranged in five branches and ten lines of inquiry. The following chapter describes how these branches and lines of inquiry were determined. In Chapter 4, these lines of inquiry form the basis for the metastudy linking validation mechanisms to classes of KMS.

Chapter 3

Methods

The purpose of this study is to examine the literature to discover cumulative frameworks within which the knowledge management discipline is developing and to use these frameworks to develop an understanding of validation mechanisms for the scope of knowledge management initiatives. Table 3.1 displays the research questions presented in the Introduction. A review of the taxonomies of KMS forms the basis for research into the important features to consider when designing or implementing a validation mechanism.

General Questions
RQ1: What are the ways in which KMS can be classified?
RQ2: What can be learned from the literature on KMS regarding validation?
RQ3: What perspectives underly the classifications?
Validation Questions
RQ4: How is knowledge translated to official knowledge?
RQ5: What are the mechanisms to determine if or prevent official knowledge from becoming obsolete?
RQ6: How is official knowledge transferred throughout the organization?

Table 3.1: Restatement of research questions

Because there is so little research that connects validation mechanisms to KMS, a metastudy was appropriate to survey the KMS literature in search of important considerations for validation mechanisms. A metastudy is a "critical interpretation of existing qualitative research" (Paterson, Thorne, Canam, & Jillings, 2001, p.2). The primary reason for using a metastudy methodology is that it is important to begin to build upon previous work to develop a cumulative body of research in the field of knowledge management (Huber, 1991). A quick search of the knowledge management literature reveals a preponderance of articles proposing a taxonomy, framework, or landscape of KMS. Rather than write another such article, research is needed that accepts the dominant taxonomies as they are and simply interprets them.

However, there is danger in a field that constantly examines itself. The danger is that the research will begin to rely on introspection rather than on maturing the field (Turner, 1991). Therefore, this study will also employ a metasynthesis methodology to extend beyond the current literature to synthesize new theory. The aim of this study is to determine the necessary points of consideration for the design of validation mechanisms that are logically and holistically consistent with the collection of KMS in the literature. In short, there are two methodological attributes that this study is attempting to maximize. One, the author wishes to build upon the existing knowledge management literature rather than discard it in favor of a new framework. Two, the author does not wish to merely introspect on this literature, but to synthesize novel work from it.

3.1 Criteria for Study Inclusion

To be reviewed for inclusion in the study, articles had to be published in a conference or journal that requires peer-review and the articles had to be retrievable by the

keywords listed in Table 3.2. These keywords are synonyms intended to reveal articles with content that includes a unique taxonomy of KMS.

Keywords
taxonomy, typology, classification, systematization, styles, types, foundation, strategy, school, landscape, framework

Table 3.2: Keywords used to identify articles for study inclusion

To be included in the study, the article had to present a novel taxonomy describing the nature of KMS. In addition, the articles had to be general in nature. An article that, for example, detailed a taxonomy of KMS for healthcare in Asia, was not appropriate for this study.

3.2 Study Search and Retrieval

The typical search and retrieval methodology for a metastudy is to compile a list of keywords central to the study and to use these keywords as query terms in exhaustive database searches (Nicholas, Globerman, Antle, McNeill, & Lach, 2006). Such a methodology places value on a comprehensive review of the relevant scholarly literature and assumes the completeness of the databases used for search. A comprehensive review is necessary only if the claims of the study depend upon a representative sample. In this study, value is placed not on capturing a comprehensive collection of articles, but on capturing a cumulative collection of articles. In other words, the goal of the search and retrieval will be to capture work that builds upon previous work. No claim is made that the studies included in this review will be representative of the body of knowledge management literature on taxonomies of KMS.

To retrieve cumulative work, the citation network (Lawrence, Giles, & Bollacker,

1999) of knowledge management literature was used. As starting points in the citation network, the top five most cited works in the knowledge management literature as calculated from the articles included over five years at the Hawaii International Conference on System Sciences were chosen (Croasdell et al., 2003). These articles are listed in Table 3.3 in ranked order.

Top Five Citations
Nonaka, I., & Takeuchi, H. (1995). *The knowledge-creating company: How Japanese companies create the dynamics of innovation.* New York: Oxford.
Davenport, T. H., & Prusak, L. (1998). *Working knowledge: How organizations manage what they know.* Boston: Harvard Business School Press.
Nonaka, I. (1994). A dynamic theory of organizational knowledge creation. *Organization Science, 5*(1), 14–37.
Polanyi, M. (1967). *The tacit dimension.* New York: Anchor Books.
Blackler, F. (1995). Knowledge, knowledge work, and organizations: An overview and interpretation. *Organization Studies, 16*(6), 1021–1046.

Table 3.3: The top five most cited articles in knowledge management

Google Scholar was used to explore the citation index of these top five articles. A citation index is a tool for retrieval where citations in a scholarly article are used as index terms. Using a citation index, articles that cite an article of interest (i.e., those published after the article of interest) can be found. Google Scholar ranks the results of a "cited by" search such that the most highly cited articles and those that are cited by the most highly cited articles receive high rankings (Noruzi, 2005). All five articles were examined using the "cited by" search function in Google Scholar to find relevant articles that cite these foundational articles. Articles were flagged for further review if they were highlighted using the "Find" command of the browser on any of the keywords presented in Table 3.2. Because Google Scholar ranks the results according to a citation ranking metric, only the first 100 articles of the "cited by" search were reviewed as they can be assumed to contribute the most to cumulative research. Articles found in the keyword search were reviewed according

to the selection criteria presented in Section 3.1. Articles selected for inclusion in the study were subjected, in a recursive manner, to the same search function until no more articles were discovered. Due to the small time period over which articles were reviewed (1967 to the present), reviewing the citation network until it was exhausted was not an overly burdensome task.

3.3 Data Analysis

There are three outcomes of this study. The first outcome is a citation network of cumulative work in taxonomies of KMS. The network is displayed as a directed graph and organized along a timeline. This analysis is valuable to charting how knowledge management as a field is progressing and to reveal the lines of inquiry in this specific topic. These lines of inquiry form the basis for the metastudy.

The second outcome is the metastudy of the articles in the citation network. The qualitative analysis involves the interpretation of the articles in their respective lines of inquiry. The intent is to reduce the taxonomies into categories and themes relevant to the validation of knowledge. The purpose of this work is to derive the features that are important in a validation mechanism.

The third outcome of this study is the metasynthesis of the articles. Using the categories and themes of the metastudy portion, the metasynthesis developed a list of features and research topics to consider when designing or evaluating a knowledge validation mechanism. The purpose of this section is to relate the design of validation mechanisms to the types of KMS in existence today.

Chapter 4

Results

This study examined twenty-two articles to extract the relevant features of validation mechanisms in terms of KMS. The articles were reviewed in Chapter 2 and are further discussed in this chapter. The results are presented in three sections. In the first section, the articles chosen for the metastudy are arranged according to the citation network through which they were found. This section organizes the articles into five branches and ten lines of inquiry. The second section discusses commonalities between the articles to identify patterns of importance to knowledge validation. The third section presents a meta-synthesis combining the patterns identified into a collection of features necessary to consider when designing a knowledge validation mechanism.

4.1 Citation Network

Ten lines of inquiry were found using the methodology outlined in Chapter 3. These lines represent twenty-two articles spanning the years from 2000 to 2008. Figure 4.1 displays the ten lines of inquiry used in this metastudy and their relationship to

the five seed articles listed in Table 3.3. Rounded squares indicate these five most cited articles that seeded the search. The edges issuing from these nodes indicate "cited by" connections. Following the citation path from left to right, the ten lines of inquiry are revealed. Ovals indicate articles that head a line of inquiry. These articles cite a top-cited article and meet the selection criteria outlined in Chapter 3. Rectangles indicate articles that cite an article that heads a line of inquiry and that, therefore, belong to one of the ten lines of inquiry. There were no articles tracked in Google Scholar at the time of this writing that cited one of the articles represented by a rectangle and that were deemed relevant based on the keywords and review of the abstracts. The twenty-two articles that compose the metastudy were published in eleven journals and three conferences. Appendix A lists the complete citations for the articles chosen.

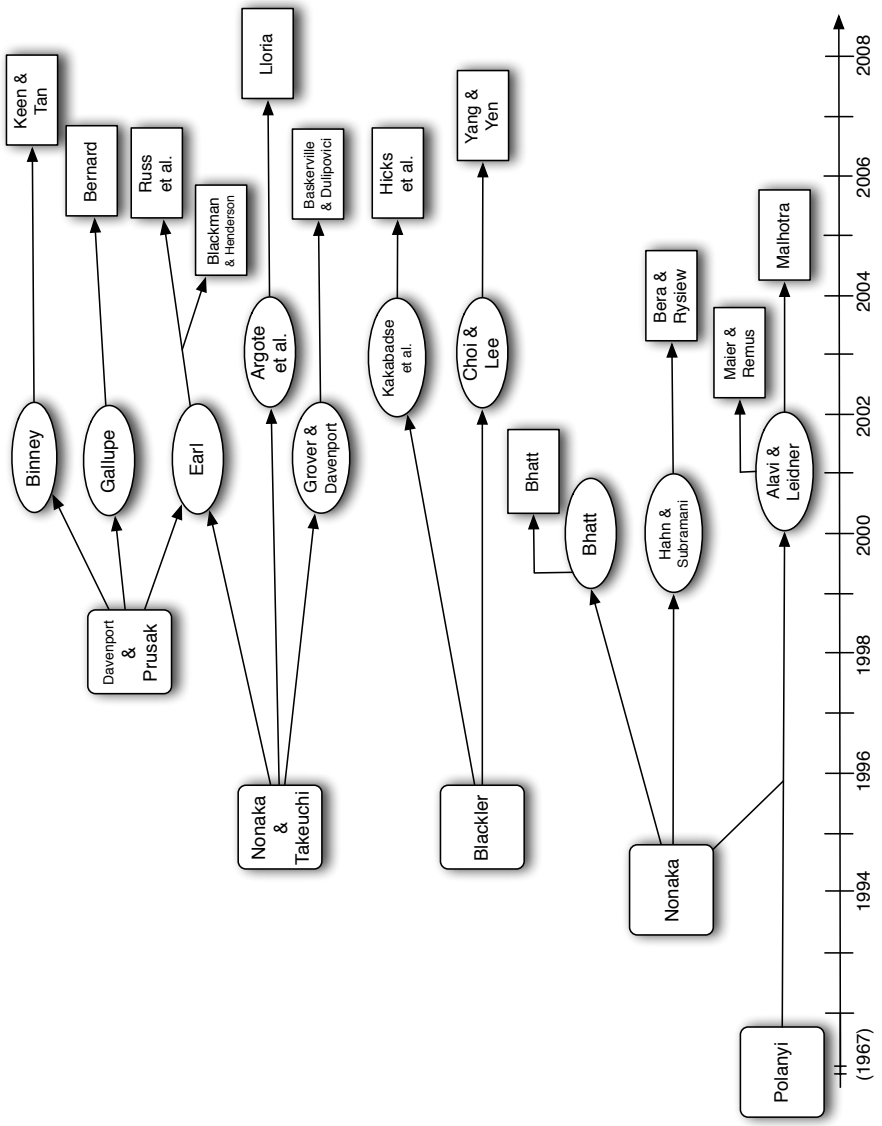

Figure 4.1: The citation network of the metastudy articles plotted by the year in which the articles were published.

4.2 Metastudy

This section describes the patterns discovered in the articles related to knowledge validation. The articles were analyzed along their lines of inquiry to determine similar themes that define each line. The intention was to find, in each line of inquiry, a defining collection of features required of validation mechanisms. It was assumed that each line of inquiry would represent an evolving, but unified perspective on the best way to parse the landscape of KMS and, therefore, would provide a unique but coherent set of features required for validation. However, the lines of inquiry failed to provide distinct perspectives and the patterns that were found transcended the boundaries of the lines of inquiry. Therefore, many of the figures presented in this section include a key indicating the articles that contributed to the analysis. Figure 4.2 displays an empty version of the key. The key corresponds to the lines of inquiry as depicted in Figure 4.1, but removes the temporal distribution of the articles. A specific article can be located by noting its relationship to the other articles. Here, circles represent seed articles and rectangles represent the twenty-two articles of the study. If an article contributed to the conclusions presented in a figure in this section, the key represents that article by darkening its location in the key.

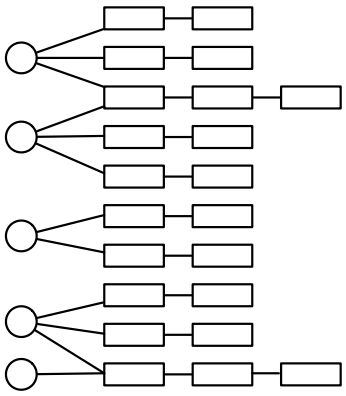

Figure 4.2: Article identifier for the origin of metastudy conclusions.

The remainder of this section is divided into three subsections. Each subsection addresses one of the research questions of this thesis.

4.2.1 Initial Validation

Grover and Davenport (2001) provide the dichotomy that delineates the methods through which official knowledge is initially validated. They divide the methods into deliberate and emergent processes. A deliberate process, in this context, refers to management identifying the knowledge that is superior and designating it as official knowledge—that which is preferred over other knowledge. Emergent processes refer to means of developing official knowledge without explicit intention.

Deliberate	Emergent
choose codification or personalization	diversity/clarity balance
appropriate incentives	require/discretion balance

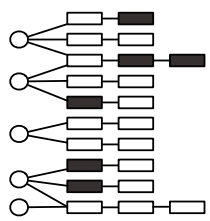

Figure 4.3: Official knowledge can be initially validated through deliberate or emergent processes.

Figure 4.3 shows the differences between the two approaches. If deliberate processes are used to initially validate official knowledge, there are two results. One, the form of the knowledge will be the result of a strategic choice such as that between codification of knowledge or personalization. Two, incentives will play an important role. Incentives must be designed to maximize the desired outcome.

Regardless of attempts to deliberately create official knowledge, much of the

initial validation is emergent and develops out of the processes that occur within the organization. There are some rules to help emergent processes work for the organization. These rules are stated in the form of balances that must be struck. Official knowledge should express multiple divergent views. This diversity will result in a more robust knowledge base. However, the diversity must not be at the expense of providing a clear direction to the knowledge seeker. The other conundrum is that between requiring adherence to official knowledge and allowing employee discretion. In some instances, requiring that employees use official knowledge when the situation applies, regardless of their intuition can be an important way to avoid mistakes. The employee may know how to solve their local problem in their own way, but only official knowledge will solve the problem without creating problems elsewhere in the organization. This authoritarianism must be balanced with employee discretion to deviate from the official knowledge if it will not render the best outcome.

The primary reason for official knowledge that has initially been appropriately validated to fail to render the best outcome is obsolescence. Organizations exist within constantly changing environments that may render previously valid knowledge invalid. The techniques to monitor and change official knowledge so as to protect against obsolescence are discussed in the next subsection.

4.2.2 Obsolescence

The lifecycle of knowledge is an important consideration of a validation mechanism for official knowledge. Knowledge that was once true may become false over time. Knowledge may become obsolete. The validity of knowledge is tied to the environment within which the knowledge will be used. Figure 4.4 displays the continual process required to validate an organization's official knowledge against the environment. Validation against the environment is to ensure that the information remains

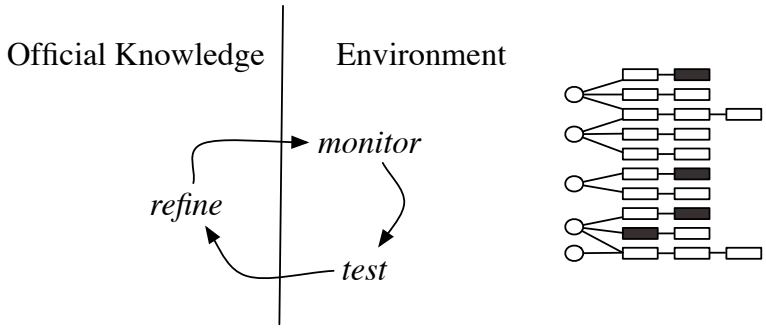

Figure 4.4: Knowledge must be continually validated against a changing environment.

accurate and pertinent.

The articles include two elegant and distributed solutions that may help to keep the base of official knowledge current. One, is based on the motivational factors of social norms. If prestige is granted to those who contribute to the organization's official knowledge, individuals will be more likely to maintain a relationship with the knowledge they contribute. For obsolescence, this means individuals will choose to update their contributions as the environment changes so as to maintain the prestige they gain from the contribution. Two, if each time an individual deviates from official knowledge the reason for the deviation is recorded, these instances of deviation will serve to refine the database of official knowledge. Deviation will suggest problems or contexts where the current official knowledge is not adequate. If deviation becomes regular, it will indicate that the official knowledge has been rendered obsolete.

There appear to be two classes of ways in which knowledge can be rendered obsolete. The first is organizational context. In recognizing that knowledge validation occurs when knowledge is transferred, the purpose of the validation is clear. Knowledge that was valid in one context, may not relate to the context to which it is being transferred. The purpose of the validation is to determine whether the knowledge

stills represents the organizational context. The second class of ways in which knowledge can be invalidated is if the knowledge no longer fits the environment in which it will be applied. The environment differs from the context in that knowledge that was applied to one problem can successfully be applied to another problem that is nearly identical. However, if these problems do not relate in a natural way to the environment, then the knowledge application will still fail. This is very similar to the single-loop and double-loop learning of Argyris (1978). For organizations, the importance of aligning knowledge to the environment is apparent—if the organization fails to understand the environment, it will fail to meet the demands of its customers.

A well-maintained base of official knowledge is worthless if that knowledge is not accessible to those who need it in the organization. The transfer of official knowledge to individuals is a validation process because individuals must determine that the knowledge they receive is true. A discussion of validation during the transfer process is the subject of the next subsection.

4.2.3 The Transfer Process

Once knowledge is validated at the organization level to become official knowledge, it must be transferred to those in the organization who will use it. The transfer of knowledge between those in the organization is one of the most central preoccupations of the field of knowledge management. It is no surprise, therefore, that the majority of the articles reviewed dealt with knowledge transfer rather than the creation of official knowledge or its obsolescence.

One of the ways that transfer is discussed is in terms of the process view of knowledge management. The process view refers to the conception of knowledge management as a series of stages each involving a transformation of knowledge. This view is in opposition to the functional view of knowledge management, which

conceives of knowledge management as support for the tasks and roles within an organization. Although the processes are often described as discontinuous and the stages vary by author, the process view is important to this study because it suggests when validation must be applied to knowledge.

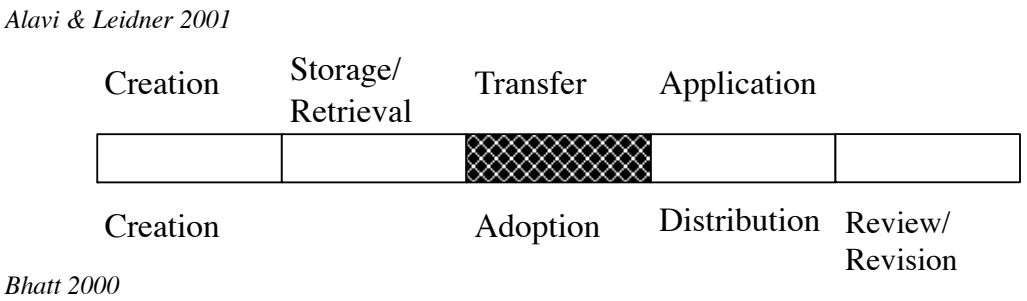

Figure 4.5: The stage of the knowledge management process during which knowledge validation is required (shaded region).

Figure 4.5 displays the stage of the knowledge management process during which validation must occur. While the names of the stages vary by author, the purposes align: validation must occur when information is transmitted to an individual. Note that this transmittal can be from technology to individual or from individual to individual. Figure 4.5 displays the stages of the knowledge management process as conceptualized by Alavi and Leidner (2001) and by Bhatt (2000).

The transfer and adoption processes are important for knowledge validation because they involve the human process of sensemaking. The sensemaking process occurs at the individual level and involves a number of factors. It is a "messy" process in that the outcome is not well-predicted based on the inputs and it varies by individual. From the articles, two features could be derived that influence sensemaking. The first feature is trust. Trust refers to the credibility of the knowledge itself as well as the credibility of the originator of the knowledge. Trust is reliant on the means of knowledge generation. This refers to the incentives an individual has to

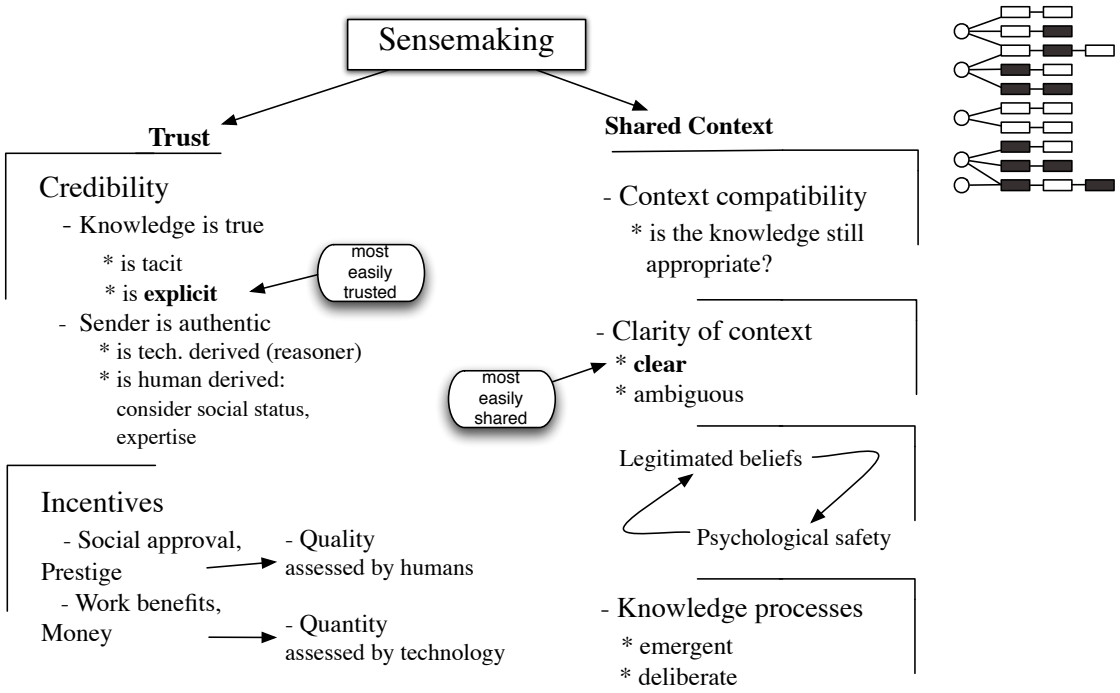

Figure 4.6: Sensemaking results from the interplay of trust and shared context.

share the knowledge. The second feature is a shared context. Shared context refers to the knowledge, norms, culture, and beliefs that unite the information sender to the information receiver. It also refers to whether the process by which the knowledge became official was deliberate or emergent. Figure 4.6 shows the interplay of these features in the sensemaking process.

McDermott asserts that knowledge is "recreated in the present moment" (McDermott, 1999, p. 106). In other words, an individual calls upon knowledge to perform a specific action or solve a specific problem. The final observation of the transfer process relates the features of the problem to knowledge management strategy and thus, to an epistemology and a standard for validation. Table 4.1 lists three features and their relationship to techno-centric and human-centric KMS. Techno-centric KMS

work best with problems that have previously been solved, involve a clear context, and where the goal is to solve the problem at hand. Human-centric KMS are better able to handle novel problems where the context is ambiguous. Human-centric systems work well for problem solving as well as problem recognition.

	Techno-centric	**Human-centric**
Problem Type	solved problem	novel problem
Problem Context	clear context	ambiguous context
Solution Goal	problem solving	problem recognition

Table 4.1: Problem features and their relationship to knowledge management strategy.

The preceding metastudy results addressed issues for initial validation, for obsolescence, and for the transfer process as separate and distinct domains of research. However, the goal of this study is to understand all three validation processes as part of a single mechanism within a knowledge management system. The next section describes the results of the metastudy in terms of this system-wide perspective.

4.3 Metasynthesis

The results of the metastudy just presented is an accumulation of observations regarding knowledge validation in KMS. This section attempts to structure these observations into a framework that can be used to guide future research and the design of knowledge validation mechanisms for organizations.

Table 4.2 displays a theme that is recurrent in the articles of the metastudy—KMS are defined by the epistemological assumptions under which they are designed. A belief in the objectivity of knowledge results in a techno-centric knowledge management system where codification is emphasized and explicit knowledge is harvested. Conversely, a belief that knowledge is essentially a human quality that does not

thrive away from the social processes that manifest it results in a human-centric knowledge management system where tacit knowledge is esteemed and social processes are supported. Even authors such as Maier and Remus (2003) and Malhotra (2005) that advocate the combination of both knowledge management strategies recognize the fundamental divide between the two approaches. If the standards for knowledge validation are determined by epistemology, then the techno-centric approaches will entail different validation standards than human-centric approaches to knowledge management. Thus, one of the most fundamental features of a validation mechanism is the epistemology to which the over-arching system subscribes.

Epistemology	**Empiricist**	**Rationalist**	**Constructivist**
KM Strategy	Techno-centric	Techno-centric	Human-centric
KM Goal	Codification	Codification	Personalization
Knowledge	Explicit	Explicit	Tacit

Table 4.2: Relationship between epistemology and knowledge management approaches.

The culmination of this study is a research framework that makes sense of the conclusions presented in the previous subsection. Table 4.3 depicts this research framework as a checklist. The table presents all three validation problems that must be solved to develop a validation mechanism that completely validates official knowledge. Each validation problem requires the design of a mechanism with a number of features. The metastudy has provided some features for each validation problem that populate the table; however, there are certainly more features to be revealed in subsequent work. In addition, the checklist includes research topics that fit within this framework. The research topics present avenues that require further development to understand their role within the validation mechanism. The role for future knowledge management research is to extend this framework by adding or evolving features and to research within this framework so that each validation problem and their inter-relationships are well understood.

Validation Mechanisms for Official Knowledge		
Types of Validation		
Initial Validation	**Obsolescence**	**Transfer Process**
Features: • codification v. personalization • appropriate incentives	**Features:** • organizational context • external environment	**Features:** • sensemaking • problem type
Research Topics:	**Research Topics:** • provide incentives to maintain • deviation tracking	**Research Topics:** • sensemaking: trust and incentives • problem type: novel, recognition, clarity of context

Table 4.3: Checklist of features to consider when designing a validation mechanism for official knowledge.

Chapter 5

Discussion and Conclusions

The methodology employed in this study did not work as expected. Specifically, the lines of inquiry failed to represent a coherent perspective regarding the most meaningful way to parse the landscape of KMS. Perhaps the reason lies in that the citation network is more dense than Figure 4.1 indicates. The complete citation network displays a much different view of the interrelatedness of the lines of inquiry. Figure 5.1 shows the citation network of the articles in the metastudy including all citation edges. The lines of inquiry are denoted by the bold lines. Unlike Figure 4.1, which only shows the citation edges projecting forward in time, and of those, only the edges that appeared in the top 100 search results on Google Scholar, this figure includes the citations of any ranking. This depiction reveals that the citation graph is less like ten isolated lines of inquiry and more like a connected graph.

In addition to the denseness of the network, the five seed articles vary little from each other. Specifically, the tacit dimension of knowledge formulated by Polanyi is the central idea of Nonaka's 1994 paper and this paper is the precursor to Nonaka and Takeuchi's 1995 book. In other words, these three seed articles do not represent three distinct branches, but a single branch. The methodology employed by this

study is perhaps more applicable to fields with more divergent work where there are clear schools of thought. The methodology is also more applicable to divergent topics; the topic of this study, taxonomies, is inherently synthetic.

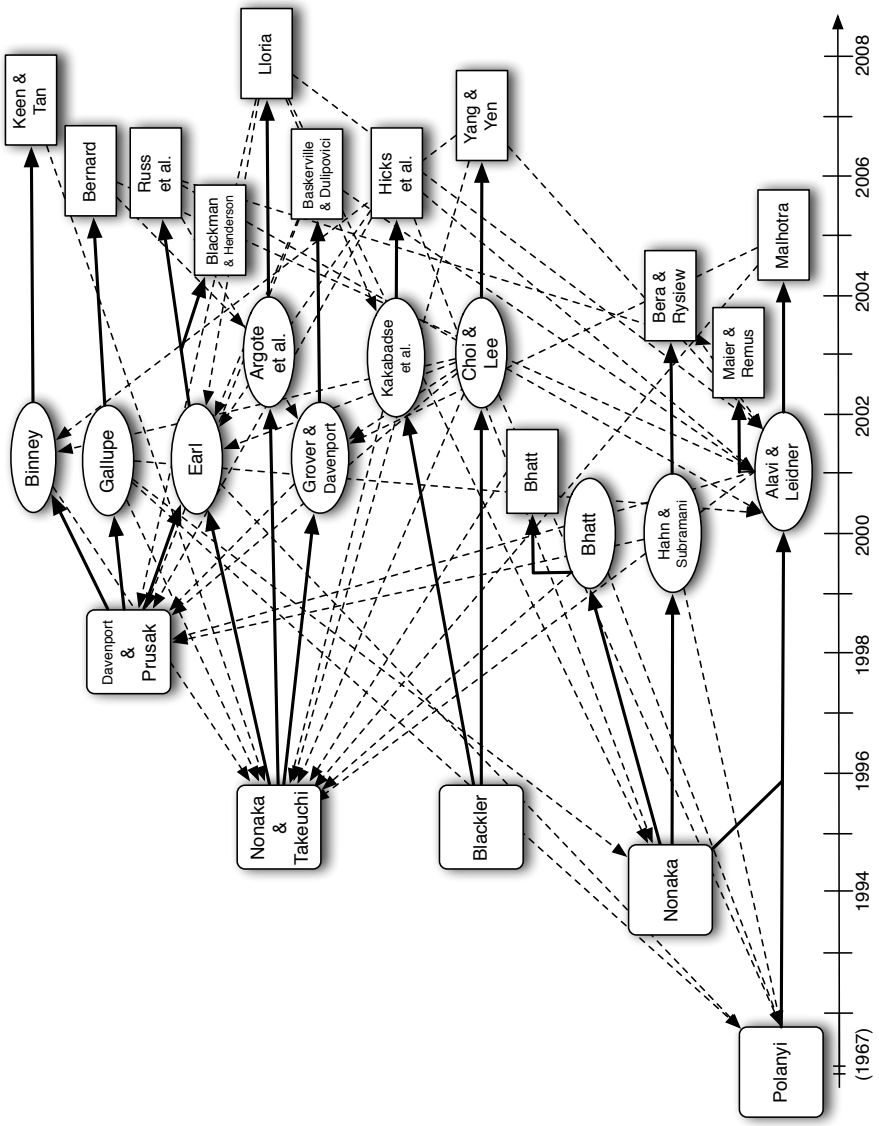

Figure 5.1: The citation network for articles in the metastudy including all citations. The lines of inquiry are shown in bold.

Despite the difficulty in analyzing the articles along lines of inquiry, the study draws a number of conclusions related to validation mechanisms for official knowledge. These conclusions are presented according to the validation problem to which they relate: initial validation, obsolescence, or the transfer process.

First, initial validation can take place through deliberate or emergent processes. The deliberately designed validation mechanism must choose between codification and personalization and must carefully consider the design of incentives to meet chosen objectives. Emergent validation is also designed, but at a higher level of abstraction. Here, it is important to provide a structure that allows balance between diversity of opinion and clarity of direction and between adherence to official knowledge and individual discretion.

Second, discussions regarding concern over the obsolescence of knowledge and discontinuity between official knowledge and the environment indicate that correspondence to the environment is an important part of validation. The burden of continual evaluation of knowledge can be lessened through system design. For example, if social norms serve as the incentive for participation, it can be expected that contributors will update their contributions as the environment changes the contribution's relevance and accuracy. Another technique is to record instances of deviation from official knowledge so as to track waning applicability.

Third, the process view of knowledge management indicates the stage in the process when individual validation of knowledge is important. The stage where information is transferred to an individual whether from technology or from another individual is the stage where this validation should occur. Sensemaking is the process that occurs when information is transferred to an individual. Successful sensemaking involves the validation of knowledge and depends on trust in the system and in the knowledge as well as a shared context. Transferred knowledge is necessarily tied to a problem such that certain features of the problem impinge on the validation of that

knowledge. These features are the novelty of the problem, whether the context is ambiguous or clear, and whether the goal is problem recognition or problem solving.

The contribution of this study is a knowledge management philosophy plus a research framework that is consistent with that philosophy. The study is grounded in three premises. One, organizations know. This premise leads to the definition of official knowledge as organization level knowledge. Two, a systems perspective is needed to comprehend organization level knowledge. Based on this premise, knowledge management systems are defined as the combination of people, techniques, and technologies. Three, knowledge management should study the design of KMS. This tenet leads to the central question of the study, what design features are relevant to validation mechanisms for official knowledge? The knowledge management philosophy combined with the research framework provides a guide to future research in the design of validation mechanisms. This framework comes populated with the conclusions of the metastudy.

Future work will extend the features of the checklist by extracting the relevant features of existing validation mechanisms such as those listed in Appendix B. Through an understanding of the composite features of each validation problem—initial validation, obsolescence, and the transfer process—informed validation mechanisms can be designed. The validity of official knowledge is of prime importance to organization success. It is hoped that research into the important features of knowledge validation will result in mechanisms that improve the effectiveness of KMS by improving the reliability of the knowledge they contain.

Appendices

Appendix A

List of meta-study articles

First level citations indicated by ovals in Figure 4.1 and displayed in order of their appearance in the figure from bottom to top.

Alavi, M., & Leidner, D. E. (2001). Knowledge management and knowledge management systems: Conceptual foundations and research issues. *MIS Quarterly*, *25*(1), 107–136.

Hahn, J., & Subramani, M. R. (2000). A framework of knowledge management systems: Issues and challenge for theory and practice. In S. Ang, H. Kremar, W. J. Orlikowski, P. Weill, & J. I. DeGross (Eds.), *Proceedings of the twenty-first international conference on information science (ICIS 2000)* (pp. 302–312). Atlanta: Association of Information Systems.

Bhatt, G. D. (2000). Organizing knowledge in the knowledge development cycle. *Journal of Knowledge Management*, *4*(1), 15–26.

Choi, B., & Lee, H. (2003). An empirical investigation of KM styles and their effect on corporate performance. *Information and Management*, *40*, 403–417.

Appendix A. List of meta-study articles

Kakabadse, N. K., Kakabadse, A., & Kouzmin, A. (2003). Reviewing the knowledge management literature: Towards a taxonomy. *Journal of Knowledge Management*, *7*(4), 75–91.

Grover, V., & Davenport, T. H. (2001). General perspectives on knowledge management: Fostering a research agenda. *Journal of Management Information Systems*, *18*(1), 5–21.

Argote, L., McEvily, B., & Reagans, R. (2003). Managing knowledge in organizations: An integrative framework and review of emerging themes. *Management Science*, *49*(4), 571–582.

Earl, M. (2001). Knowledge management strategies: Toward a taxonomy. *Journal of Management Information Systems*, *18*(1), 215–233.

Gallupe, B. (2001). Knowledge management systems: Surveying the landscape. *International Journal of Management Reviews*, *3*(1), 61–77.

Binney, D. (2001). The knowledge management spectrum—understanding the KM landscape. *Journal of Knowledge Management*, *5*(1), 33–42.

Second level citations indicated by rectangles in Figure 4.1 and displayed in order of their appearance in the figure from bottom to top.

Maier, R., & Remus, U. (2003). Implementing process-oriented knowledge management strategies. *Journal of Knowledge Management*, *7*(4), 62–74.

Malhotra, Y. (2005). Integrating knowledge management technologies in organizational business processes: Getting real-time enterprises to deliver real business performance. *Journal of Knowledge Management*, *9*(1), 7–28.

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Baskerville, R., & Dulipovici, A. (2006). The theoretical foundations of knowledge management. *Knowledge Management Research and Practice*, *4*, 83–105.

Lloria, M. B. (2008). A review of the main approaches to knowledge management. *Knowledge Management Research and Practice*, *6*, 77-89.

Appendix A. List of meta-study articles

Russ, M., Jones, J. K., & Fineman, R. (2006). Toward a taxonomy of knowledge-based strategies: Early findings. *International Journal of Knowledge and Learning*, *2*(1/2), 1–40.

Blackman, D. A., & Henderson, S. (2005). Know ways in knowledge management. *The Learning Organization*, *12*(2), 152–168.

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Appendix B

Table of validation mechanisms

Empiricist	**Rationalist**	**Constructivist**
• training • job shadow • scientific process • observation	• ontology, reasoner • credibility assessment • vocabularies	• wiki • usage statistics • collective ranking • mentor • peer review • superior review • rhetoric • self-report • reputation management • consumer reports

Table B.1: Validation mechanisms by epistemology.

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