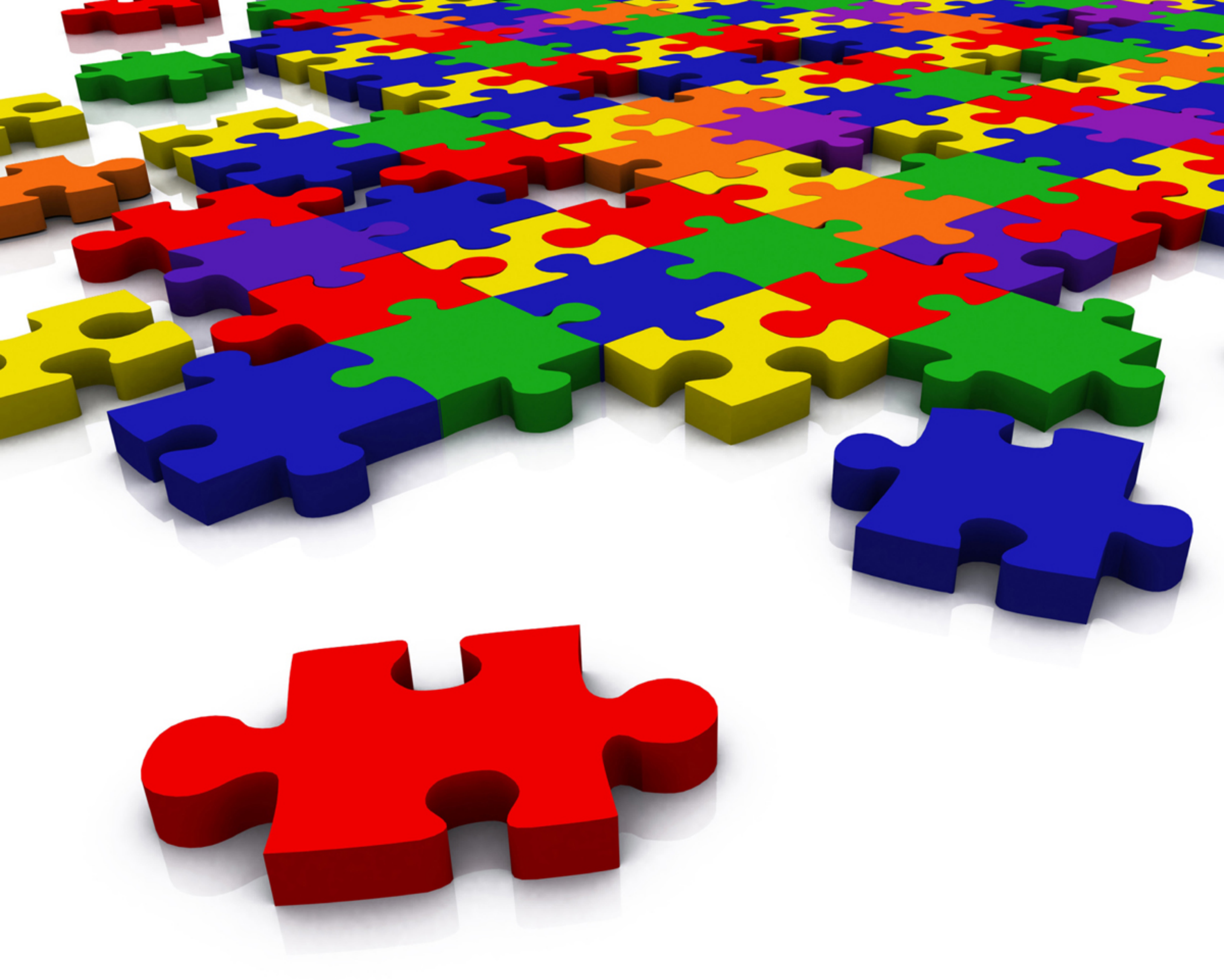

KNOWLEDGE WORK

2010

The Knowledge Institute

School of Communication and Information

RUTGERS
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The State University of New Jersey

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Preface

Early in Orson Scott Card's science fiction novel, *Shadow of the Hegemon* (2001), its hero, Bean, races to find and rescue his kidnapped colleagues. He pores through information in books and on the Internet, seeking clues that will help him:

> But it was pointless because he knew he wasn't going to find it this way. The real information never got onto the net until it was too late to do anything about it. Somebody knew. The facts he needed to find his way to his friends were available in a dozen sites—he knew that, *knew* it, because that's the way it always was, the historians would find it and wonder for a thousand pages at a time: Why didn't anybody notice? Why didn't anybody put it together? Because the people who had the information were too dim to know that they had, and the people who could have understood it were locked in an apartment in an abandoned resort that even tourists didn't want to come to anymore (p. 52).

Bean's problem, though fictional, is an apt symbol of what may be the most important organizational need in the world today: how to get the right knowledge to the right person at the right time.

In theory, more information is more accessible now than ever before in human history, thanks to the Internet and other developments in communication technology. But information is relatively useless in its raw form; only when it is put into the right context is it transformed into useful knowledge. Even then, its value is limited unless the knowledge reaches the right person, who is able to put it to use. As Bean discovers, somebody always knows, but the one who knows may not be the one best suited to deploy that knowledge, or most needful of it.

The papers that follow were generated by graduate students engaging in various ways with the problem of knowledge management within organizations. These students, from Rutgers University in New Jersey and from Wayne State University in Michigan, come from a variety of graduate level disciplines, and have chosen various angles from which to explore problems of knowledge management:

- Krista Welz makes an exhaustive review of the growth of information and the effect of that growth on workplace productivity. Keung Eun Oh proposes using topic maps to organize knowledge objects so that knowledge might better be managed and shared within an organization. Katherine Gibson argues that more attention needs to be paid to the ethical considerations in knowledge management, observing that little notice is given of KM's political and socio-cultural aspects in existing KM textbooks.
- Bibi Alajmi introduces concepts from social psychology to modify existing theoretical constructs about what prompts individuals to share knowledge with others, and how organizations can structure interactions to promote such sharing. Funda Kivran-Swaine proposes recognizing and using individual cognitive and learning styles to promote greater knowledge sharing and knowledge building in an on-line community.
- Lisa Caputo also offers an approach to knowledge management by taking advantage of the human propensity for storytelling, a method of knowledge transfer that has proven to be very effective in knowledge retention. Kathleen Reaume also argues that corporations should provide specific opportunities for storytelling as a means of knowledge transfer.
- Zhe Li analyzes a corporate blog, finding that engineers using the blog were more inclined to make their tacit knowledge explicit, thus making it available to the corporation as a whole. Young Hoon Kim examines a hypothetical company to illustrate possible failures of knowledge sharing and to propose systems that would facilitate sharing through social networking.
- Courtney Reinfried considers how knowledge is exchanged in on-line teaching, identifying areas where knowledge sharing can be improved.
- Lorena McDowell somewhat surprisingly discovers in a small sample that there was little difference across generations in terms of preferred modes of receiving new information. And Samantha Quintas suggests that decision support systems can aid environmental workers to better intercede into complex ecological systems.
- Davida Scharf points to an application of knowledge management in patient education to improve health outcomes.

The variety of topics and approaches used by these students may suggest new areas for research and new methods for knowledge management in large organizations. They amply demonstrate the potentials of young researchers in this exciting field, and I am proud to have been invited to take part in this project as faculty editor.

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Acknowledgements

Small volumes reflect a considerable amount of determined effort, as do larger tomes. This small work was a collaborative project undertaken by students and faculty at Rutgers University's School of Communication and Information (SC&I) with writing contributions from Wayne State University's School of Library and Information Science. We wish to acknowledge the writers who contributed their ideas about knowledge creation, knowledge sharing, and the organization of knowledge objects. We also acknowledge the hard work of the production team, all from Rutgers, who worked through the summer of 2009 to proofread, edit, and format the book.

A special recognition goes to doctoral student Susan T. Wengler who served conscientiously as the student editor for the project. Susan's professionalism and eye for detail carried the project forward and allowed graduate and undergraduate students from different departments to work together and complete the book. Much of the work was done remotely by using e-mail and other information and communication tools. Susan masterfully developed trust among the team and managed the decision making process superbly.

Connie Pascal, a doctoral student in the SC&I PhD program was the energetic project manager for the publication. Connie organized meetings, project documents, and communicated with the team, the printers, and others as required—all with a positive can-do attitude. Connie brings her unique talents to all the projects she undertakes. We are grateful to have had her involvement in the Knowledge Institute's publishing endeavor for two years running.

Professor Waller Hastings served as the faculty editor for the book. With his considerable publishing and teaching experience Professor Hastings was an invaluable addition to the publication team and advised us on matters of proper style and format. For his loyal participation and steadfast involvement, we thank him.

Tara Kelley was the initial layout editor after the main editorial work was completed. Her fresh and energetic style made working with her a genuine pleasure. Christine Goldthwaite applied her professional design expertise to the design and formatting of the final version of the book. Christine's fine eye and careful attention to detail combined with her sense of humor and collegial work style moved the project along. Her help was greatly appreciated, and without it we would not have been able to bring the project to fruition.

The publication editorial team wishes to acknowledge the following students for their careful work—all done on a voluntary basis without academic credit or financial compensation. As one can see from the list, some students assumed more than one role. We

commend their generosity. It is worth noting that the students who contributed to the editing and final design came from all three departments of Rutgers School of Communication and Information, and represent undergraduate, graduate and PhD programs.

- **Content Editors:** Andrew Gerber, Suchitra Kamath, Sung Un Kim, Priscilla Pineda
- **Proofreaders:** Andrew Gerber, Tara Kelley, Christine Schneider, Paula Spiletwycz
- **Formatters:** Sung Un Kim, Jelisa Scotton, Krista Welz, Christine Wong, Difei Xie
- **Layout Editor:** Tara Kelley
- **Art Direction and Design:** Alumna Christine Goldthwaite

These students and faculty members embody the interdisciplinary spirit that is inherent in the curriculum of the Rutgers University School of Communication and Information and that of its Knowledge Institute. Our hats are off to the scholars who wrote the book and the editorial and publication team that organized it and prepared it for printing.

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Intentions to Share: Investigating Information Professionals' Knowledge Sharing Behavior

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Abstract

This paper develops an understanding of knowledge sharing behavior through the adaptation of two major theories imported from social psychology: Theory of Reasoned Action (TRA) and Theory of Planned Behavior (TpB). Exploring these theories from a knowledge sharing perspective provides an understanding of the different factors facilitating or hindering individual's knowledge sharing behavior. An extension of these theories has been created to include knowledge sharing constructs into the decision making framework presented by TRA and TpB. At the end, the paper develops theoretical propositions that will set the stage for future research questions and hypotheses to be tested in a real setting. Focusing on information professional knowledge sharing behavior, the paper will have a significant contribution to the understanding of the motivational and volitional factors that determine information professional's knowledge sharing behaviors.

Introduction

Knowledge sharing has been identified as a major focus area within knowledge management. Unfortunately, some organizations perceive knowledge sharing from a technological perspective, investing in tools that motivate individuals to share their knowledge while neglecting the human and communicative aspects of knowledge sharing. This approach, although inspiring, cannot guarantee successful knowledge sharing actions. McDermott (1999) asserts that information technology can inspire but cannot deliver knowledge. Meanwhile, Hislop (2002) concludes that knowledge sharing practices are 90 percent people and 10 percent technology. The aforementioned studies (McDermott, 1999; Hislop, 2002) collectively confirm Tuomi's (1999-2000) argument that knowledge sharing is fundamentally social and that successful knowledge-sharing practices require a broad understanding of not only technical, but of social and psychological aspects of human organization.

Thus, in order to understand why individuals share or hoard their knowledge and to suggest practical approaches for motivating them, it is necessary to examine their *knowledge sharing behavior*. And although several studies have

examined factors influencing individual knowledge sharing and suggest that positive knowledge sharing behaviors stem from enabling cultures, rewarding systems, and supportive management styles, surprisingly few studies have employed theoretical frameworks to specifically examine the predictors of the decision to share knowledge among a group of individuals. Moreover, knowledge sharing has been widely investigated in two main contexts—business and healthcare. However, less attention has been directed to other contexts that if investigated, will yield a better understanding of how and why members in these contexts share their knowledge, and what are the real motivators to share.

The information professions are selected as an interesting and inspiring context to study. Information professionals understand the importance of accessibility and sharing of expertise to benefit the end user. Yet, there is less understanding of what motivates information professionals to share their expertise and knowledge accumulated over their years of experience. Davenport and Prusak (1998) once stated that knowledge sharing is unnatural and difficult to achieve, and that the human tendency is to hoard and not share their knowledge. While this conviction might be true in many contexts, with information professionals the natural tendency is to share. Yet, our knowledge about reasons behind their knowledge sharing behavior is less obvious and needs special investigation.

This research project proposes a decision-making framework developed by extending the successful theories of the motivational determinants of individual knowledge sharing behavior, Theory of Reasoned Action (TRA) (Fishbein and Ajzen, 1975), and Theory of Planned Behavior (TpB) (Ajzen, 1991, 2002), to assist in answering the research's three main questions: How does TRA and TpB inform the KM community on information professional knowledge sharing behavior? What constructs predict, determine and motivate knowledge sharing behavior?; and How do these theories inform us on specific context such as online communities' knowledge sharing behavior?

Literature Review

This section aims to provide an understanding of knowledge sharing as a general organizational and individual process. This is to be done by introducing different definitions, characteristics and frameworks that will shed light on knowledge sharing as an individual behavior.

Knowledge Sharing: Definitions and Characteristics

Knowing about the "Knowing Process." Usually, a discussion of knowledge sharing, or knowledge management (KM) in general, starts with defining knowledge and how it is different or relevant to data and information. This paper intends to take a different starting point: an inquiry into the individual's own experience regarding the use, discovery and sharing of knowledge. Thus, rather than focusing on knowledge per se, it becomes necessary to understand the knowing process that could shed light on different perspectives and how different people perceive knowledge sharing and creation. Orlikowiski (2002) explains that knowing is an ongoing social accomplishment, constituted and reconstituted in

everyday practice. This perspective takes us from the traditional, cognitive view of knowledge as a thing, to the collective performative view of knowledge as socially constructed (Heaton, Bergeron, Bertrand-Gastaldy, and Mercier, 2005) continuously reproduced and negotiated in interaction among members of a knowledge community. Weick (1995) emphasized that knowledge creation and consequently, sharing, is grounded in human agency and that it emerges in a reflexive monitoring of the stream of experience. As such, it is an unfinished construction that must continually be sustained in the ongoing flow of human work and interaction. Knowledge creation and sharing takes part in the organizing process in which "individuals involved consensually in validating rules and conventions for reducing equivocality through an interpretive context and interlocked behavior" (Weick, 1995, p. 3). Weick identified three main processes in organizing: enactment, selection and retention. These three processes provide some clues and clarification on how we individuals can perceive knowledge sharing as a process. Enactment is the first stage where individuals directly engage the external environment, which they scan and monitor for cues, raw material or criteria that might be seized or dismissed in the selection process. The selection stage, on the other hand, involves imposition of various structures on enacted equivocal displays in an attempt to reduce equivocality. Once the output is perceived as successful, it is retained and eventually re-worked as experience that influences new organizing processes.

What do these propositions tell about knowledge sharing? Szulanski (2000) developed a framework of knowledge transfer, identifying four main phases: initiation, implementation, ramp-up, and integration. Each phase can be linked to decisions made through enacting to external environments, selecting from enacted cues and finally storing past experience to function as criteria for any new decisions to be made. Thus, knowledge sharing is based on decisions in the main four phases: decision to initiate sharing, decision to implement, decision to trust the recipient, and decision to apply new knowledge, with each decision based on the enactment-selection-retention processes according to Weick's (1995) formula.

Knowing about "Knowledge Sharing." In an attempt to understand knowledge sharing**,** Lee & Al-Hawamdeh (2002) define knowledge sharing as the deliberate act in which knowledge is made reusable through its transfer from one party to another. On the other hand, Bordia, Irmer, Garden, Phaire, and Abusah (2004) have classified knowledge sharing as an organizational citizenship behavior and defined knowledge sharing behavior as "an individual behavior that is discretionary, not directly or explicitly recognized by the formal rewards system, and that in the aggregate promotes the effective functioning of the organization" (p. 130).

Lin (2006) differentiates between individual knowledge sharing and organizational knowledge sharing. Individual knowledge sharing is all about communicating with the others to help them get something done more efficiently and effectively, while organizational knowledge sharing is based on capturing, organizing, transferring, and making available that experience-based knowledge that reside within the organization.

On the other hand, knowledge sharing has been identified as a social process based on people-to-people interactions (Tuomi, 2000; Ryu, 2003) and a communicative process (Heaton et al., 2005). Thus, understanding knowledge sharing as a process requires analyzing the different constructs it consist of be it technical, social, psychological, or organizational constructs. This will take us to the following section that focuses on analyzing the different components of knowledge sharing as a process. These different frameworks explicate knowledge sharing by presenting in-depth insight on how this sharing process is actually done.

Knowing about "Knowledge Sharing in the Information Profession." In general, the goal of any KM initiative in libraries is "to promote relationship in and between libraries, between libraries and the user; to strengthen knowledge internetworking and to quicken knowledge flow" (Shanhong, 2001, p. 3). Thus, investing in the different types of KM processes—identifying, creating, capturing, sharing, and utilizing—is the best way to accomplish and promote the new mission of libraries as "people-to-people" organizations, instead of the traditional "book-to-people" mission.

However, in a library context, it can be noted that a great deal of knowledge sharing is entirely uncoordinated and that any sharing of information and knowledge has been on an informal basis and is usually based on conversation (Maponya, 2004). Jantz (2001) has pointed out that in many library settings there is no systematic approach to organizing the knowledge of the organizations and making it available to other librarians and staff in order to improve the operation of the library. Thus, understanding the different organizational, social, and even psychological factors relevant to knowledge sharing will assist in improving the knowledge sharing process, and will enable libraries leaders to set the strategies for promoting the sharing of knowledge and expertise among librarians.

Theoretical Framework and Research Hypothesis

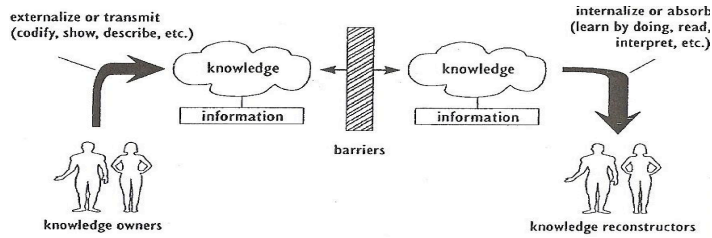
Bordia, Irmer, Garden, Phaire, and Abusah (2004) have classified knowledge sharing as an organizational citizenship behavior and have defined knowledge sharing behavior as "an individual behavior that is discretionary, not directly or explicitly recognized by the formal rewards system, and that in the aggregate promotes the effective functioning of the organization" (p. 130). Thus, knowledge sharing can be theoretically and empirically investigated like any other deliberate individual behavior (smoking, voting, etc). Theories from social psychology, most notably the theory of reasoned action (TRA) and the theory of planned behavior (TpB), have been extensively used to explain individual behaviors. This research follows a similar path using the TRA and TpB theories in order to investigate individual knowledge sharing behavior.

Knowledge Sharing Frameworks. In the following section, three of the most cited and influential frameworks will be reviewed: Hendricks's view of knowledge sharing (1999), Nonaka and Takeuchi's dynamic theory of knowledge creation (1994, 2003), and Szulanski's framework of stickiness and knowledge sharing (2003). The purpose of this section is to provide more understanding of knowledge sharing as a process consisting of inputs, operations and outputs. Once

the process ingredients are identified, identifying problems and difficulties and providing solutions for it will be achievable. The three frameworks will be discussed in logical order, starting with more traditional and classical views of knowledge sharing to those most complicated, which involve the social and psychological aspects of knowledge sharing.

Hendricks' (1999) classical view of knowledge sharing presumes a relationship between at least two parties: one that possesses knowledge and the other that acquires knowledge. Two sub-processes make up the process of knowledge sharing. First, knowledge sharing presumes an act of "externalization" by those who have the knowledge (knowledge owners) and second, knowledge sharing presumes an act of internalization by those seeking to acquire knowledge (knowledge reconstruction).

Figure 1: *A simplified model of knowledge sharing*



Source: *Hendriks, 1999*

Nonaka and Tachuchi's (1994, 1995) dynamic theory of knowledge creation follows the cognitive model of knowledge, which perceives knowledge as a symbolic transcription of individual understanding. Once transferred into more explicit format, the communication of knowledge is non-problematic. According to Nonaka and Tachuchi (1994, 1995), organizational knowledge emerges from a series of ongoing transformations among two major types of knowledge: tacit and explicit. These transformations require that different individual ideas and skills be divulged and combined into collective routines and shared knowledge bases, that encoded knowledge be internalized by individual, and that individuals share their skills with one another.

Figure 2: *The dynamic theory of knowledge creation*

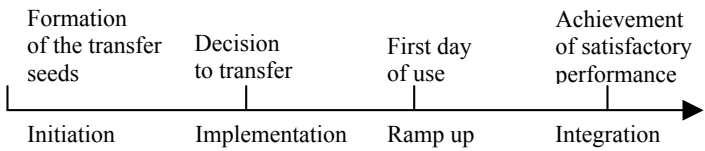
	Tacit Knowledge	Explicit Knowledge
Tacit Knowledge	Socialization	Externalization
from Explicit Knowledge	Internalization	Combination

Source: *Nonaka, 1994*

Szulanski's (2003) framework of knowledge sharing stickiness shed light on the difficulties encountered while transferring knowledge. Within this framework, knowledge transfer is classified into four main stages: initiation, implementation, ramp-up, and integration. In his model, Szulanski focused on the stickiness of knowledge sharing by identifying problems related to the transfer process. The model was based on the general expectation that factors that affect the opportunity to transfer are more likely to predict difficulty during initiation phases, whereas factors that affect the execution of the transfer are more likely to predict difficulty during subsequent implementation phases.

The empirical finding suggested that factors such as motivation and perceived reliability are significant in the first three stages of the transfer. Traits of the recipient unit, most notably absorptive capacities—their abilities to identify, value and apply new knowledge—become significant during implementation. Causal ambiguity is significant at all stages of the transfer. Causal ambiguity and the lack of recipient's absorptive capacity appear to be the most important predictors of stickiness. In a nutshell, the empirical evidence indicates that organizations learn how to better transfer best practices—and eventually to cope with stickiness—by drawing on the lessons of previous knowledge transfers.

Figure 3: *The process of knowledge transfer*



Source: *Szulanski, 2003*

Social Psychological Theories

Theory of Reasoned Action and Theory of Planned Behavior. Theory of reasoned action (TRA) (Fishbein, 1975) and theory of planned behavior (TpB) (Ajzen, 1991, 2002) have been adopted extensively to specifically examine the predictors of individual's deliberate decision making process to engage into a specific behavior. However, few applied these theories to investigate knowledge sharing behavior (Kuo & Young, 2008; Ryu et al., 2003). In the following sections, the two theories will be discussed thoroughly in an attempt to lead to the construction of a model relevant to knowledge sharing. The main idea here in adopting social psychological theories is not to predict knowledge sharing, even though this is a main objective of these theories; rather the goal is to understand individual knowledge sharing behavior.

Theory of Reasoned Action. TRA overcomes the traditional assumptions that an individual's attitude is the main predictor of an individual's behavior. The conceptual framework suggests that the performance or non-performance of a specific behavior with respect to some object usually cannot be predicted from knowledge of the person's attitude toward that object. Empirical studies investigating attitude-behavior relationship have found that attitude is not a determinant of individual actual behavior (LaPiere, 1934; Corey, 1937); rather, intentions should be investigated as the main predictor. TRA studies beliefs, attitudes, subjective norms, intentions, and behaviors attempting to draw structural relationships between these different constructs. Applying these constructs on understanding knowledge sharing, will assist in analyzing motivation factors influencing individual's knowledge sharing behavior. A reminder here is that organizational and contextual motivation factors including enabling culture and rewarding systems are influencing individuals' behaviors indirectly through impacting individuals' attitude toward knowledge sharing and eventually toward his/her intention to share.

Intentions (Behavioral Intention). Intentions are the most consistent predictor of behavior. According to Ajzen and Fishbein, intentions are assumed to capture the motivational factors that influence behaviors; they are indications of individual's willingness and readiness to behave. Thus, information specialists' intention to share knowledge highly determines his/her behavior to actually share knowledge with others. Research has shown that the best way to predict whether or not an individual will perform a specific behavior is by asking the simple question of whether he/she intends to perform that behavior (Fishbein & Ajzen, 1975). This argument leads to the following proposition:

> *Proposition 1: The stronger the individual's intention to share knowledge, the more likely he/she will share their knowledge with other information professionals.*

Beliefs. According to the TRA framework, a person's intentions are a function of certain beliefs directed to the behavior itself rather than beliefs about the object of the behavior. Basically, beliefs are formulated based on direct observation or information received from outside sources. This information will eventually help an individual associate the object to various attributes. In this manner, he/she forms beliefs about him/herself, about other people, and about behaviors. The totality of a person's beliefs serves as the informational base that ultimately determines his/her attitudes, intentions and behaviors. Thus, this approach views the human as an essentially rational organism who uses the information at his/her disposal to make judgments and arrive at a decision. Yet, understanding an individual's salient beliefs will assist in predicting his/her attitude toward an object, which could be manipulated as information delivered to the individual can be manipulated and directed to a specific object or behavior.

Three types of beliefs guide behavioral intention: Beliefs about the likely outcomes of the behavior and the evaluations of these outcomes (*behavioral beliefs*), beliefs about the normative expectancies of others and motivations to comply with these expectations (*normative beliefs*), and beliefs about the presence of factors that may facilitate or impede performance of behavior and the perceived power of these factors (*control beliefs*).

Attitude (Behavioral Beliefs). Attitude can be described as learned predisposition to respond in a consistently favorable or unfavorable manner with respect to a given object (Keisler et al., 1969, p. 4). Based on this conceptual definition, there are three basic features of conceptualizing attitude: the notion that attitude is learned, that it predisposes action and that such actions are consistently favorable or unfavorable toward the object (Fishbein & Ajzen, 1975, p.6). Attitude, as a general behavioral disposition, has an impact on specific behaviors only indirectly by influencing some of the factors that are more closely linked to the behavior in question (Ajzen, 1991), which is an individual's intention to perform that behavior. Thus, an information professional's attitude toward sharing their knowledge with others determines their intention to actually perform this behavior. Previous research has shown a strong significant relationship between individuals' attitude toward knowledge sharing and their intentions to share knowledge with others in which attitude provides a satisfactory explanation of variance in knowledge sharing intentions (Kuo & Young, 2008; Bock et al., 2006). These argument leads to the following proposition:

> *Proposition 2: The more favorable information professional's attitude toward knowledge sharing practices, the stronger his/her intention to share knowledge.*

Subjective Norms (Normative Beliefs). Subjective norms are based on how significant others are thinking about an individual's specific behavior and whether the individual should or should not perform that behavior is in question. Research has provided significant evidence that an organization's positive perception of knowledge sharing will produce pressure that could motivate

individuals to comply. Connelly and Kelloway (2001), when studying virtual communities, concluded that team members' perceptions of management support of knowledge sharing are significant predictors of positive knowledge sharing culture. Harder (2008) asserts the aforementioned conclusion and found the impact of managerial support with individual's autonomous motivation to share knowledge. Lu, Leung and Koch (2006) found that co-worker collegiality has an indirect influence on knowledge sharing by lowering greed—enjoying other's contributions without cost—and raising self-efficacy.

On the other hand, Liao (2008) examined managerial social power and found significant impact regarding managers' social power on knowledge sharing behavior. Liao presented two models for investigating the impact of the five types of social power—reward, coercive, expert, reference, and legitimate— on employees' knowledge sharing behavior. While reward power and expert power have direct influence on knowledge sharing behavior, coercive power, legitimate power, and reference power have direct effects on expert power. Therefore, these five types of social powers have direct and indirect effects on knowledge sharing behavior. In a nutshell, employees' perceptions of their managers and significant peers' acceptance and encouragement of knowledge sharing will yield positive knowledge sharing behavior because of the power to change or influence employees' behaviors and attitudes toward knowledge sharing. These arguments lead to the following proposition:

> *Proposition 3: The stronger the information professional's perceived subjective norms toward knowledge sharing practices, the stronger his/her intention to share knowledge.*

Social Norms. Even though subjective norms indicating "important people" pressure an individual to comply with a specific behavior, social norms share the same significant influence on an individual's behavior. The basic assumption of the influence of social pressure is that an individual looks for a balanced relationship in which reciprocity is essential. Knowledge sharing has been conceptualized as a social process that will eventually put pressure on individual to reciprocate and share their expertise and knowledge. In addition, seeking a balanced relationship will eventually facilitate the creation of strong ties among individuals and, consequently, develop the trust necessary for successful collaboration and knowledge sharing. These arguments lead to the following proposition.

> *Proposition 4: The stronger the information professional's perceived social norms toward knowledge sharing practices, the stronger his/her intention to share knowledge.*

Theory of Planned Behavior (TpB). Although some people may develop intentions to perform a specific behavior, they might not take any actual actions. This discrepancy has been labeled the "*intention-behavior gap*" (Sheeran,

2002). TpB addressed this issue by bringing into the TRA framework a new volitional factor that might impact an individual's intention to behave, and that is a perceived behavior control.

Perceived Behavior Control (PBC). PBC is defined as an individual's confidence that he/she is capable of performing the behavior under investigation (Ajzen, 1991). And according to TpB, perceived behavior control together with behavioral intention can be used directly to predict behavioral achievement (Ajzen, 1991).

In 2002, Ajzen demonstrated the conceptual and methodological ambiguity surrounding the concept of PBC. Consequently, PBC was decomposed into two major constructs: *Self-efficacy* and *controllability*. *Self-efficacy* is defined as an individual's confidence in his/her ability to perform a behavior (Bandura, 1994). *Controllability* is defined as an individual's beliefs about the extent to which performing the behavior is up to him/her. Testing the two-factor structure of perceived behavior control, research has yielded a significantly better fit when self-efficacy and controllability are included in the TpB model as separate latent variables rather than as the combined indicators of perceived behavior control (Ryu, Ho, & Han, 2003). Thus, these two constructs will be used to investigate individual's control over knowledge sharing behavior.

Self-efficacy has been widely adopted as a behavioral control measure. Self-efficacy beliefs function as one set of proximal determinants of how people behave, their thought patterns and the emotional reaction they experience in taxing situations (Bandura, 1982). According to Bandura, individuals with high levels of perceived self-efficacy approach tasks with efficacious outlooks, producing high levels of commitment, while individuals with low levels of self-efficacy, will shy away from controversial activities. Knowledge sharing is one type of such practices. Self-efficacy can be developed by four main sources of influence: mastery of experience, vicarious experience, social persuasion, and by reducing people's stress reaction and altering their negative emotional proclivities and misinterpretations of their physical states (Bandura, 1994).

Perceived self-efficacy plays a key role in the self-regulation of motivation (Bandura, 1994). Adoption of self-efficacy measures has yielded significant findings regarding the effects of an individual's perceived self-efficacy as a predictor of his/her intention to perform a specific behavior. Thus, the following assumption is that an information professional's self-efficacy will eventually influence his/her intention to share expertise with other professionals.

> *Proposition 5: The greater the information professional's perceived self-efficacy, the stronger his/her intention to share knowledge.*

Self-efficacy is perceived as multi-domain and multi-level (Kuo & Young, 2008). And to better increase the power of self-efficacy as a construct, Kuo and Young suggested that researchers should incorporate multiple measures for self-efficacy to yield better prediction power. Going back to the idea that knowledge sharing is a dynamic process (Nonaka & Takeuchi, 1995), Kuo and Young suggested that future studies should include the different activities of any

knowledge creation (Nanaka and Takeuchi, 1995), including socialization, externalization, combination, and internalization, all to be perceived in relation to self-efficacy. For example, the higher the information professional's perceived self-efficacy in externalizing personal expertise and socializing with other peers, the greater the intension to actually share personally with other professionals. The higher the confidence in his/her own abilities, the more he/she will share.

Proposition 6a: The stronger the information professional's socialization self-efficacy, the stronger his/her intention to share their expertise/knowledge with other peers.

Proposition 6b: The stronger the information professional's externalization self-efficacy, the stronger his/her intention to share expertise/knowledge with other peers.

Proposition 6c: The stronger the information professional's internalization self-efficacy, the stronger his/her intention to share their expertise/knowledge with other peers.

Proposition 6d: The stronger the information professional's combination self-efficacy, the stronger his/her intention to share their expertise/knowledge with other peers.

Controllability. Controllability could be related to organizational capabilities and available resources. The assumption is that the stronger the information professional's perception of the easiness to share knowledge, the stronger the intention to share. This is to say that the sense of control over his/her own behavior will lead to actually behavior.

Proposition 7: The greater the information professional's level of controllability, the stronger his/her intention to share knowledge with other peers.

Types of Knowledge. While in the previous section knowledge sharing was taken as a general concept, it is worth investigating knowledge sharing behavior with different types of knowledge. Following Polanyi's (1966) classification of knowledge as explicit and tacit, Lu et al. (2006) extended their research model by examining the relationship among information technologies, knowledge types (tacit and explicit), and knowledge sharing. Their study found that inclusion and distinction of knowledge types in the knowledge sharing model are important and yield different results. Thus, this research proposes to include three main types of knowledge relevant to information profession: technical, subject-based and ethical. The main purpose of including these types of knowledge is to investigate the focus of information professional knowledge sharing behaviors. It is well-known that information professionals invest their sharing of technical

expertise; however, less is dedicated to ethical knowledge. Going back to Sheeran's (2002) vision of an information professional, the information specialist's role is not merely that of a bookkeeper, nor of a technical supporter; that role should exceed technicalities to be effective in building social epistemology.

> *Proposition 8: The stronger the effect of information professional's attitude, subjective norms, self-efficacy, and controllability on his/her behavioral intention, his/her sharing behavior will differ on each knowledge type—technical, subject-based, or ethical.*

Motivational and Volitional Model of Knowledge Sharing

TRA and TpB frameworks emphasize the idea that a person's behavioral intention is viewed as two complementary models– motivational and volitional. The motivational model is based on an individual's salient beliefs about the evaluative of function of two main factors: attitude toward the behavior and his/her subjective norms. The volitional model is presented by perceived behavioral control that is based on the easiness or difficulty of performing a specific behavior. Thus, for motivated individuals, volitional processes mediate the effects of intentions and translate intentions into actual behaviors.

Figure 4: *An extended model representing motivational and volitional factors influencing knowledge sharing behavior.*

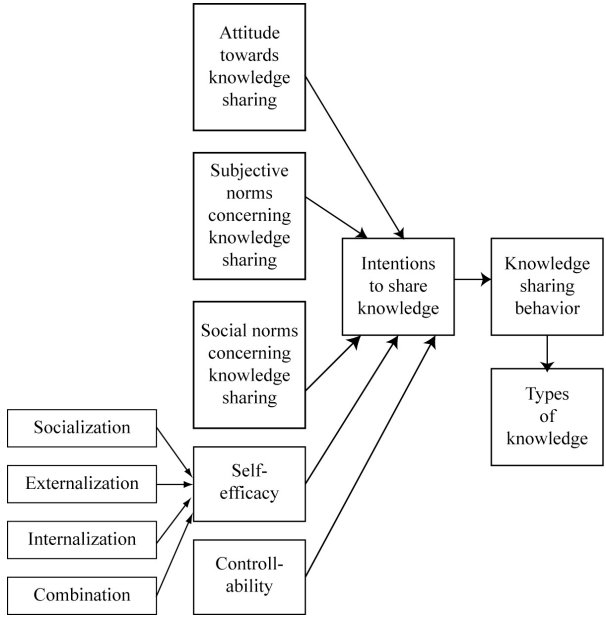


Table 1: *Definitions of the motivational and volitional constructs*

Concept	Definition
Intention (behavioral intention)	Person's subjective probability that he/she will perform certain behaviors.
Belief	Individual's subjective probability judgment linking an object to some attributes.
Attitude	A person's general feeling (affect) of favorableness or unfavorableness toward some stimulus object.
Subjective norms	Perceptions of other important people and whether the individual should or should not perform the behavior in question.
Perceive behavioral control	Individual's abilities to perform a behavior.
Self-efficacy	Individual's confidence in his/her ability to perform a behavior (Bandura, 1982).
Controllability	Belief about the extent to which performing the behavior is up to the actor (Ajzen, 2002).

Conclusion

This paper identifies the different motivational and volitional factors determining information professional's knowledge sharing behavior. Two theories are adopted from social psychology: Theory of Reasoned Action (TRA) and Theory of Planned Behavior (TpB). While adopting the basic constructs of these two theories, this paper suggests a theory extension in which other relevant constructs are added to assist in better understanding the decision making process information professionals take when sharing their experience and knowledge with other

information professionals. Yet, this paper presents the basics for a further research study to be conducted using multi-methods for investigating information professionals' knowledge sharing behaviors in the academic world. The major propositions discussed in this introductory paper will set the stage for building further research questions and hypothesis.

References

Ajzen, I. (1991). The theory of planned behavior. *Organizational Behavior and Human Decision processes*, *50*, 179-211.

Ajzen, I. (2002). Perceived behavior control, self-efficacy, locus of control, and the Theory of Planned Behavior. *Journal of Applied Social Psychology, 32*(4), 665-683.

Bordia, P., Irmer, B. E., Garden, M., Phair, K., & Abusah, D. (2004). Knowledge sharing in response to a supportive work environment: Evidence from an Australian engineering firm. In B. Trezzeni, P. Lambe, S. Hawamdeh (Eds.), *People, knowledge and technology: what have we learnt so far.* Proceeding of the first iKMS International conference on knowledge management (pp. 129-139). Singapore: World Scientific.

Bandura, A. (1982). Self-efficacy mechanism in human agency. *The American psychologist, 37(2), 123-147.*

Bandura, A. (1994). Self-efficacy. In V. S. Ramachaudran (Ed.). *Encyclopedia of human behavior* (Vol. 4, pp. 71-81. New York: Academic Press.

Connelly, C., & Kelloway, K. (2001). Predictors of employees' perceptions of knowledge sharing cultures. *Leadership and Organization Development Journal, 4*(5), 294-301.

Corey, S. M. (1937). Professional attitudes and actual behavior. *Journal of Educational Psychology*, 28, 271-280.

Davenport, T. H. & Prusak, L. (1998). *Working knowledge: How organizations manage what they know.* Boston: Harvard Business School Press.

Fishbein, M., & Ajzen, I. (1975). *Belief, attitude, intention and behavior: an introduction to theory and research. Reading*, MA: Addison-Wesley.

Harder, M. (2008). How do rewards and management styles influence the motivation to share knowledge. Retrieved from www.cbs.dk/smg on April 7th, 2009.

Heaton, L., Bergeron, P., Bertrand-Gastaldy, S. & Mercier, D. (2005). Knowledge moves: A communication perspective. *In The Fifth European Conference on Organizational Knowledge, Learning, and Capabilities* 2004 Innsbruck/Austria. OKLC, Innsbruck.

Hendriks, P. (1999). Why share knowledge? The influence of ICT on the motivation for knowledge sharing. *Knowledge and Process Management,* 6(2), 91-100.

Hislop, D. (2002). Mission impossible? Communicating and sharing knowledge via information technology. *Journal of Information Technology, 17*(4), 165-177.

Kuo, F. & Young, M. (2008). A study of the intention-action gap in knowledge sharing practices. *Journal of the American Society for Information Science and Technology, 59*(8), 1224-1237.

LaPiere, R. (1934). Attitudes versus actions. *Social Force, 13*, 230-237.

Lee, C. K., & Al-Hawamdeh, S. (2002). Factors impacting knowledge sharing. *Journal of Information and Knowledge Management, 1*(1), 49-56.

Lin, H. (2006). Impact of organizational support on organizational intention to facilitate knowledge sharing. *Knowledge Management Research and Practice, 4*, 26-35.

Lu, L., Leung, L., & Koch, P. T. (2006). Managerial knowledge sharing: the role of individual, interpersonal, and organizational factors. *Management and Organization Review*, *2*(1), 15-41.

McDermott, R. (1999). Why information technology inspired but cannot deliver knowledge management. *California Management Review, 41*(4), 103-117.

Nonaka, I. (1994). A dynamic theory of organizational knowledge creation. *Organization Science, 51*, 24-38.

Nonaka, I., & Takeuchi, *H. (*1995). *The knowledge-creating company: How Japanese companies create the dynamics of innovation*, New York: Oxford University Press.

Polanyi, M. (1966). *The tacit knowledge*. London: Routledge and Kegan Paul.

Ryu, S., Ho, S. H. & Han, I. (2003). Knowledge sharing behavior of physicians in hospitals. *Expert Systems with Applications*, *25*, 113-122.

Sheeran, P. (2002). Intention-behavior relations: A conceptual and empirical review. In W. Stroebe & M. Hewstone (Eds.), *European Review of Social Psychology* (vol. 12., pp. 1-30). Chichester: Wiley.

Szulanski, G. (2003). *Sticky knowledge: Barriers to knowing in the firm*. London: SAGE publications.

Tuomi, I. (2000). Data is more than knowledge: Implications of the reversed knowledge hierarchy for knowledge management and organizational memory. *Journal of Management Information Systems 16*(3), 103-117.

Weick, K. E. (1995). *Sensemaking in organizations*. Thousand Oaks: Sage Publications.

Bringing Knowledge to Life: The Role of Story in Knowledge Management

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Abstract

Stories have been passed down for centuries because they can relay both actions and emotions. Fact or fiction, with happy or sad endings—they all carry messages containing tacit knowledge from senders to receivers. In organizations, stories play an intricate part in communicating knowledge because they stimulate dialogue, create context, enhance retention levels, and motivate action. Leaders can integrate them interpersonally, virtually, or in conjunction with one another. Through stories, managers can also encourage employees to form communities of practice to rouse conversation and produce differing viewpoints, and thus, synthesized solutions. When managers effectively use stories, they are implementing better knowledge management practices and creating organizational cultures that respect and promote open lines of communications.

Introduction

Once upon a time…there was story! Storytelling is one of the earliest forms of knowledge transfer. Stories, whether read or heard, can bring life to ideas and create an experience where the audience feels like it is immersed in the emotions of the situation. Tacit knowledge, which is not easily codified, can be better understood through captivating stories. Teachers have used these techniques in their classrooms for years, and organizations are finally catching up. Storytelling is vital to organizational communication because it creates dialogue, and it is through dialogue that people add context to information and construct knowledge. Managers need to integrate stories, both in-person and virtually, to create this dialogue, build community within their organizations, and lead their organizations to innovate. Thanks to one of the world's oldest forms of communication, new life can be breathed into today's modern organization. However, to do so, managers must actively and purposefully take advantage of this tradition.

What Are Knowledge and Knowledge Management? Though some people may use the terms knowledge, information, and data interchangeably, they actually are all very different from one another. Data are simple and raw; they are, for example, the results from an experiment. Information is data taken one step

further; it is organized data. To continue the example, information can be extracted from the results of an experiment put into a formatted spreadsheet. Knowledge, though, is a process that involves interpretation and is derived from the context that each person adds to information. To complete the example, knowledge is the researcher's interpretation of the results from the experiment. Because no two researchers have had the same exact experiences, the results may carry different knowledge to different researchers (Davenport & Prusak, 1998, 2000).

Furthermore, there are two types of knowledge: tacit and explicit. McInerney (2002) explains a simple way to differentiate between the two types. Tacit knowledge is hidden; it is the knowledge that people have internalized, but cannot necessarily document or verbalize. People may be able to demonstrate how to tie their shoes, but they may not be able to explain the process to others. Explicit knowledge can be seen as the artifacts that people have used to attempt to document their tacit knowledge. Because tacit knowledge is internalized, it is harder to transfer from one person to another. In general terms, knowledge management is the process of making this hidden, tacit knowledge available and useable to the rest of the organization.

Part of knowledge management is the spread of ideas between individuals. A community of practice is an informal group with a common interest that strengthens individual knowledge by sharing with one another on a regular basis. These communities of practice help to transfer tacit knowledge because they allow for conversation. Also, because they allow for social interactions, employees engage in building a socially constructed idea of context within which they can better understand their work environment. Because they have this shared community, they can better construct knowledge that they pass between them (Wenger, McDermott, & Snyder, 2002). Communities of practice, though, do not just arise in face-to-face environments. They can be developed virtually through social networking sites, discussion boards, wikis, and blogs. Also, a community of practice does not have to be limited to only one mode of communication. Often a community that began physically can be enhanced virtually, and vice versa. In doing so, communities of practice interact using both synchronous and asynchronous communications to form more bonded relationships. Thus, more socially constructed context arises, which ultimately results in better knowledge transfers (Petter & Vaishnavi, 2008).

What is Story? Stories are "the telling of a happening or connected series of happenings, whether true or fictitious" (Denning, 2004, What are the main types of stories and narrative section). They have been used for centuries to pass on knowledge. One of the oldest examples is the Bible. It does not matter if these biblical stories are fact or fiction; people use them to teach lessons and motivate (Snowden, 1999). The same is true of both oral and written stories that are used in the business world. Listed below are several types of stories that are of particular importance to the transfer of knowledge in businesses:

> **Anecdotes** – These are often short and entertaining accounts of an event. They may include metaphors that allude to the listeners' current

behaviors and aid the listeners in understanding their current behaviors and thus, how they can change them (Denning, 2004).

Springboard Stories – These stories help to show the audiences the bigger picture of changes that are going to occur and give the audiences a better understanding of how to cope with the changes. As their name indicates, they are designed to spring people to action (Denning, 2005).

Anti-Story – These negative stories are created in response to prior organizational stories and are intended to undermine the original stories' morals. An organization must be careful not to spread stories that will elicit an anti-story response from its employees (Snowden, 1999).

Why is Story Important to Knowledge Management? Stories allow for complex ideas to be expressed. They allow the tellers to recount context and intricate details that cannot be accurately described in artifacts like training manuals, which are straightforward and comprised of just basic details. Because stories reveal complex ideas not easily transferred in knowledge artifacts, they are essential tools for transferring tacit knowledge (Stewart, 1998). One way that stories transfer tacit knowledge is through the storytellers' emotions. Orally, storytellers can change their tone, volume, and facial expressions to relay an attitude toward an event. On paper, storytellers can choose choice words that have positive or negative connotations. These emotions suggest to listeners and readers how they should feel about the situation. So without explicitly telling the audience how to feel, the storytellers have made their audiences engage with the story and interpret its moral. Thus, the audience has learned some tacit knowledge through the storytellers' attitudes toward the events that transpired in the stories (Linde, 2001).

Not only does storytelling convey emotions and morals, it also engages the audience, makes them think, and encourages more storytelling. The audience becomes part of the narrative and participates in creating a social construction for it. Effective stories create active audiences who interpret the meaning and create conclusions. These conclusions are not always in agreement with the story, but even a disagreement can make the audience think (Linde, 2001). When an audience engages and reflects, they are much more likely to retain knowledge and use that knowledge in the future. Just being talked at and told that something is right or wrong will not engage an audience. Instead, it frequently causes the audience to disregard or forget what they were told (Colantonio et al., 2008). When effective stories are shared, they take on lives of their own because good stories beg to be retold. They spread through organizations because, by nature, stories are designed to be shared and passed on. Not only can stories continue to be retold, but they can also birth positive counter stories with differing viewpoints. As stories travel through organizations, more people become part of the story, and thus more valuable knowledge learning occurs (Denning, 2007).

Stories are also passed throughout organizations to eliminate corporate amnesia. Corporate amnesia is the idea that once older employees retire, younger

employees will "reinvent the wheel" because they do not know the successes and failures of their predecessors. For example, at the organization English Nature, all new employees are told the same story during training to enforce how they must circulate stories to eliminate the amnesia factor. This government environmental organization attempted to block the buildup of sand at the River Haven in Saltfeet. Their first attempt to fix the problem, which was to straighten the river bend, failed. Years later, after all the people involved with that project retired, the same problem arose. The new employees once again tried to straighten the bend, only to have that attempt fail as well. After the second failing, a retired employee spoke out about how that same course of action had been tried years back. English Nature now often tells this story to its employees to help them remember that straightening the river bend will not work, but also to encourage employees to share these types of anecdotes with one another to increase the overall corporate memory (Donaldson, 2003).

Stories not only capture the organizational memory; they can also inspire employees to work for the organizational good. Effective stories can motivate people to change and take action to move toward company goals (Denning, 2005). These springboard stories often create organizational identities and provide more than just morals of how employees should identify with situations. Often, these stories convey overall company values and reveal company procedures. Because they have narratives and allow the audience to connect to the story, they are much more helpful for relaying company objectives than memos, mission statements, and policy manuals. Audiences do not connect to these uninteresting artifacts, do not retain their content, and are not motivated to take necessary actions to enhance the organizational goals. Leaders who use stories to inspire strengthen their company values because they make their employees believe in those company values (Stewart, 1998).

Through story, people also find common ground and open up to one another. They spark dialogue and make people more comfortable with one another. When meetings begin with stories, "ideas cross-pollinate, rapport increases, and the entire meeting comes to life in a way that naturally and predictably focuses the audience's collective enthusiasm on the business at hand" (Kahan, 2003, p. 1). It is through story that people find commonalities and begin to trust one another. That trust is the basis for knowledge sharing. If employees do not have confidence in one another, they will hoard knowledge from each other. By sharing stories, employees gain trust for one another and begin to expand the lines of communication (Sumner, 2005). A common misconception about trust is that people have to like each other in order to trust one another. That is not true. Actually, an effective working community is composed of differing viewpoints, and though people may not like each other's views, they may still respect these differing view points. As long as they trust one another, they will all continue to share their differing viewpoints, resulting in an environment where ideas can synthesize. Stories open up lines of communication to allow for collaboration and better-formed ideas (Kahan, 2003).

Group storytelling is another way to share and blend ideas. Often, groups use storytelling to recount a project that they worked on together. When only one

person recounts the events, she or he may forget steps that occurred. This single voice also ignores the fact that there were multiple viewpoints (Perret, Borges, & Santoro, 2004). When groups work together to describe what happened, the audience gets a better picture of why the groups made the decisions that they did. Also, one person's memory may trigger another memory for someone else. Group members bounce off each other and can "jump in with additions, questions, corrections, comments, and protests" (Acosta et al., 2004, p. 134). Because ideas bounce around, the process of group storytelling is not linear, but follows the stream of consciousness in which the group engages (Snowden, 1999). These group storytelling sessions reveal knowledge that otherwise would not have been remembered, recounted, and passed on to other employees. In other words, by eliciting the story from different members of the group, all members, instead of just one person, reveal their tacit knowledge (Perret et al., 2004).

Not all stories have happy endings, though. These are the stories that people are much less inclined to share. People tend to keep these stories quiet so that others cannot see the mistakes they made, but it is often stories about mistakes that are the most beneficial to other employees. Stories about successes just reinforce the same habits, and other employees do not learn anything new. Often storytellers do not even realize the elements of luck that influenced the positive results in their stories. By circulating anecdotes about lucky situations, employees are actually doing damage to corporate learning. Stories about failures not only help everyone to learn what not to do, but also encourage employees to develop new ways to react in similar situations. Managers must create an environment where employees feel safe revealing stories about mistakes. Otherwise, valuable lessons will be lost to the entire organization.

How Can Leaders Integrate Story into Knowledge Management? All types of stories need to be integrated into organizational culture, not just the positive or the negative ones. Managers can weave stories into company culture in several different ways. First, they can encourage all meetings to start with a story swap session. In this way, employees begin in a comfortable atmosphere and can keep abreast on the experiences of coworkers they do not come into contact with on a daily basis. Managers can even call meetings with the intention of just sharing work "war stories." These formal meetings would show employees that management encourages dialogue between employees and shows that they value the sharing of tacit knowledge, whether it is positive or negative (Petter & Vaishnavi, 2008). Another tactic to encourage the sharing of war stories is to remove the employees from the work atmosphere. Managers can take employees to a coffee shop, restaurant, or even a bar. Because they are removed from their stuffy offices, employees feel less inhibited and are more willing to share anecdotes about the workplace. This technique is not sneaky as long as employees are told the purpose of the chats and that they will be monitored (Donaldson, 2003). Overall, these face-to-face techniques encourage dialogue between employees and communities of practice to form. They also create an open environment that is receptive to stories and the knowledge they carry.

Communities of practice can also be created virtually. Virtual communities can be anonymous or identify users. Anonymity adds a level of security for many people. They feel safe sharing stories that they would otherwise feel uncomfortable sharing in person. Often, the stories they feel more comfortable revealing in virtual communities are the negative, poorly ending stories. Some people do not need the cover of anonymity to feel more comfortable in virtual environments. Even if they have to identify themselves, just the lack of face-to-face interactions causes them to take on different personas then they would in person (Snowden, 2000). To further make employees comfortable in online environments, managers can implement social networking technology. Facebook users have shown that people are willing to divulge personal information about themselves online, and employees may be willing to participate in a similar format on closed intranets in order to get to know one another better and build more open relationships (Denning, 2007). Managers need to tread carefully in online communities of practice, though. When employees feel too comfortable, they sometimes create malicious anti-stories that counter affect the constructive knowledge sharing. Managers need to find the healthy medium (Snowden, 2000).

Overall, online communities of practice are a great tool to encourage knowledge transfers, and mangers can create these e-sharing communities quite cost-effectively through blogs. Blogs can easily be accessible companywide. Because they are companywide, employees that normally do not engage in conversation have the opportunity to work collaboratively and swap stories. By commenting on each other's blogs, employees can become more social with one another (Gordon, 2006). In addition, employees can be encouraged to read each other's blogs before going to meetings, especially meetings with employees whom they do not normally interact with. Blog narratives reveal their writers' personalities and allow readers to virtually get to know each other. If all employees had to read each other's blogs, then at meetings they would be more familiar and trustful with each other and achieve more success (Ives & Wallington, 2005). Another advantage to blogs is that they create a place for employees to relay their expertise to one another. Future problems could be solved faster because employees would be more familiar with each other's talents and thus know whom to contact for solutions to particular problems (Ives & Wallington, 2005).

Company wide wiki databases are another way to cost effectively introduce story to an organization and create virtual communities of practice. Managers can implement best practice wikis where employees create stories of how they either positively or negatively executed projects. These wikis can be searchable and hyperlinked to other best practice narratives. Because employees will have the ability to edit pages, they can create new narratives that tell more than one view of the story and transfer more tacit knowledge (Petter & Vaishnavi, 2008). Both blogs and wikis encourage dialogue as users can respond to one another and generate new knowledge from the discourse. However, if no one uses them, they are useless. Managers have to encourage their use. For example, Mike Roberts, the former CEO of McDonald's USA, maintained a blog that employees could comment on. It encouraged dialogue, but also showed that knowledge

sharing was not just for his employees. Managers have to set the example and demonstrate that knowledge sharing starts at the top (Reid & Gray, 2007).

Another way that managers can take advantage of technology to share stories is through storytelling software. Storytelling software allows participants to asynchronously piece together stories. Like with the virtual communities of practice, the lack of face-to-face interaction opens people up and allows them a safe way to share comments that they would have otherwise kept to themselves. These systems provide maps that employees can link ideas to. Like in face-to-face group storytelling sessions, these virtual stories do not run linear. Group members can branch off from whichever point in the story they choose to. The non-linear stories are conceptual maps that provide visual images (for example, directional arrows) to the stories' progressions. Managers choose these types of systems because it is easier to view where disagreements within the story occurred. For example, two employees can branch off at the same point in the story and the reader can easily tell that there were two opinions that were taken into consideration. Also, through the use of visual images, storytelling software increases the memories of both those telling the stories and those learning from them. These virtual systems, though asynchronous, still encourage dialogue, and it is through the dialogues that contexts are created (Acosta et al., 2004).

Interactive drama is another way to convey valuable stories because it intensifies the level of engagement that the audience has with the stories. Managers can arrange for actors to attend training sessions and perform a typical meeting at the company. Prior to the demonstration, managers can provide the actors with descriptions about particular employees they are supposed to mimic. By watching the story evolve in front of them, employees are participants not just because they are interpreting the story, but also because they can recognize each other in the role-play. This situation "creates a window through which they can examine their own organization and the behaviors around them – again with a view to developing ways to change those behaviors to achieve better results" (Steed, 2005, p. 48). After the completion of the drama, a discussion can ensue based on what the employees learned about each other and themselves. Interacting with story through drama creates dialogue through which employees can open communication lines and build better trust (Tromski & Doston, 2005). Managers can also implement role-playing and interactive drama virtually. Virtual role-play systems allow employees to move through specific company situations and make decisions on how to proceed through them. Each decision they make changes the story in which they are interacting. Because employees learn from both positive and negative outcomes, tacit knowledge learning occurs. Employees are then able to integrate these lessons into their everyday work environment (Wagner, 1997).

Conclusions

Storytelling is an incredibly useful tool for managers to motivate their employees. Managers can pass springboard stories throughout their organizations and encourage workers to make the necessary changes for the organizational cultures. Stories are also potent devices to facilitate knowledge transfers. Because stories

carry meaning, it is easier to transfer tacit knowledge through them. By nature, stories create dialogue and differing opinions. In these dialogues, contexts are explored, knowledge is understood, and new knowledge is created. Not enough managers take advantage of story, though. The power of story is too valuable to ignore, and leaders should look for ways to integrate stories into their organizational culture.

References

Acosta, C. E., Collazos, C. A., Guerrero, L. A., Pino, J. A., Neyem, A., & Motelet, O. (2004). StoryMapper: A multimedia tool to externalize knowledge. *Proceedings of the XXIV International Conference of the Chilean Computer Science Society,* 133-40.

Colantonio, A., Kontos, P.C., Gilbert, J.E., Rossiter, K., Gray, J., & Keightley, M.L. (2008). After the crash: Research-based theater for knowledge transfer. *Journal of Continuing Education in the Health Professions, 28*(3), 180-85.

Davenport, T. H. & Prusak, L. (1998, 2000). *Working knowledge: How organizations manage what they know.* Boston: Harvard Business School Press.

Denning, S. (2004). What are the main types of stories and narratives? www.stevedenning.com. Retrieved April 26, 2009, from http://www.stevedenning.com/Main_types_story.html.

Denning, S. (2005, Oct.). Mastering the discipline of business narrative. Strategy & Leadership. Retrieved April 26, 2009, from http://www.stevedenning.com/slides/MasteringBusinessNarrative-Final-Oct2-05.pdf

Denning, S. (2007). *The secret language of leadership: How leaders inspire action through narrative.* San Francisco: Jossey-Bass.

Donaldson, R. (2003, Jul/Aug). Using storytelling to connect with stakeholders at English Nature. *KM Review, 6*(3), 3.

Gordon, C. (2006, June). Wikis–a disruptive innovation. *KMWorld, 15*(6), 1, 26.

Ives, B. & Wallington, A. (2005). Using blogs for personal KM and community building. *Knowledge Management Review, 8*(3), 12-15.

Kahan, S. (2003). Jumpstart storytelling: Accelerating high performance in meetings. www.SethKahan.com. Retrieved April 26, 2009, from http://www.storyatwork.com/documents/JumpStart_Storytelling_Seth_Kahan.pdf.

Linde, C. (2001). Narrative and social tacit knowledge. *Journal of Knowledge Management, 5*(2), 160-70.

McInerney, C. (2002). Knowledge management and the dynamic nature of knowledge. *Journal of the American Society for Information Science & Technology, 53*(12), 1009-1018.

Perret, R., Borges, M. R. S., Santoro, F. M. (2004). Applying group storytelling in knowledge management. *CRIWG 2004, LNCS 3198*, 34-41.

Petter, S. & Vaishnavi, V. (2008). Facilitating experience reuse among software project managers. *Information Sciences, 178,* 1783-1802.

Reid, M. & Gray, C. (2007, October). Online social networks, virtual communities, enterprises, and information professionals: Part 2. Stories. *Searcher, 15*(9), 23-31, 33.

Snowden, D. (1999, March). Story telling: An old skill in a new context. *Business Information Review, 16*(1), 30–37.

Snowden, D. (2000, Sept.). The art and science of story or "Are you sitting uncomfortably?": Part 1: Gathering and harvesting the raw material. *Business Information Review, 17*(3), 147-56.

Steed, R. (2005). The play's the thing: Using interactive drama in leadership development. *Journal of Business Strategy, 26*(5), 48-52.

Stewart, T. A. (1998, Sept. 7). The cunning plots of leadership. *Fortune, 138*(5), 165-66.

Sumner, J. (2005, Jul/Aug). Storytelling puts knowledge in context. *KM Review, 8*(3), 2.

Tromski, D. & Doston, G. (2003). Interactive drama: a method for experiential multicultural training. *Journal of Multicultural Counseling and Development, 31,* 52-62.

Wagner, C. (1997). Learning through role play software: A feasible approach to professional education? *Wirtschaftinformatik, 39*(6), 547-53.

Wenger, E., McDermott, R., & Snyder, W. M. (2002). *A guide to managing knowledge: Cultivating communities of practice*. Boston: Harvard Business School Press.

The Politics and Ethics of Knowledge Management

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Abstract

This paper provides a focused discussion of knowledge management (KM) literature and views it through several lenses. Using Noel Tichy's (1983) "strategic rope" change management model with its interwoven technical, political, and cultural strands as a conceptual framework for KM theory and practice, this paper suggests that the literature of KM needs to reflect all of these aspects. A brief review of the KM literature, including other writers' research, and a study of keyword searches in WorldCat OCLC indicated that the KM literature was disproportionately weighted in favor of KM as a technology, and that the political and cultural aspects—particularly the ethical aspects—of KM received relatively little coverage. Similarly, a focus on KM literature from the perspective of management outweighed 'other voices' or perspectives from the knowledge workers, i.e., "the knower." The paper calls for future research and scholarly publications on the politics, culture, ethics, and language of KM. It also issues a 'clarion call' for the KM profession to collaboratively develop and promulgate a code of ethics for the KM profession.

Introduction

Background and Purpose. Nearing completion of my first course on knowledge management, I found that I had many questions about KM as well as some concerns. The introductory textbook literature on knowledge management (KM) I reviewed seemed to deal extensively with the technology of KM—definitions, models, 'how-to' toolkits, lessons learned, 'best practices,' challenges of, and barriers to, implementing KM and how to overcome them, and benefits to the organizations that implement a KM initiative. Prior to deciding on a research question, I did a brief sampling of approximately 20 books of the type that could be used in an introductory KM class or by a KM professional/practitioner. I reviewed the table of contents and index for keywords such as "power," "political relations/relationships," "ethics," "core values," and "code of ethics."

While some of these topics, and in particular organizational culture and trust, were well covered with respect to organizations, I found it much more difficult to find discussions of these topics with respect to KM itself—as a discipline, profession, and strategic change management model. The KM literature I scanned appeared to reflect a technological perspective, with an emphasis on

models and processes. As one who believes that no technology is neutral and that, in the context of KM, technology can have both positive and negative impacts on 'the knower,' I decided to explore how well the KM literature addresses important aspects such as KM politics, culture, and ethics.

This paper provides an exploration of knowledge management (KM) and views it through several lenses. Its conceptual framework presents KM as an organizational or strategic change management model, which, following Tichy's (1983) approach comprises technical, political, and cultural dimensions and dynamics. It argues that extant KM literature is heavily weighted towards the technological or process aspects of KM, with comparatively little attention being paid to KM's political or cultural aspects. It also typically views KM from the perspective of management, with comparatively less focus on knowledge workers' perspectives. While some KM literature speaks of the need for organizations to address their own organizational culture, KM does not appear to have shone a very bright reflective light on itself, either as a discipline or as a profession. Because of this, the core values, ethical considerations, and power relationships intrinsic to KM, as a technology, have not been addressed in the literature in as specific a manner as found in related disciplines and professions such as Organization Development and Library and Information Science.

This paper focuses broadly on the politics and ethics of KM and also takes a brief look at its implied culture and values by focusing on its language, as articulated in the KM literature, as one indicator of culture and values. The intention of this paper is to add to the conversation about the politics and ethics of KM and to suggest some areas for future KM research, as well as to offer several ways through which some of the KM issues discussed may be usefully addressed.

Key Research Questions

While I considered several research questions related to the politics and ethics of KM, I decided to focus on the following questions: (1) to what extent does knowledge management, as a profession and a discipline, pay attention—as explicitly articulated in its literature and on relevant websites—to issues of politics/political relationships and ethics/values/culture within KM as an organizational/strategic change management model? And, (2) is this attention sufficient? While recognizing that these questions cannot be answered quantitatively in this paper, I nevertheless would like to use this approach as a starting point for my discussion.

I will not be providing a discussion of the various definitions of knowledge management or whether knowledge can, in fact, be managed. While some authors such as Steve Fuller (2002, p. 2) and Alexander Styhre (2003) believe that 'knowledge management' is an "oxymoron" (p. 25), I will, nevertheless, provide the following working definition for the purposes of this paper:

> Knowledge management is the deliberate and systematic coordination of an organization's people, technology, processes, and organizational structure in order to add value through reuse

> and innovation…through creating, sharing, and applying knowledge as well as through feeding the valuable lessons learned and best practices into corporate memory in order to foster continued organizational learning (Dalkir, 2005, p. 3).

Conceptual Framework

I am starting with the assumption that knowledge management is a type of organizational or strategic change management model. It shares many of the key objectives (although not necessarily the same approaches) of other organizational development/change models, namely, improving organizational performance, effectiveness, efficiency, and 'bottom line' profits. While there are many change models in the literature, I have selected Tichy's (1983) conceptual framework through which to examine knowledge management, since it is both easy to understand and, in my view, compelling. It is also easy to transfer the framework to the field of knowledge management. Briefly, Tichy (1983) indicates that "three dominant traditions have guided thinking about organizations and the practice of change" (p. 7). The first tradition is "the technical view [which, as Argyris and Schon (1978)] point out…is instrumental and rational…the focus is upon the acquisition and application of the knowledge useful for effective performance of organizational tasks, and the organizational world is conceived as fundamentally knowable through scientific method (p. 323)" (as cited by Tichy, 1983, p. 7). A second tradition is the political view, which sees organizations as "political entities that can only be changed by the exercise of power by the dominant group over those with less power or by bargaining among powerful groups" (p. 7). The third tradition is the cultural view, which sees organizations as "cultural systems of values with shared symbols and shared cognitive schemes which tie people together and form a common organizational culture. Change comes about by altering the norms and cognitive schemes of the members of the organization" (p. 7).

Tichy brings together these three traditions in his approach to viewing organizations and uses the metaphor of the "strategic rope," which has the three strands interwoven so that "individual strands are not distinguishable" and "it is not clear from casual observation what is technical, what is political [and] what is cultural" (p. 10). KM, if it is to be an effective organizational/strategic change management model, needs to pay attention to all of these aspects and this multiple focus should be reflected in the KM literature, also.

Data and Methodology

To help determine my research questions, I scanned approximately 20 books that appeared to be the type of books that either could be used in an introductory KM class or by a KM professional/practitioner. This was determined based on bibliographic information, tables of contents, and indexes of the KM books in a research university's library. A more in-depth review was conducted on a few selected books. After my research questions were determined, I conducted a keyword search on April 19, 2009, on WorldCat OCLC (books and other materials

contained in libraries worldwide) using keyword combinations of (a) "knowledge management," or (b) "knowledge worker" and: (1) "technology"; (2) "process"; (3) "data mining"; (4) "extraction"; (5) "intellectual capital"; (6) "intellectual property"; (7)"politics"; (8)"power"; (9)"power relations"; (10)"organizational power"; (11)"ethics"; (12)"values"; (13) "culture"; (14)"organizational culture"; (15) "code of conduct"; (16) "business ethics"; (17) "organizational learning"; (18) "organization development"; (19) "library and information science"; (20) "information science"; (21) "organizational change"; and (22) "change management." The results of this study will be highlighted below. Complete data are contained in the appendix.

I also reviewed several web sites that indicated that their organization was in some way related to the KM profession. A review of academic institutions providing courses on KM or their KM curricula was not conducted, although this would be an area for future research. Since this study is very limited, I will also include the research findings of other writers who have conducted more extensive studies of the KM literature in regard to, for example, the extent to which attention is paid to political and cultural aspects of KM in the literature. More detailed research along these lines could also be an important addition to the KM literature.

Discussion

KM as a Technology. In 1997, Yogesh Malhotra commented on the literature on IT-enabled knowledge management in scholarly research as well as in the trade press. He noted that various authors in the literature "specify the *minutiae of machinery* while disregarding how people in organizations actually go about acquiring, sharing and creating new knowledge (Davenport 1994)…[and] ignore the human dimension of organizational knowledge creation" (Malhotra, 1997, pp. 293-295).

Since then, the KM literature seems to have partially addressed some of these issues, through, for example, some elaborate and detailed models (Dalkir, 2005; Firestone & McElroy, 2003; McElroy, 2003; Tiwana, 2002), but the question still remains as to whether the KM literature has really come to terms with KM's own political and cultural dimensions. A related question is whether the KM literature pays sufficient attention to 'the knower' as a 'subject' (i.e., from the perspective of the knowledge worker as a human being) rather than just as an object within a technology. Steve Fuller (2002) notes that "the KM literature tends to treat knowledge workers as if they were conveyors of precious metals that management then needs to extract from their less than precious bodies…[and in] terms of the factors of production, knowledge workers appear more as raw materials than labor" (p. 10).

Alexander Styhre, in his 2003 critique of KM and its literature, which he notes as being informed by "critical and postmodern theory," suggests that the KM literature still appears (as of 2003) to be weighted in favor of a technology-oriented approach. Styhre cites Fahey and Prusak (1998), who have argued that "a lot of knowledge management literature takes an 'information technology approach' to knowledge" (p. 22). He indicates that there are differing views as to what KM

literature has focused on, noting that while Fahey and Prusak suggest that "[t]o date, a lot of knowledge management literature has been occupied with codified knowledge and…information and data" (p. 23), "more recent knowledge management literature argues that knowledge is imbued with routines, standard operating and the day-to-day practices of the organization (Feldman, 2000; Pentland & Rueter, 1994)" (Styhre, 2003, p. 23). These topics fit within the realm of what I consider to be 'the technology of KM,' and serve to support my argument that the KM literature is still heavily weighted towards KM as a technology.

Highlights of a Study of Keyword Searches in WorldCat OCLC

My study on April 19, 2009 of relevant keyword searches in WorldCat OCLC confirmed the results of my initial scan of KM literature and supports the argument that KM literature is weighted in favor of technology and processes. For example, a keyword search of "knowledge management" and "technology" found **6,174** (English: **5,869**) records. A search of "knowledge management" and "process" found **3,253** (English: **3,112**) records. A search of "knowledge management" and (1) "politics" found only **468** (English: **447**) records, while a search replacing "politics" with "power" found **1,119** (English: **1,085**) records, and a search replacing "politics" with "power relations" found **117** (English: **115**) records. A search using the keywords "knowledge management" and "ethics" found **502** (English: **499**) records, while replacing "ethics" with "values" resulted in **643** (English: **620**) records, and replacing "ethics" with "culture" resulted in **1,207** (English: **1,139**) records

Similar searches replacing "knowledge management" with "knowledge workers" and the same second keyword(s) previously noted resulted in even fewer records, respectively (OCLC, 2009). While the use of keyword searches is not conclusive evidence of the contents of the materials reviewed, they can provide some useful 'flags' that suggest the need for further research to help explain those findings and also help frame research questions. For the complete data compiled in this study, see the Appendix.

Both the findings of my study and the research of the authors cited seem to support my view that the first tradition mentioned by Tichy, namely, the technical view, is still the predominant view of knowledge management—as a profession and as a discipline—as made 'explicit' in the literature. Further, I would hypothesize that this explicit knowledge of KM reflects the underlying 'tacit' knowledge and perspective of the main designers and spokespersons of KM. This is not to say that the KM literature does not mention the need for organizations to focus on organizational culture, also, but rather that, by putting the responsibility on organizations to sort out and deal with their own political and cultural dimensions, KM conveniently is able to absolve itself of dealing with these aspects which are intrinsic—as in Tichy's strategic rope—to KM itself.

KM as a Political Entity

Politics can be defined in several ways, including: "the art or science concerned with winning and holding control over a government," or, in the case of business,

"competition between competing interest groups or individuals for power and leadership" (Merriam-Webster, 2009c). Merriam-Webster's definition of "power politics" has implications for ethical considerations since power politics are "based primarily on the use of power (as military and economic strength) as a coercive force rather than on ethical precepts" (Merriam-Webster, 2009d). While politics is about power, an ethical framework can be used as a counterbalance to power, or at least as a way to help mitigate some of the potentially negative impacts of power.

In the case of KM, politics is about organizational power—who wields it, what the impact is, and who is affected (positively and negatively). As Tichy (1983) points out, the political dimension in organizations is interwoven with its technical and cultural aspects. I would argue that knowledge management is a highly political activity since it directly impacts the power relationships in organizations, in part by attempting to 'capture' and 'extract' employee knowledge to provide benefits largely (but not solely) to the employer and management.

While this statement by McKenzie and van Winkelen (2004) is made in connection with diversity and alignment issues in organizations, it also applies to KM as a change strategy related to innovation: "Power imbalances inevitably emerge within any human system…Decisions relating to innovation in processes may be particularly problematic because they almost invariably threaten the status quo: innovation is 'an inherently political activity'" (p. 84). In addition, as Alvesson (2004) indicates, "knowledge development is dependent on social interaction and on broad areas of contact with knowledgeable others" (p. 98). Thus, collaborative knowledge creation and exchange necessarily involve social relations and human interaction, regardless of what technologies may or may not be utilized.

The need to pay attention to KM as a political system is also supported by Mintzberg (1983), who discusses a theory of organizational power. Mintzberg's main premise is that "organizational behavior is a power game in which various players, called *influencers*, seek to control the organization's decisions and actions" (p. 22). If one accepts Mintzberg's statement, KM processes and 'players' are thus inherently political.

Others, such as Morgan (1986), have written about organizations as political systems, and how an organization exhibits one or more "modes of political rule" such as: autocracy; bureaucracy; technocracy; codetermination; representative democracy; and direct democracy (p. 145). Although a discussion of this topic is beyond the scope of this paper, it would be interesting to examine KM in terms of these and other political 'types.'

Styhre (2003) appears to be one of the few writers who have addressed the lack of attention to issues of power in what he calls "mainstream knowledge management theory" (p. 8), stating that "knowledge management literature has shown very little interest in the relationship between knowledge and power" (p. 94). In his critique of KM literature, which is "informed by critical and postmodern theory" (p. 11), he notes that "the pioneers have the prerogative of defining concepts and setting the research agenda" (p. 7). He further argues that "mainstream knowledge management theory" has shown its "ignorance of the ontological, epistemological and…political qualities of knowledge" and that

mainstream KM theorists "tend to conceive of and write about knowledge as if it were some kind of commodity that could easily be applied to cases…[and that] knowledge is regarded as some kind of monetary entity that can be exchanged into different currencies and translated and modified easily" (p. 8).

I concur with Styhre's view that "the insistence on knowledge as a key organizational resource among mainstream knowledge management theorists certainly demands some more elaborated thinking in terms of the qualities and potentials regarding 'knowledge' and 'management' than the one offered in the mainstream knowledge management literature" (p. 10).

In his chapter on "Knowledge, Power and the Power of Knowledge," Styhre provides a brief overview of classic theories of power and then details postmodern perspectives on power, citing the analyses of power by Michel Foucault and Paul Virilio (pp. 83-96). Importantly, he indicates that the "postmodern association between knowledge and power…emphasizes the immanent power in knowledge…[and that the] postmodern analysis of knowledge, in terms of power…brings knowledge back down from the heights of abstraction and idealization" (p. 96).

Styhre's work is a rich example of the type of analysis needed in the KM literature to directly address the political or power dimensions of KM, regardless of what the politics or culture of any given organization implementing KM may be. Again, while it is beyond the scope of this paper to do a more detailed examination of KM itself as a political system, based on KM's built-in power structures, social relationships, and culture, this seems to be another interesting and important area for future research.

KM as a Culture

In my discussion of KM culture I will focus on values, ethics, and language. Culture can be defined as:

> "the integrated pattern of human knowledge, belief, and behavior that depends upon the capacity for learning and transmitting knowledge to succeeding generations…shared by people in a place or time…the set of shared attitudes, values, goals, and practices that characterizes an institution or organization…the set of values, conventions, or social practices associated with a particular field, activity, or societal characteristic" (Merriam-Webster, 2009a).

A culture can be observed through its explicit artifacts, such as behaviors, which reflect the underlying shared values and norms. A culture can also be observed through its language, its selection of words to represent what it is and what is important to it. However, culture, such as organizational culture, can also be 'tacit' or non-explicit. This is evident to new employees who, not knowing what the culture is, learn by observation and/or are 'taught' by other employees the organizational culture that exists beyond the written policies and official documents (that is, "how we really do things around here").

While an organization's values may be made explicit via, for example, a code of conduct, they may very well be 'hidden' from immediate view, i.e., their values would be 'tacit' knowledge in the mind of the organization if it were a person. However, values are as we know very powerful and provide the guiding principles for an organization and many of the behaviors of its employee at all levels.

I would suggest that just as organizations can have cultures, organizational/strategic change management models, such as KM, also have a 'culture' or 'cultures.' This culture may be made explicit in documents such as KM literature or an ethical code for the profession, or it may be 'tacit,'—that is to say, implicit and even hidden from casual view. Using an "iceberg" model (Center for Intercultural Learning, 2009) to describe KM, the explicit information and knowledge about KM culture, as articulated in KM literature and on KM websites, are 'above the surface' of the KM model's 'waters' and visible to all; while an implicit, undocumented, but influential culture, including values and ethics, lies below the surface, guiding both KM theory and practice, but with a much less visible 'hand.' Thus, when KM's culture or cultures, including its underlying values and ethics, are not directly addressed in the literature and by the profession, these remain 'hidden' and less open to scrutiny and challenge.

Ethics of Knowledge Management

Ethics can be defined as "the discipline dealing with what is good and bad and with moral duty and obligation… a set of moral principles**:** a theory or system of moral values… the principles of conduct governing an individual or a group…a guiding philosophy… a consciousness of moral importance" (Merriam-Webster, 2009b).

If one recalls Tichy's interwoven strands, it is clear that politics and culture are tightly woven together and that they both are also interwoven with the technical dimensions of KM. If one accepts the premise that KM is inherently political, the need for a strong ethical stance on the part of all those engaged in KM—as a counterbalance to that power—is clear. Land, Amjad and Nolas (2007) refer to ethical issues in knowledge management as "the underlying motives for the introduction of KM systems, the way they are actually used and the impact of their use on individuals, the organization, and society" (p. 1).

While it is essential that an organization's management and employees have a strong ethical orientation and adhere to a corporate code of ethics, if KM does, as I suggest, come with its own (largely) unwritten values and ethics, it is all the more vital that these values and ethics be codified so as to be visible. This not only allows for better alignment of KM values and ethics with an organization's culture but can also, hopefully, help fill a void in organizations without a written code of ethics and serve to highlight any corporate behaviors that may be contrary to KM's ethical code and values.

It is therefore extremely important that the KM literature (particularly introductory 'textbook' materials), academic curricula, and professional associations directly and explicitly address matters related to KM's values, ethics, and culture. Yet, as Land, Amjad, and Nolas (2007) indicate, "there has been

relatively little discussion on the ethical issues, despite its relevance to KM systems and the interaction of actors, processes, and technology in all aspects of KM from design to actual use" (p. 1). Dalkir's (2005) *Knowledge Management in Theory and Practice* provides a fairly comprehensive introduction to the topic of KM and yet devotes only four pages to a discussion of ethics (pp. 297-300) and notes that "[w]hat is needed is a KM code of ethics to help govern the professional practice of knowledge management work" (p. 299).

Related professions such as Organization Development and Library and Information Science, which 'come with' their own clearly defined and articulated set of 'core values' and 'Code of Ethics,' can provide suitable models or at least starting points for discussion. For example, the OD Network, a key international professional association for Organization Development professionals, has its "Organization and Human Systems Development Credo" displayed prominently on its website (OD Network, 2009). The website states that this 1996 "Statement and Credo have always been intended as 'working documents' of professional beliefs, values and ethical guidelines." The Credo includes a statement on OD professionals' purpose, namely:

> "to facilitate processes by which human beings and human systems live and work together for their mutual benefit and mutual well-being" and indicates that the OD "practice is based on a widely shared learning and discovery process dedicated to a vision of people living meaningful, productive, good lives in ways that simultaneously serve them, their organizations, their communities, their societies, and the world" (OD Network, 2009).

Similarly, the American Library Association has a "Code of Ethics," the 70th anniversary of which was celebrated in 2009. As stated on the ALA website, ALA members "recognize the importance of codifying and making known to the profession and to the general public the ethical principles that guide the work of librarians, other professionals providing information services, library trustees and library staffs" (American Library Association, 2009). The issue of ethics and the ALA's Code of Ethics was covered in at least one course within Wayne State University's Master in Library and Information Science program, and the Code of Ethics appears in more than one introductory textbook (Rubin, 2004; Greer, Grover, & Fowler, 2007).

Knowledge management is, as noted by several writers (Dalkir, 2005; Lehaney, Clarke, Coakes, & Jack, 2004; Wallace, 2007), relatively new and still evolving. While much of the KM literature to date appears to have focused on KM technologies and processes, there is still ample opportunity for the discipline and the profession to shift its attention to issues such as ethics and the development of a code of ethics for the profession. The Organization Development and Library and Information Science professions both provide good potential models for the KM profession to utilize.

Language of Knowledge Management

Language, I would argue, is a very telling, explicit artifact of culture, which includes values and ethics. While it is beyond the scope of this paper to 'study' the language of KM in a comprehensive or systematic way, it is interesting to note the 'flavor' of some of the key terms used in KM, such as "data mining," "extraction," and "knowledge hoarding." What do these sorts of terms tell us about the predominant roots of KM and the philosophy, ethics, and culture of KM? Clearly, "data mining" and "extraction" suggest an engineering and/or science perspective, while "intellectual capital" clearly places KM within a business/profit-oriented framework. The term "knowledge hoarding," is, I suggest, quite offensive at one level since, it could be argued, it suggests that a knowledge worker who chooses not to share information and/or knowledge is somehow 'guilty' of keeping knowledge that rightfully belongs to the organization.

With respect to KM terminology, some of the findings of the aforementioned study of keyword searches are quite revealing. Combining "knowledge management" with other keywords that reflect the technological orientation (and, I would argue, culture) of KM such as "data mining" and "extraction" resulted in **649** (English: **631**) records, and **155** (English: **153**) records, respectively. In addition, a search of the keywords "knowledge management" and "intellectual capital" found **786** (English: **693**) records, while a search of "knowledge management" and "intellectual property" (which could be considered as being related to 'ethics' and knowledge worker rights) found only **295** (English: **279**) records. In addition, a keyword search of "knowledge workers" and "intellectual capital" found only **115** (English: **91**) records, and a search of "knowledge workers" and "intellectual property" found only **16** records (OCLC, 2009). This latter search may suggest a lack of attention in the KM literature to knowledge workers as 'subjects,' as well as to their personal (as opposed to organizational) intellectual property rights. Future research on the language of KM would be a welcome addition to the literature, and perhaps a much needed wake-up call for the KM profession.

KM Professional Associations and Ethics/Core Values.

So, what exactly are the core values of KM? Where can a 'Code of Ethics' for the KM profession be found? Having read two introductory textbooks in depth (Dalkir, 2005 and Wallace, 2007), having scanned a number of 'how-to' books on the topic, and having reviewed several websites of professional associations with a focus on KM, the short answer is that I do not know—which is a telling comment in itself. As previously mentioned, unlike the American Library Association or the Organization Development Network, both professional organizations in their respective fields, knowledge management has no 'governing' professional body to provide guidance on KM's core values.

As Wallace (2007) notes, KM, as "an emerging field…is naturally lacking in form and structure" (p. 219), and "[k]nowledge management as a field or discipline does not appear to have found a secure, consolidated home in a professional association" (p. 222). However, some of the professional associations

that include a focus on KM are: the Singapore-based iKMS; the International Knowledge Management Institute (KM Institute); and the Knowledge Management Professional Society (KMPro), which "claims more than 120,000 members in 88 nations" (Wallace, 2007, p. 222). While neither the Academy of Management nor the American Management Association have a unit focused on KM, the American Society for Information Science & Technology, the Aslib Knowledge and Information Management Network (KIMNET), and the International Federation of Library Association include KM units (Wallace, 2007, pp. 222-223).

While there may be additional professional KM associations, a review on April 20, 2009 of the websites mentioned by Wallace (2007, pp. 222-223) revealed the following:

- iKMS: no evidence of a Code of Ethics for KM professionals/members on the public, i.e., non-member web pages (Information & Knowledge Management Society, 2009)

- International Knowledge Management Institute (KM Institute): no evidence of a Code of Ethics for KM professionals (International Knowledge Management Institute, 2009)

- Knowledge Management Professional Society (KMPro): no evidence of a Code of Ethics for KM professionals/members on the public (i.e., non-member web pages); however, the Knowledge Management Professional Society (KMPro) states that "we are an industry authority and our members are experts in the KM field. As the world's largest KM professional society, one of our roles is to initiate, establish, evaluate, maintain and administer professional credentialing programs that promote and support knowledge management professionals and the knowledge management profession" (Knowledge Management Professional Society, 2009).

In addition, regarding the KMCI (KMCI, 2009), an international professional association of knowledge management practitioners which also provides training and certificate programs in knowledge and information management, Dalkir (2005) indicates that "a great deal of work is being done …[on ethics] by the KMCI" (p. 299). However, a review of this website on March 23, 2009 failed to find anything approaching 'core values' for KM or a Code of Ethics for the profession. One article on the website by its co-director, Mark W. McElroy, entitled "Business Ethics, Risk Management, and the Open Enterprise" (2004), dealt with ethical issues within corporations but not within the KM profession itself.

Yet the need to ensure a strong ethical foundation within the KM profession is not only a moral issue, but also sound business practice. As Evans (c2007) notes, "[t]here is a growing body of knowledge to indicate that organizations that act in a socially responsible manner, following high ethical standards will in the long-run outlast and outperform companies that pursue profits

at all costs. This connection between value and ethics has been around for a long-time, but several studies have confirmed it" (first paragraph). The ethics-related corporate scandals of companies such as Enron, Arthur Andersen, Worldcom (Neef, 2003), Halliburton, and Adelphia Communications (Patsuris, 2008), and—more recently—of various major banks and mortgage companies, suggest that there is truth in this statement and again show the need for strong corporate ethics, including enforcement of ethical codes. A strong ethical stance on the part of KM professionals and consultants may not be sufficient to ensure an organization's ethical behavior, but it is an important ingredient in any KM initiative nonetheless.

This is not to suggest that KM professionals are not interested in ethical issues related to KM. At least one paper, entitled *Philosophy and Ethics in Knowledge Management* (Sheffield & Mason, 2007) was presented at the 40th Annual Hawaii International Conference on System Sciences in 2007. In addition, at least one conference is scheduled in 2009 on this very topic. The theme of the 2009 National Knowledge Management Conference, held at Pepperdine University, is "The Intersection of Ethics and Knowledge Management." The conference will cover topics such as: Social, cultural and ethical impact of Web 2.0; Advancing privacy, security and trust in a knowledge-driven economy; Advancing globally responsible practices through knowledge management; Ownership, collaboration and digital rights management; Individual rights vs. Collective rights; Legal (and illegal) implications; Stewardship, mentoring and succession management; Multi-generational learning and knowledge-sharing; Return on investment and corporate social responsibility (CSR); and Establishing values-centered employees (Gurteen.com, 2009). In addition, Neef (2003) believes that "[i]ntegrity in business has never been more important" (p. vii) and that integrating ethics into knowledge management and risk management (pp. 15-18) can be used to help companies develop a strategic approach to corporate integrity.

While professional associations play an important role in guiding the ethical behavior of their members, educational institutions involved in teaching knowledge management also play a vital role in guiding emerging KM professionals with respect to both general business ethics and KM ethics in particular. While a review of higher education curricula on KM to determine how well ethics is being covered is beyond the scope of this paper, this would provide yet another interesting area for further research.

Conclusion

In this paper I started with the premise that knowledge management is an organizational/strategic change management model. Using Tichy's (1983) "strategic rope" model with its interwoven technical, political, and cultural strands as my conceptual framework for KM theory and practice, I have suggested that the literature of KM needs to reflect all of these aspects. A brief review of the literature and other writers' research, together with keyword searches in WorldCat OCLC, indicated that the KM literature was disproportionately weighted in favor of KM as a technology, and that the political and cultural aspects—particularly the ethical aspects—of KM received relatively little coverage, when compared to the

technology or process aspects of KM. Similarly, a focus on KM from the perspective of management outweighed 'other voices' or perspectives from the knowledge workers, i.e., 'the knower.'

While KM is still a relatively new field, with foundations in many disparate disciplines (Dalkir, 2005; Wallace, 2007), it would appear, at least from the KM literature, that KM's historical roots in technologies and from organizational science, scientific management, business reengineering, cognitive science, and information technology are outweighing its human relations and organizational learning ones. Similarly, critical discussions of knowledge workers as 'subjects,' rather than as 'objects' from which knowledge products are to be extracted, are largely absent in the literature (with notable exceptions such as Fuller's (2002) *Knowledge Management Foundations*). While authors such as Alvesson and Kärreman (2001); Spender (2005, 2009); Styhre (2003); and Wilson (2002) have offered critiques of knowledge management, additional critiques would be welcome. Hopefully, some of them will focus on the politics, culture (including language), and ethics of KM. In the meantime, a concerted collaborative effort by the KM profession (amorphous as it appears to be) to develop and promulgate a code of ethics for the KM profession should be a key priority. In this regard, the fields of Organization Development and Library and Information Science, and professional associations such as the OD Network and the American Library Association, provide excellent resources and models, including codes of ethics.

References

Alvesson, M. (2004). *Knowledge work and knowledge-intensive firms*. Oxford; New York: Oxford University Press.

Alvesson, M., & Kärreman, D. (2001, November). Odd couple: Making sense of the curious concept of knowledge management. *Journal of Management Studies, 38*, 995-1018.

American Library Association. (2009). Code of ethics of the American Library Association. Retrieved April 21, 2009, from http://www.ala.org/ala/aboutala/offices/oif/ifgroups/cope/Code%20of%20Ethics%202008.pdf

Argyris, C., & Schon, D. (1978). *Organizational learning: A theory of action perspective*. Reading, MA: Addison-Wesley.

Centre for Intercultural Learning. (2009). Iceberg model of culture. Retrieved May 2, 2009, from http://www.international.gc.ca/cfsi-icse/cil-cai/magazine/v02n01/doc3-eng.pdf

Dalkir, K. (2005). *Knowledge management in theory and practice*. Burlington, MA: Elsevier/ Butterworth-Heinemann.

Davenport, T. H. (1994). Saving IT's soul: Human-centered information management. *Harvard Business Review, 72*(2) 119-131.

Evans, M. H. (c2007). Value through ethical behavior. Retrieved April 19, 2009, from http://www.exinfm.com/board/value_through_ethical_behavior.htm

Fahey, L., & Prusak, L. (1998). The eleven deadliest sins of knowledge management. *California Management Review, 40*(3), 256-276.

Feldman, M. S. (2000). Organization routines as a source of continuous change. *Organization Science, 11*(6), 611-629.
Firestone, J. M., & McElroy, M. W. (2003). *Key issues in the new knowledge management*. Amsterdam; Boston: Knowledge Management Consortium International; Butterworth-Heinemann.
Fuller, S. (2002). *Knowledge management foundations*. Boston: KMCI Press; Butterworth-Heinemann.
Greer, R. C., Grover, R. J., & Fowler, S. G. (2007). *Introduction to the library and information professions*. Westport, CT: Libraries Unlimited.
Gurteen.com. (2009). 2009 National knowledge management conference: The intersection of ethics and knowledge management. Retrieved April 20, 2009, from http://www.gurteen.com/gurteen/gurteen.nsf/id/T043945/
Information & Knowledge Management Society. (2009). Information & Knowledge Management Society (iKMS). Retrieved April 20, 2009, from http://www.ikms.org/
International Knowledge Management Institute. (2009). International Knowledge Management Institute. Retrieved April 20, 2009, from http://www.gurteen.com/gurteen/gurteen.nsf/id/km-institute
KMCI. (2009). KMCI.org. Retrieved May 2, 2009, from http://www.kmci.org/index.html
Knowledge Management Professional Society. (2009). Knowledge Management Professional Society. Retrieved April 20, 2009, from http://www.kmpro.org/
Land, F., Amjad, U., & Nolas, S-M. (2007). The ethics of knowledge management. *International Journal of Knowledge Management, 3*(1), 1-9.
Lehaney, B., Clarke, S., Coakes, E., & Jack, G. (2004). *Beyond knowledge management*. Hershey, PA: Idea Group Publishing.
Malhotra, Y. (1997). *Knowledge management in inquiring organizations.* Paper presented at the Proceedings of 3rd Americas Conference on Information Systems (Philosophy of Information Systems Mini-track), Indianapolis, IN, August 15-17, 1997.
McElroy, M. W. (2003). *The new knowledge management: Complexity, learning, and sustainable innovation*. Amsterdam; Boston: KMCI Press; Butterworth-Heinemann.
McElroy, M. W. (2004). Business ethics, risk management, and the open enterprise. Retrieved March 23, 2009, from http://www.kmci.org/media/Business_Ethics_Risk_Mgmt_OE.pdf
McKenzie, J., & van Winkelen, C. (2004). *Understanding the knowledgeable organization: Nurturing knowledge competence* (1st ed.). London: Thomson.
Merriam-Webster. (2009a). Culture. Retrieved March 23, 2009, from http://www.merriam-webster.com/dictionary/culture
Merriam-Webster. (2009b). Ethics. Retrieved March 23, 2009, from http://www.merriam-webster.com/dictionary/ethics

Merriam-Webster. (2009c). Politics. Retrieved March 23, 2009, from http://www.merriam-webster.com/dictionary/politics

Merriam-Webster. (2009d). Power politics. Retrieved March 23, 2009, from http://www.merriam-webster.com/dictionary/power%20politics

Mintzberg, H. (1983). *Power in and around organizations*. Englewood Cliffs, NJ: Prentice-Hall.

Morgan, G. (1986). *Images of organization*. Beverly Hills, CA: Sage Publications.

Neef, D. (2003). *Managing corporate reputation and risk: Developing a strategic approach to corporate integrity using knowledge management*. Amsterdam; Boston: Elsevier/Butterworth-Heinemann.

OCLC. (2009). WorldCat OCLC. Retrieved April 19, 2009, from Michigan State University Libraries.

OD Network. (2009). Organization and human systems development credo. Retrieved April 21, 2009, from http://www.odnetwork.org/aboutod/credo.php

Patsuris, P. (2008). The corporate scandal sheet. Retrieved May 1, 2009, from http://www.forbes.com/2002/07/25/accountingtracker.html

Pentland, B. T., & Rueter, H. H. (1994). Organization routines as grammars of action. *Administrative Science Quarterly, 39*(3), 484-510.

Rubin, R. E. (2004). *Foundations of library and information science* (2nd ed.). New York: Neal-Schuman Publishers.

Sheffield, J., & Mason, R. M. (2007). *Philosophy and ethics in knowledge management.* Paper presented at the 40th Annual Hawaii International Conference on System Sciences (HICSS'07).

Spender, J. C. (2005). Review article: An essay on the state of knowledge management. *Prometheus, 23*(1), 101-116.

Spender, J. C. (2009). Revisiting KM's origins and objectives [draft]. Retrieved May 1, 2009, from http://www.jcspender.com/uploads/Encylopedia1.pdf

Styhre, A. (2003). *Understanding knowledge management: Critical and postmodern perspectives*. Malmö, Sweden; Herndon, VA: Liber; Copenhagen Business School Press.

Tichy, N. M. (1983). *Managing strategic change: Technical, political, and cultural dynamics*. New York: Wiley.

Tiwana, A. (2002). *The knowledge management toolkit: Orchestrating IT, strategy, and knowledge platforms* (2nd ed.). Upper Saddle River, NJ: Prentice Hall.

Wallace, D. P. (2007). *Knowledge management: Historical and cross-disciplinary themes*. Westport, CT: Libraries Unlimited.

Wilson, T. D. (2002). The nonsense of 'knowledge management.' *Information Research, 8*(1) paper no. 144 Retrieved from http://InformationR.net/ir/8-1/paper144.html.

Appendix

Results of Selected Keyword Searches in WorldCat OCLC

A keyword search was conducted on April 19, 2009, on WorldCat OCLC (books and other materials contained in libraries worldwide) using the keyword combinations noted in this table. The results are displayed below.

Keywords	Number of records Keyword + knowledge management	Number of records Keyword + knowledge worker
Technology	6,174 (E: 5,869)	415 (E: 398)
Process	3,253 (E: 3,112)	222 (E: 199)
Data Mining	649 (E: 631)	10 (E: 7)
Extraction	155 (E: 153)	4 (E: 3)
Intellectual Capital	786 (E: 693)	115 (E: 91)
Intellectual Property	295 (E: 279)	16 (E: not stated)
Politics	468 (E: 447)	107 (E: 97)
Power	1,119 (E: 1,085)	141 (E: 129)
Power Relations	117 (E: 115)	32 (E: 29)
Organizational Power	230 (E: 224)	21 (E: 20)
Ethics	502 (E: 499)	65 (E: 62)
Values	643 (E: 620)	98 (E:87)
Culture	1,207 (E: 1,139)	173 (E: 162)
Organizational Culture	413 (E: 390)	31 (E: not stated)
Code of Conduct	18 (E: not stated)	4 (E: not stated)
Business Ethics	175 (E: 174)	13 (E: not stated)
Organizational Learning	1,910 (E: 1,788)	67 (E: 65)
Organization Development	787 (E: 750)	66 (E: 62)
Library and Information Science	254 (E: 245)	16 (E: 14)
Information Science	2,859 (E: 2,803)	87 (E: 82)
Organizational Change	834 (E: 796)	56 (E: 54)
Change Management	2,268 (E: 2,191)	85 (E: 83)

E=English

Source: *OCLC. (2009). WorldCat OCLC. Retrieved April 19, 2009 from Michigan State University Libraries. Compiled by Catherine A. Gibson.*

Illuminating Knowledge Sharing in Light of Transactive Memory System Theory and Social Network Analysis

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Abstract

The current paper introduces the theory of transactive memory system (Wegner, 1987) into the context of knowledge sharing. By proposing that there is a relationship between transactive memory system among individuals and knowledge sharing, this paper elaborates on how an individual's motive for knowledge sharing can be shaped at the collective level. By utilizing a hypothetical case study, this paper examines the effectiveness of social network analysis and demonstrates how an organization can use this method to assess how a transactive memory system forms and develops.

Introduction

Knowledge sharing (KS) is a multidimensional and multifaceted concept; thus, it can be explained in light of various dimensions, such as individual, collective, institutional influences, human psychological and cognitive factors, socio-cultural factors, and technological aspects. The current paper will examine the cognitive basis of knowledge sharing by virtue of transactive memory system. A transactive memory system is "a set of individual memory systems in combination with the communication that takes place between individuals" (Wegner, 1987, p.186). It also aims to look at KS in light of individuals' collective motives. In this regard, the theory of transactive memory system (TMS) is considered to provide a well-reasoned way of seeing KS. What this paper ultimately wishes to contribute is to broaden the existing understanding of KS through a lens of transactive memory system. An ideal situation of facilitating knowledge sharing is where TMS is well developed and operates among individuals.

While it is crucial for organizational members to be aware of other members' area of expertise, which is necessary to complete their task effectively, the case may be that they have difficulty building up a perception of "expertise recognition" (Garner, 2006, p.333). The current study aims to provide a hypothetical case that shows how effective it is to use social network analysis (SNA) to assess and identify the difficulties that organizational members may experience in utilizing other members' knowledge and expertise (Cross, Parker,

Prusak, & Borgatti, 2001). To that end, I draw upon transactive memory system theory, which illustrates the importance of expertise recognition. The degree to which each individual is well aware of another person's expertise is a crucial precondition of effective knowledge sharing. Without knowing another's expertise, knowledge sharing cannot be fully implemented. Of course, an individual comes to know another person's expertise by personal means, such as personal networking and referral. But the question is whether an individual can figure out the other person's expertise in a more systematic and effective way that maximizes the degree of expertise recognition.

Information/communication Dilemma

Researchers have shown that sharing information through a discretionary database is difficult. This is because a social dilemma exists. People's individual interests are to take advantage of others' contributions as much as possible, but they are less interested in contributing their own information. That is, there can be a situation in which an individual's interest conflicts with the group's (Kalman, Monge, Fulk, & Heino, 2002). Such a social dilemma is called the "information/communication dilemma" (Bonacich & Schneider, 1992). In fact, the information/communication dilemma has a deep theoretical tradition. Theories of collective action captured the dilemma by virtue of the "prisoner's dilemma," which explains why individuals do not behave in order to maximize their own interests as well as others' (Olson, 1965).

The under-provision that clearly emerges in discretionary information repositories is an acute example of the "tragedy of the commons," which is the term that Hardin coined to explain the destruction of public goods (Hardin, 1968). In the famous P2P (peer-to-peer) network, Gnutella, 66 percent of Gnutella users download others' content without uploading their own, and only 1 percent of Gnutella users contribute more than half of the total content (Adar & Huberman, 2000). In an attempt to maximize their self-interest, some individuals do not care about the fact that the commons (e.g., a field of fertile grass, a discretionary database, etc.) that benefits them could be destroyed by pursuing these short-term interests. Of course, in organizations, knowledge sharing is implemented and supported by a set of rules and incentives. Thus, it may be safe to say that such devastating under-provision would not emerge in organizations at the same level as it does in a discretionary database. However, it is still the case that knowledge sharing is not easy to implement and instigate.

The present paper does not attempt to introduce the theory of transactive memory system into the context of knowledge sharing in order to help to solve the information/communication dilemma, the prisoner's dilemma, or the tragedy of the commons. However, this theory may provide a foothold for how to increase an individual's motive to share knowledge at the collective level.

Collective Motives for Knowledge Sharing

There have been some studies that attempt to look at an individual's motive for knowledge sharing at the individual level, which is viewed as separate from the group level. These studies rely on the "Theory of Reasoned Action" (Fishbein &

Ajzen, 1975) and the "Theory of Planned Behavior" (Ajzen, 2002). Although the research does not ignore the impact of group influence, such studies do not fully take into account the impact of collective motives to share knowledge. Given that an individual's attitudes and behaviors toward knowledge sharing are influenced by individual factors as well as collective level factors, it is important to also look at some cognitive factors that play out at the collective level. Therefore, the focus of knowledge sharing moves from individual motives for knowledge sharing to collective motives. In exploring such collective motives of knowledge sharing, the theory of transactive memory system may provide a useful theoretical framework.

Components of Transactive Memory System

To understand how a transactive memory system is developed, one needs to break it, down into three domains: individual memory, external memory, and transactive memory (Wegner, 1987).

Individual Memory. In the domain of individual memory, information becomes part of an individual's memory through three stages: "the encoding, storage, and retrieval stage" (p.186). Along with such basic components of individual memory, there is one very important component: the organization of information that is stored in an individual's memory (Wegner, 1987). For the internally stored information to be used for some certain purpose, it is necessary to be well organized. One may experience difficulties in utilizing what he/she memorizes effectively unless his/her information is stored in such an orderly way such that it is easy to find and retrieve it effectively.

External Memory. Just as people use "external storage"(e.g., notebooks, stickers, organizers, index cards, etc.) to save their memory in their everyday life, they also use the cognitive capacity of other people as an external space to store their information (Wegner, 1987). Other people's cognitive capacity can be utilized as external storage because no one can memorize all of the information to learn everything that is relevant to their task, and no one wants to do so. Therefore, there are individuals who wish to take advantage of others' expertise (specific knowledge, information, or skills, etc.) rather than learn or master them on their own. As knowledge in the modern world becomes more specialized and the amount of information and knowledge increases at an enormous pace, it may be impossible and even undesirable for members to learn all the necessary knowledge and skills on their own. No employer wants his/her employee to be bogged down learning totally new skills and knowledge in the middle of a given task.

According to Wegner, the process of external memory entails labeling the *location* where information is externally encoded, stored, and retrieved, whereas internal memory necessitates labeling *items*. In the realm of external memory, the item itself may not be memorized, but without memorizing the location of the item, there will be a loss of information.

Transactive Memory. Whether information is externally or internally stored, that information is not retrievable unless it is retrieved by someone who wants to use it (Wegner, 1987). The memory that each individual builds up

interdependently has a bigger capacity than individual memory. Accordingly, such extended memory will be instrumental in dealing with organizational tasks.

Wegner claims that an individual has access to information that is stored in another's memory because that person knows that the other person has what he/she needs. In this process, an individual may be able to do so by utilizing his/her own unique labels that indicate who has what information.

Just as with individual and external memory, transactive memory also includes the process of encoding, storage, and retrieval. What is distinct with transactive encoding, storage, and retrieval is that these processes take place across interactions with different people. To engage in transactive encoding, people participate in a collective process to decide locations and forms of information that they want to store in a group (Wegner, 1987). Transactive retrieval occurs among individuals who have different kinds of internal memory. A person who wants to use some information that he/she does not store can retrieve it from a person who has stored information in his/her memory internally. A transactive memory system occurs when people are cognizant of others' expertise. This is formally termed as "expertise recognition," (Garner, 2006) although Wegner, one of the original authors of the theory of transactive memory system, never used this term.

On the other hand, it should be noted that Wegner did not take into account the willingness to share information. As one of the early TMS theorists, he focused on TMS as a cognitive mechanism in light of the exchange of cognitive capacity. He did not directly consider another factor that may impact the extent to which people form TMS: the willingness to share information. But he contributed to the conceptualization of TMS that is crucial to better understand how an individual uses another's cognitive capacity. Thus, the current study emphasizes the necessity of harnessing another's cognitive capacity to better elaborate on people's willingness to share knowledge.

Transactive memory system was approached in terms of group performance (Hollingshead, 2000). For Hollingshead, transactive memory system is "the specialized division of labor with respect to the encoding, storage, and retrieval of information" (p. 258). For transactive memory system to be well developed among members, each member should retain different kinds of information that are not redundant. Hollingshead claims that group members are supposed to develop their own specialized expertise. She stresses the importance of differentiated knowledge without meaning for group members to develop a new and unique skill as a result of such a division of labor. The division of labor that TMS theorists rhetorically point out stems from the existing knowledge and skills of each group member. It is not that each member should develop a new area of knowledge according to any planned decision. The extent to which TMS is well developed depends on how well differentiated each member's knowledge is. If a group/team has a more differentiated range of knowledge, it is more likely to develop TMS effectively than a group that has more homogenous knowledge.

Cognitive Interdependence and Convergent Expectation

Hollingshead strengthens TMS theory by incorporating two important factors: "cognitive interdependence" and "convergent expectations" (2001, p. 1081). Hollingshead sees interdependence as a cognitive aspect of people. According to her, cognitive interdependence becomes greater as people are aware of another's expertise in the relevant domain. Through the process of acquiring and sharing knowledge, they become dependent on one another. As Brandon and Hollingshead (2004) have pointed out correctly, forming interdependence with others is what makes it possible to develop transactive memory system.

Hollingshead applied the concept of convergent expectations to the theory of transactive memory system. Convergent expectations refer to "the extent to which group members shared expectations about one another's knowledge affects how they tacitly coordinate who will learn what" (2001, p.1082). She claims that convergent expectations occur when people's cognitive interdependence fits their perception of others' knowledge (2001). According to Hollingshead, convergent expectations depend on the accuracy of perceptions about the differentiation of each one's expertise.

Brandon and Hollingshead (2004) introduced Blickensderfer, Cannon-Bower and Sales (1997) shared mental models to explicate transactive memory system. Shared mental models are defined as "the extent to which individual team members' mental models overlap—the extent to which team members share the same understanding of the task and the team" (p.252). They argued that when group members have shared mental models, they are more likely to develop transactive memory systems effectively. Then, when do members share some sort of mental model for their task? Brandon and Hollingshead suggest that when group members work together at what they called 'the task-expertise-person (TEP)' unit, the TEP facilitates forming shared mental models. Subsequently, such mental models lead to the development of transactive memory systems.

Brandon and Hollingshead (2004) also introduced two constructs that were related to the development of transactive memory system: "task representation" and the "task-experience-person (TEP) unit." In their model of the cyclical development of TMS, the TEP unit plays a role as a boundary in which members shape a group-shared mental model while implementing the given tasks (Brandon & Hollingshead). In order to highlight task issues, what they called "task representation," they placed emphasis on the TEP unit as a basic space in which group members' interactions surrounding a particular task occur.

The problem here is that organizational members are frequently incognizant of their mental models and the fact that their behaviors are affected by these models (Senge, 1990). Senge (1990) defined mental models as "deeply ingrained assumptions, generalizations, pictures, or images that influence how we understand the world and how we take action" (p.8) Mental models of organizational individuals may work harmoniously or conflict with each other. For example, a person who is embedded in a product design team may feel that another

partner who belongs to a strategic management team is reluctant to share what they find and learn. At the same time, the person on the management team does not think that there is a problem with the way that they cooperate with the product design team member. Such a disparity in mental models regarding tasks could hamper effective knowledge sharing.

In developing Wenger's seminal work on transactive memory system, Hollingshead explored under what conditions transactive memory system develops. Drawing on her findings and arguments of the relationship between transactive memory system and cognitive interdependence and convergent expectation, the current paper argues that there is a relationship between TMS and knowledge sharing. First, TMS theory contributes to understanding knowledge sharing since one's cognitive mechanism explains his/her individual motive to share knowledge at the collective level. This theory allows one to find an individual's motive to share knowledge by fully illustrating the role of cognitive interdependence. The very fact that no one can master every skill and gain all the knowledge that is necessary for successful task completion may be a starting point for individuals to build a cooperative system with others: transactive memory system.

Second, although it is not explicitly mentioned, it can be safe to assume that TMS theory points out the limitations of an individual's cognitive capacity and the tendency to compensate for his/her own shortages by using others. Such a perspective may provide a robust explanation in that it finds motives of sharing knowledge at more fundamentally necessary levels. Based on the review of extant literature and newly generated implications, this paper provides two propositions.

> *Proposition 1. A well-developed transactive memory system in an organization may facilitate knowledge sharing among individuals.*
>
> *Proposition 2. Expertise recognition, the most defining factor in TMS, is related to the extent to which individuals communicate and interact with each other.*

Other Factors Related to Transactive Memory System

Incentives. Hollingshead (2001) found that individuals are more likely to learn others' knowledge when there are incentives. Her finding suggests that external interventions, such as incentives, may work for developing transactive memory system. Along with the presence of incentives, she argues that other people's instruction plays a role in facilitating expertise recognition (2000). Expertise recognition depends not only on an individual's perception, but also on other people's instruction or advice regarding people's specialties.

Nature of Knowledge. Hollingshead, Fulk, and Monge (2002) argued that intranets could play a role in helping group members to know other members' expertise. Their argument is correct, to the extent that members' expertise can be translated into explicit knowledge and is codifiable. Whether the nature of knowledge is linked to the possibility of sharing knowledge using information and

communication technologies has been discussed (Hislop, 2002). According to Hislop (2002), the notion that explicit knowledge can be shared via information technologies is simply predicated on the objectivist perspective on knowledge. The objectivist perspective on knowledge holds that explicit knowledge can be shared via information and communication technologies. However Hislop argues that there is another perspective that provides a different view on knowledge sharing via information technologies. The epistemology of practice perspective focuses on the socially constructed nature of knowledge, arguing that information technologies are limited in sharing knowledge.

Impacts of Environmental Factors. Unlike the early expectation that such a technological innovation facilitates knowledge sharing, the information system itself does not guarantee improvements of knowledge sharing: rather it is a needed environment for knowledge sharing (Pan, Hsieh, & Chen, 2001). Pan, Hsieh and Chen's (2001) study shows that the degree of global knowledge sharing is influenced by not only information technology but also environmental factors, such as human resource management.

Impacts of Hidden Profile. It is worthwhile to look at a series of hidden profile research. The central findings of a hidden profile study is that team members tend to discuss a great deal of information when they discuss common information among members rather than when they discuss uncommon information (Wittenbaum, Hollingshead, & Botero, 2004). Therefore, unshared information may be easily ignored during the group discussion. This is problematic in that teams are better off when each member has his/her own unique contribution of information and it is shared.

Assessment of Transactive Memory System: Social Network Analysis

In spite of the theoretical benefits of a well-developed transactive memory system, realistically, it may not be easy to develop and maintain an effective TMS. As a result, it is important to assess the extent to which TMS is developed and what impedes this process. Since communication and information exchange among team members during the process of task completion are critical for facilitating and maintaining TMS, in this regard, social network analysis may be a more useful tool to assess and examine the communication and interaction among organizational members (Monge & Contractor, 2003). In order to examine whether communication and information exchange can help individuals to be more aware of another's expertise, I conducted a hypothetical case study that employs social network analysis.

Problematic Situations

Within an organization, an individual tends to rely heavily on people whom he/she already knows and with whom he/she is familiar. The extent to which an individual seeks and acquires useful resources (e.g., advice, critical information, and deep levels of knowledge) is determined by the boundary of that person's network. In particular, when it comes to a task-related relationship, one may easily find such non-social relationships tend to be smaller and more limited despite a variety of

individuals. This can be explained by homophily, which captures the nature of human being's relationships (Monge & Contractor, 2003). Homophily refers to a human being's tendency to interact with another who is similar to them, whereas heterophily is people's tendency to prefer another who is different from them (Rogers, 1995). According to Rogers, homophily is related to effective communication and diffusion. When individuals have things in common with respect to many different attributes (e.g., sex, ethnicity, nationality, race, and religion), they are more likely to communicate effectively with each other. Homophily is a double-edged sword in the organizational context. It may facilitate the flow of information, and even some level of explicit knowledge within the boundaries of a homophilous network; it may also hamper connection and communication beyond the homophilous network (Rogers, 1995).

Critical Incidences

In fierce competition with a rival company, SmartFun Co. found itself confronting an undesirable situation. They learned that in a rival company, every unit related to developing a new product shared one of the core processes that evaluated its brand new online game. They also found that several product development units in SmartFun Co were incognizant of the process, with only one unit was actually aware of it. This was a result of innocent ignorance, rather than conscious competition between their subunits for information hoarding. SmartFun Co. ended up failing to get its new product approved by the association of American online gaming industries.

There has been a great deal of employee complaints regarding the current policy enforcement within SmartFun Co. While the company has been emphasizing the importance and necessity of knowledge sharing across the different units with regard to new product development, its executives found that the degree of smooth knowledge sharing has not been satisfactory. Unlike their initial expectations, employees complained because they could not find and contact other people in the different units. Their complaints were understandable, since their work was completely dependent upon the compartmentalized characteristics of given specific tasks. That is, whether to find someone for information seeking is not an individual's volitional matter, but rather a structural issue. Therefore, the executives wanted to assess why such a clear company policy was not implemented among its employees.

After a team manager, Tom, left his position, SmartFun Co. found itself caught in an abnormal communication breakdown. Communication among the employees was not taking place in the way that it was supposed to be. Since the program language unit's employees relied heavily on Tom's role with regard to connection to other units, Tom's absence resulted in a breakdown in the process of communication. Ideally, each employee within the department should have formed a formal and task-related relationship with employees in other units. But due to the compartmentalization of specific game development processes, they were unable to do so. They were well suited for given specific tasks, but were unable to handle more streamlined connections. Such compartmentalization of an organization leads

to disconnection in smooth communication flow rather than smooth knowledge sharing.

Social Network Analysis (SNA)

This study assumes that constructing an effective transactive memory system can be possible through the actions of management. Letting an individual resort to his/her own personal ways of knowing another's expertise does not guarantee more effective knowledge sharing. For management's intervention, it may be crucial to canvass what their members' expertise is, and where it is located. In this hypothetical case study, I introduced an online game developing company, SmartFun Co. Reflecting the fact that effective knowledge sharing in organizations is becoming increasingly more important; SmartFun Co. placed tremendous emphasis on knowledge sharing among its employees. However, despite efforts from management, employees confronted problems in facilitating knowledge sharing. In an attempt to improve and promote the degree of knowledge sharing within their organization, SmartFun Co. decided to identify to what extent their employees actually utilized the possibility of knowledge sharing and knowledge of other people's expertise.

SmartFun Co. decided to assess and identify what problems resided within their organization with respect to knowledge sharing. Executives at the company also thought that it was necessary to get the whole picture of how each individual sought information and advice from others. To that end, SmartFun Co. employed social network analysis (SNA) researchers. The purpose of SNA is to help one see the connection of a particular person in the form of a relational web (Parise, 2007). It helps to see who plays a brokerage role in the knowledge sharing network, and who is most isolated in the network. As a result, SNA clearly reveals the relationship each individual forms and maintains in a network (Cross et al., 2001). Of course, this is not the whole range of SNA. Providing a relational map is another function that it provides.

The first step is to identify all the members' expertise that is necessary for successful task completion. The ideal type of transactive memory system will be drawn from each employee's profile, which is provided by the company's human resource management department. In addition to basic individual profiles, the input for mapping transactive memory system includes each employee's expertise, proven by what he/she had actually recently achieved. This demonstrates that what a person has done successfully well-represents what he/she is capable of. Based on such an extensive expertise map, researchers draw up an optimal form for transactive memory system. In this case, "optimal" means how well each individual employee's specialty is captured in the mapping of expertise location.

The second step is to survey the extent to which an individual actually communicates with others when another person's information, knowledge, and expertise are needed. The way social network analysis questions differ from general survey questions is that the survey questions for social network analysis require that the respondent identify specific people with whom they have a relationship or

contact for a specific purpose (e.g., task-related advice, problem solving tips, and social relationships).

The social network analysis questions used in Parise (2007) were revised for the purpose of this study with SmartFun Co. More specific survey questions were written as follows: "please indicate the extent to which you know the expertise of the people listed below," "please indicate the extent to which you seek advice from each person below when you have a question," and "please indicate the extent to which you turn to each person below prior to making a task-related decision." Each question was measured on a 7 point Likert scale with two extreme values (1: very rarely to 7: very frequent). Drawing the network was conducted using a social network analysis tool, PAJEK (Batagelj & Mrvar, 1996)

Discussion

Two social network maps were drawn based on the following question: "please indicate the extent to which you seek advice from each person below when you have a question." Figures 1 and 2 show that there is a departure between the optimal form of transactive memory system that could ideally materialize in SmartFun Co. and the current knowledge network that was formed and maintained. The program language unit is represented in gray and the program application unit is in white. The number on each node denotes the number of contacts that an individual has received for advice. For example, in the program language unit, A5 is the most frequently contacted person (i.e., the total number of contacts are 13) and, in the program application unit, B1 is the most frequently contacted person (i.e., the total number of contacts are 19). According to the number of contacts received, the size of each node varies. A5 and B1 are the biggest ones in their units, respectively. The arrows represent who seeks advice from whom: an individual who receives the arrow is the one being asked for advice, and an individual who sends the arrow is the one seeking that advice.

Figure 1 shows that the most contacts occurred within the same unit. Individuals seeking others' expertise rarely happened across the units. Connecting with other units can be possible with a boundary spanner (A5 and B1). However, given serious levels in the lack of connection to other people in different units, such a boundary spanner—equivalent to a broker in the network does not seem to guarantee all the possible connections between people. That is, a boundary spanner does not replace the necessity of each person's individual and direct connection to a person of interest.

Figure 2 displays the extent to which each individual is supposed to contact others for advice within his/her unit as well as between units. If an individual makes contact based on his/her perception of the ideal type of transactive memory system, the advice network emerges like figure 2.

Figure 1: *Advice Network*

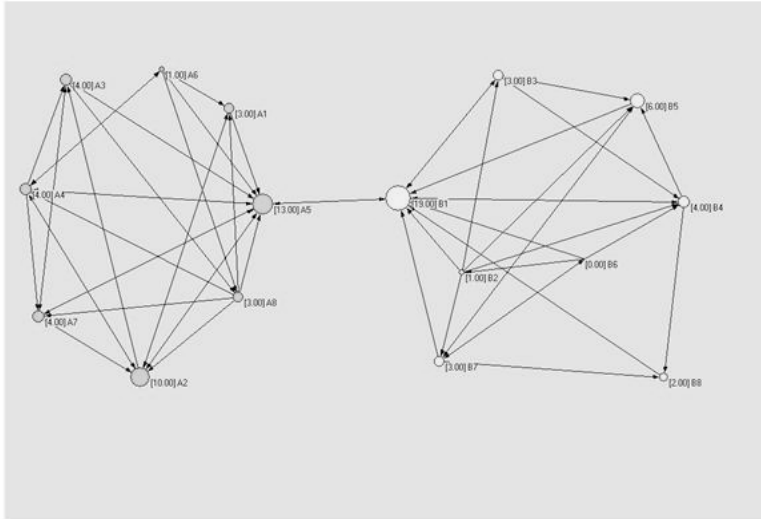
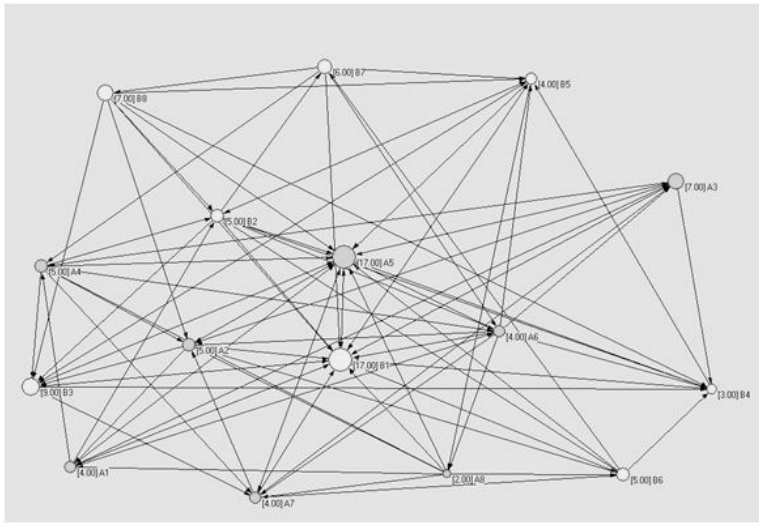


Figure 2. *Optimal Transactive Memory System*



Comparison between two figures gives some hint as to whether SmartFun Co. underutilizes each employee's potential to maximize the outcome. The fact that employees do not know the full scale of another's expertise may contribute to the idea that they are not able to benefit from another's expertise.

Finding 1. The degree of knowledge sharing varied according to the characteristics of the organizational unit. There is a difference between the program language unit and the program application unit with regard to the degree to which organizational members shared their knowledge and information.

Finding 2. There is variation among the between-unit and the within-unit employees with regard to the extent to which they have an awareness of "who knows what" (Cross et al., 2001, p.112). Whereas knowledge sharing and information seeking occur more actively within the same unit (e.g., the technical department), it is relatively rare to observe it across different units.

Finding 3. There is a boundary spanner whose role contributes to connecting different units. If someone is a boundary spanner and other people frequently make contact with that person, they are more likely to have a higher level of awareness of "who knows what." However, relying excessively on boundary spanning individuals may make it difficult for employees to form an effective transactive memory system (e.g., A5 is Tom, who appeared in critical instances.) Therefore, the company should pay more attention to ensure that each individual freely and flexibly seeks advice from other people who have a different type of knowledge.

Difficulty of Knowing Tacit Knowledge

This paper claims that tacit knowledge may make it more difficult to develop a transactive memory system. Tacit knowledge-based expertise is not only difficult to learn, but also may be difficult to identify. Why is it that employees have difficulty being aware of another's expertise? This answer may be found by looking at the nature of tacit knowledge, which may be directly associated with expertise. Polanyi famously states that it is hard to express tacit knowledge in clear language, thus it is difficult to share (1967). On one hand, it is more difficult to share tacit knowledge than explicit knowledge. On the other hand, it is difficult to know who has what kind of tacit knowledge. Tacit knowledge is difficult to share, as well as identify,. When it comes to tacit knowledge, the formation of transactive memory system may not be easily developed. Therefore, a different approach to this may be needed.

As a result, individuals know other employees' expertise in a broad sense, but they may have difficulty in figuring out their specific expertise at the tacit knowledge level. For example, one knows her colleague has a specialty with regard to computer software languages in a broad sense, but may not know what specific knowledge she has in that area. Thus, she may have difficulty determining what kind of questions she could ask, or type of help she could receive. As a result, she may be reluctant to ask and may eventually give up contacting someone.

Conclusion

One question may capture what this study aims to achieve: does transactive memory system play a role in fostering knowledge sharing? The answer is positive: an effective construction of transactive memory system is crucial to facilitate knowledge sharing in an organization. Furthermore, it is important for an organization to facilitate the formation of transactive memory system. The flow of knowledge can be facilitated and sustained by the degree to which organizational members are aware of who has what expertise.

The current study examined a hypothetical company that employed social network analysis in order to assess the extent of its effectiveness of knowledge sharing. Given that each individual plays a different role in the communication network, it will be helpful to see what kind of roles and positions an individual takes through social network analysis. To analyze how effectively an organization's communication flows, it may be crucial to know the flow of information among individuals and across the subunits within an organization. Organizations can make use of social network analysis in order to identify and assess the problems that their members may experience in engaging in knowledge sharing.

References

Adar, E. B. & Huberman, A. (2000). Free-riding on Gnutella. First Monday, 5. Retrieved on Apr 13, 2009 from http://firstmonday.org/issues/issue5_10/adar/index.html.

Ajzen, I. (2002). Perceived behavioral control, self efficacy, locus of control, and the Theory of Planned Behavior. *Journal of Applied Social Psychology, 32*, 665-683.

Batagelj, V., & Mrvar, A. (1996). Pajek v.1.23 Download from http://vlado.fmf.uni-lj.si/pub/networks/pajek/default.htm

Blickensderfer, E., Cannon-Bower, J. A., & Sales, E. (1997). Theoretical bases for team self-correction: Fostering shared mental models. In M. M. Beyerlein, D. A. Johnson, S. T. Beyerlein (Eds.), *Advances in Interdisciplinary Studies of Work Teams: Team Implementation Issues, 4*. London, UK: JAI Press.

Bonacich, P., & Schneider, S. (1992). Communication networks and collective action. In W. B. G. Liebrand, D. M. Messick, & H. A. M. Wilke (Eds.), *Social dilemmas: Theoretical issues and research findings* (pp.225-245). New York, NY: Pergammon.

Brandon, D. P., & Hollingshead, A. B. (2004). Transactive memory systems in organizations: Matching tasks, expertise, and people. *Organization Science, 15*, 633-644.

Cross, R., Parker, A., Prusak, L., & Borgatti, S. P. (2001). Knowing what we know: Supporting knowledge creation and sharing in social networks. *Organizational Dynamics, 30*, 100-120.

Fishbein, M., & Ajzen, I. (1975). *Beliefs, attitudes, intentions and behavior: An introduction to theory and research*. Boston, MA: Addison-Wesley.

Garner, J. T. (2006). It's not what you know: A transactive memory analysis of knowledge network at NASA. *Journal of Technical Writing and Communication, 36*, 329-351.

Hardin, G. (1968). The tragedy of the commons. *Science, 162*, 1243-1248.

Hislop, D. (2002). Mission impossible? Communicating and sharing knowledge via information technology. *Journal of Information Technology, 17*, 165-177.

Hollingshead, A. B. (2000). Perceptions of expertise and transactive memory in work relationships. *Group Process & Intergroup Relations, 3*, 257-267.

Hollingshead, A. B. (2001). Cognitive interdependence and convergent expectations in transactive memory. *Journal of Personality and Social Psychology, 81*, 1080-1089.

Hollingshead, A. B., Fulk, J., & Monge, P. (2002). Fostering intranet knowledge sharing: An integration of transactive memory and public goods approaches. In P. Hinds & S. Kiesler (Eds.), *Distributed Work* (pp. 335-356). Cambridge, MA: The MIT Press.

Kalman, E., Monge, P., Fulk, J., & Heino, R. (2002). Motivations to resolve communication dilemmas in database-mediated collaboration. *Communication Research, 29*, 125-154.

Monge, P. R., & Contractor, N. S. (2003*). Theories of Communication Networks*. Oxford, UK: Oxford University Press.

Olson, M. (1965). *The logic of collective action*. Cambridge, MA: Harvard University Press.

Pan, S. L., Hsieh, M, & Chen, H. (2001). Knowledge sharing through intranet-based learning: A case study of an online learning center. *Journal of Organizational Computing and Electronic Commerce, 11*, 179-195.

Parise, S. (2007). Knowledge management and human resource development: An application in social network analysis methods. *Advances in Developing Human Resources, 9*, 359-383.

Polanyi, M. (1967). *The tacit dimension*. New York, NY: Anchor Books.

Rogers, E. M. (1995). *Diffusion of Innovations*. New York, NY: The Free Press.

Senge, P. (1990). *The fifth discipline: The art and practice of the learning organization*. New York, NY: Doubleday.

Wegner, D. M. (1987). Transactive memory: A contemporary analysis of the group mind. In Mullen & G. R. Goethals (Eds.), *Theories of Group Behavior* (pp.185-208). New York, Springer-Verlag.

Wittenbaum, G. M., Hollingshead, A. B., & Botero, I. C. (2004). From cooperative to motivated information sharing in groups: Moving beyond the hidden profile paradigm. *Communication Monograph, 71*, 283-310.

Yuan, Y. C., Fulk, J., & Monge, P. R. (2007). Access to information in connective and communal transactive memory systems. *Communication Research, 34*, 131-155.

Influence of Cognitive and Learning Styles on Knowledge Sharing Behavior: A Theoretical Framework

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Abstract

This paper explains the development of a theoretical model to represent two distinct ways cognitive and learning styles can influence knowledge sharing behavior. The domain of interest for knowledge sharing behavior in this paper is online communities of practice that use knowledge management systems. Through a review of the literature, two paths through which cognitive and learning styles can affect knowledge sharing behavior are defined. The models are supported by findings from previous work.

Introduction

The purpose of this study is to investigate the possible influence of cognitive and learning styles on knowledge sharing behavior within online communities of practice and create a theoretical framework through which further research on the subject can take place. Of the many factors contributing to knowledge sharing, the effect of individual styles of information processing, such as cognitive styles or learning styles, has remained comparatively uninvestigated. This study aims to examine ways in which individual styles may have influence on knowledge sharing behavior and to take a further look at the possible outcomes of such influences. By constructing a model supported by previous work, the study aims to lay the foundation for future research on relationships between cognitive styles and knowledge sharing behavior.

Previous Work

Even though this study does not have an exact precedent, there are a great number of studies from the disciplines of knowledge management, education, human computer behavior, and organizational management that examine the influence of individual differences and cognitive styles on knowledge sharing behavior, team performance, or decision-making. The author has chosen to include previous works that point out the influence of individual differences on team performance as a base on which to develop the current study, because the context in which this study looks at knowledge sharing behavior is within a community of practice. Wenger defines communities of

practice as groups of people who share a concern or a passion for something they do and learn how to do it better as they interact regularly. A community of practice, very much like a team, works toward a common goal; therefore, it is hypothesized that factors affecting knowledge sharing behavior in a team may also affect knowledge sharing behavior in a community of practice.

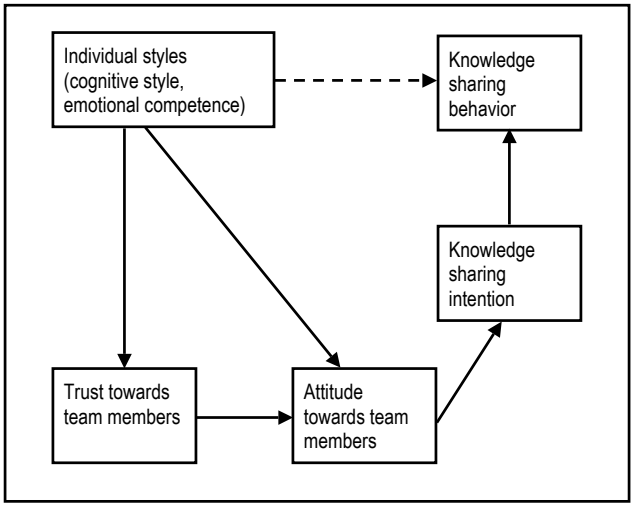
Individual Styles and Teamwork Performance

Thinking styles, also referred to as cognitive styles, can be defined as people's preferred way of thinking and acting (Sternberg, 1997). Thinking styles can also determine how a person perceives, processes, and interprets information for problem solving purposes (Sternberg, 1997) According to the study by Liu, Magjuka and Lee (2008), cognitive styles measured in two dimensions (external/internal and local/global) by the Sternberg Thinking Style Inventory have predictive power on the level of trust people exhibit towards their teammates and the satisfaction they experience from teamwork. Sternberg's Theory of Mental Governance categorizes thinking styles under five dimensions: Functions (legislative, executive, judicial); Forms (monarchic, hierarchic, oligarchic, and anarchic); Levels (local, global); Scopes (internal, external); and Leanings (liberal, conservative) (Sternberg, 1997). In their article, Liu et al. measured only the level and scope dimensions of Sternberg Thinking Styles. The participants in this study were graduate students taking an online course throughout a semester. In this study, the students were under the obligation of working in teams for a classroom project, so in that respect the context in which the knowledge sharing occurred was not the equivalent of an online community of practice. However, in the study trust is shown to be an influential factor on knowledge sharing. Consequently, if one's cognitive style has predictive power over the level of trust one exhibits related to other people with whom one is sharing knowledge, we can assume that cognitive styles may have predictive power over knowledge sharing behavior.

Offerman, Bailey, Vasilopoulos, Seal and Sass (2004) conducted a study that explored the contributions of cognitive ability and emotional competence on individual and team performance, team member attitudes, and leadership perceptions in the context of academic team projects (Offerman et al, 2004). The individual style measured in this study is emotional competence, measured by the Emotional Competency Inventory (ECI). Emotional competence is a measurement of a person's emotional abilities accompanied by products of such emotional abilities (Offerman et al., 2004, p. 223). ECI is a self-assessment measure with clusters: self-awareness, self-management, social awareness, and relationship management (Offerman et al., 2004, p.223) The study results showed that emotional competence had a significant effect on individuals' attitudes towards their team. It is possible that these findings also relate to the influence of individual styles on knowledge sharing behavior: knowledge sharing behavior is affected by knowledge sharing intention, which in turn is influenced by individuals' attitudes (Bock & Kim, 2002).

The two studies mentioned previously (Offerman et al., 2004; Liu et al., 2008) looked at the influence of individual differences on attitudes towards team members. However, the two studies operationalized individual differences in two different dimensions. Study results show that individual differences such as cognitive styles and emotional competence have a significant effect on team member attitudes. In this regard, it is worth exploring the possible effects of individual differences on knowledge sharing. As we know more about why people do or do not share knowledge, we can understand how to accommodate people's requirements in order for a healthy knowledge sharing exercise to occur.

***Figure 1**: Model demonstrating the relationship between individual styles and knowledge sharing based on previous research.*



Individual Styles, Self-efficacy, and Hypermedia Performance

Self-efficacy plays a central role in how people motivate themselves, how they cope with problematic situations, and how they make decisions at important points in their day-to-day life (Bandura, 1982). A person's belief in his/her capability of solving a problem significantly influences not only the level of motivation he/she exhibits, but also his/her performance in solving the problem. As information sharing is a voluntary act (Davenport, 1997), and as self-efficacy beliefs affect how people function in decision-making points, looking at the influence of self-efficacy on knowledge sharing is a worthwhile pursuit.

Lai (2009) conducted an empirical study that pointed out the effect of computer-self-efficacy on usage of Knowledge Management systems. Lai found that computer-self-efficacy, an individual's perceptions of his/her ability to use computers

in accomplishing a task, had significant positive influence on intention to use KMS through "perceived usefulness" and "ease of use" (p. 335). Perceived usefulness of a KMS is the degree to which the user believes that using the KMS will improve his/her job performance. Ease of use is the degree to which a user believes a system to be easy to operate. Because computer-self-efficacy was shown to have the largest effect on perceived usefulness and ease of use, and because ease of use significantly influenced intention to use KMS, Lai suggested a direction of practice, through which computer-self-efficacy within an organization could be increased. Lai stated that organizations should enable effective use of KMS through training, skilled staff, and support services, because KMS are very complicated and advanced technologies (Lai, 2009, p. 333). The model for knowledge management success, constructed by Kulkarni, Ravindran and Freeze (2006) in another study, also supports the influence of ease of use (as a parameter of system quality) and user satisfaction, which influences the sustained use of the knowledge management system.

Lin and Huang (2009) in their study tried to point out major factors influencing the usage of electronic knowledge repositories (EKRs). As the result of their survey with 500 participants, they found that of the factors measured, EKR self-efficacy was the most influential factor on an individual's EKR usage. In other words, it was pointed out that a person's belief in his/her capability to perform at a certain level using an EKR was the most important determinant factor on his/her actual usage of EKR. Lin and Huang in the end of their article suggested that the significant influence of self-efficacy on EKR usage may imply that more training programs that assist users in building self-esteem may be useful in increasing the usage of EKRs (Lin & Huang, 2009, p. 178). In a different study, Chen, Chen & Kinshuk (2009) found through a field survey that web-specific self-efficacy had predictive power over knowledge sharing intention, which positively influenced knowledge sharing behavior in virtual learning communities.

Research by Lin and Huang (2009) showed that EKR self-efficacy was the most influential factor on an individual's EKR usage. The influence of self-efficacy on intention to use KMS was also shown in the study by Lai (2009). Lai's study, as well as the study by Kulkarni et al. (2006), emphasized the influence of perceived ease of use of the KMS on the individual's intention to use the KMS. Training and support services for complicated and advanced technologies are one method of increasing the ease of use of a KMS and computer-self-efficacy; however, there exists another path one can approach this challenge through. Enhancing the interaction and user interface design of the system to suit the needs of the users working on various tasks can also increase ease of use of a system. Upon interacting with a system, objective usability of the system is an important factor influencing an individual's ease of use perception (Venkatesh & Davis, 1996). Measuring the performance of users while accomplishing a task using a system is one way of assessing objective usability of the system. One factor that had been shown to affect user performances in hypermedia systems is cognitive styles. Therefore, the influence of cognitive styles on user performance is also a useful stream of research in regard to knowledge sharing.

Research shows us that cognitive styles influence browsing behavior and performance while users accomplish given tasks using hypermedia systems. Ted

Nelson introduced the words "hypertext" and "hypermedia" in 1965 (Nelson, 1965). He described the word hypertext as a body of written or pictorial material interconnected in such a complex way that it could not be conveniently presented or represented on paper (Nelson, 1965, p.96). Hypermedia systems are non-linear systems that can consist of hypertext, videos, interactive movies, and sound. In hypermedia systems, the information is presented in a non-sequential manner, which allows users to follow a workflow most suitable to his/her need in a given time. The World Wide Web (WWW) is a classic example of a hypermedia system. KMS or EKRs are examples of hypermedia systems, also. Online knowledge sharing platforms most often have navigational structures which require users to navigate through subjects to retrieve information, as well as navigate through the system in order to contribute and share knowledge. This inherent property of online knowledge management systems points to the importance of supporting browsing in KMS to increase objective and perceived ease of use of the KMS.

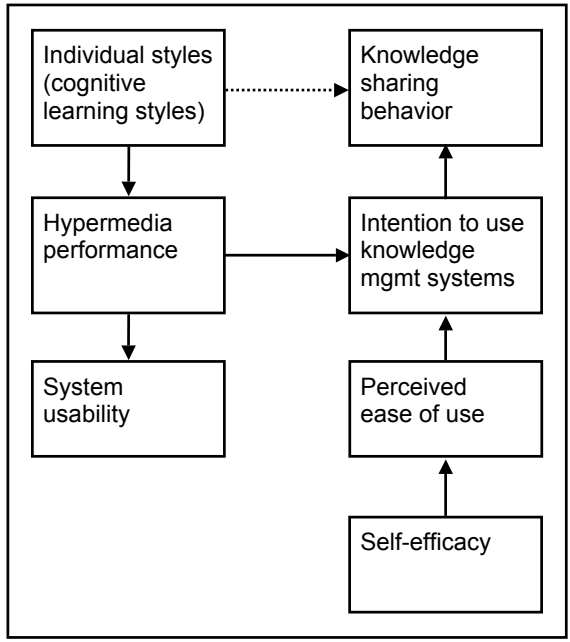
In a study conducted by Palmquist and Kim (2000), effects of cognitive styles (in field-dependence and independence dimension) were investigated in novice and expert users using a WWW search. The results of the study showed that among novice WWW searchers, subjects who were classified as Field Independent performed significantly higher than field dependent subjects while working on two search tasks: a factual search task and a topical search task. The web search experience and performance were measured by "search speed" (the average length of time spent on retrieving a piece of information and the average number of nodes visited for retrieving a piece of information (Palmquist & Kim, 2000). Research by Palmquist and Kim (2000) indicated that field dependent novices explored the web in a very passive way and got lost more often. They concluded that the user interface designers should keep novice field dependent users in mind while creating complex systems (p. 564). Lo and Chan (2008) pointed out another relationship between learning styles and interaction behavior in a web-based learning system. In that particular study, subjects belonging to different learning style groups demonstrated significant differences in their browsing behavior and the choice of components that they used. In another study conducted by Chen et al. (2009), it was demonstrated that during web-based instruction, field independent and field dependent students chose to utilize different browsing and instructional tools and widgets. In similar research done by Lee and Boling (2008), the effects of cognitive styles on structural knowledge, given different information presentations, were surveyed. Their results show that field independent and field dependent people benefited from different presentations of information in order to enhance their structural knowledge of a given subject. While field dependent people benefited from a concept map representation of information, the same representation hampered the structural understanding for field independent people. Field independent people preferred to be presented with a less explicit information-conveying approach.

The studies above show that cognitive styles and learning styles have influence over people's performance when using hypermedia systems. In these studies, performance was measured by task completion speed, task completion

effectiveness (Palmquist & Kim, 2000), and retained structural knowledge (Lee & Boling, 2008). Also, differences in choice of use of system components were observed in several studies (Lo & Chan, 2008; Chen et al., 2009). It can be deducted from these results that an individual's cognitive style affects the performance the user will exhibit while using the system. As the usability of a system can be measured by the time and effort needed to accomplish a task using the system—or, in other words, by user performance—we can conclude that the cognitive styles of users are factors that contribute to the measured objective usability of systems. Systems that do not accommodate the needs of all cognitive styles may hamper the performance of some users and therefore decrease the objective usability of the system for that certain group of users. Low usability would also negatively effect perceived ease of use of a system (Venkatesh & Davis, 1996). For a KMS, perceived ease of use of the KMS is one of the most crucial factors that influence the intention to use a KMS (Lai, 2009; Kulkarni et al., 2006). Increasing objective usability of KMS is expected to increase the intention to use a KMS, which can be achieved by further investigating the influence of cognitive and learning styles on KMS use performance.

The model in Figure 2 summarizes the relationships between self-efficacy, perceived ease of use, intention to use KMS, user performance, objective usability, and cognitive and learning styles. Cognitive and learning styles influence user performance (Palmquist & Kim, 2000; Chen et al., 2009; Lee & Boling, 2008), which is related to objective usability of a system. Objective usability influences the ease of use perceptions once the user interacts with a system (Venkatesh & Davis, 1996). Perception of ease of use is a major factor that influences a person's intention to use a KMS (Lai, 2009; Kulkarni et al., 2006) (a KMS in this case), and intention to use a system for a task influences the user's behavior. This study aims to focus on knowledge sharing as the primary knowledge management behavior. The influence of cognitive styles on knowledge sharing behavior has not yet been deeply investigated, but this model demonstrates how cognitive styles may affect knowledge sharing behavior by constructing correlation relationships based on previous work.

***Figure 2**: A model demonstrating the influence of cognitive and learning styles on knowledge sharing behavior.*



A Theoretical Model For The Effect Of Cognitive Styles On Knowledge Sharing Behavior

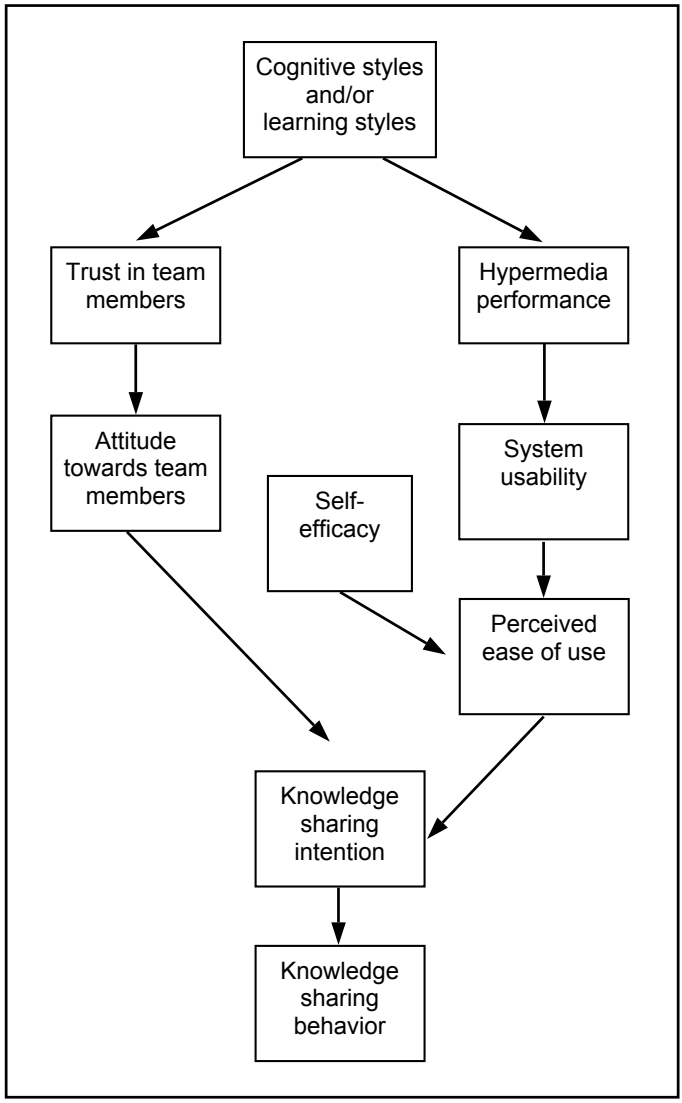
Previous research summarized in sections 2 and 3 point out two distinct ways in which the cognitive styles of individuals may influence their knowledge sharing behavior in online communities of practice.

First of all, previous research suggests that cognitive styles have predictive ability on the trust a person exhibits for a teammate and a person's satisfaction with the teamwork. Trust is an influential factor on one's attitude towards knowledge sharing intention, which affects their knowledge sharing behavior.

The second way by which cognitive styles may have influence on knowledge sharing behavior is through enhancing perceived ease of use of a knowledge management system. In online communities of practice, knowledge sharing is most likely to happen through online and interactive knowledge management systems or electronic knowledge repositories. People with different cognitive styles have different preferences for system component usage, different browsing styles, and can exhibit different task completion performances given a

single environment. Perceived ease of use may be increased through increasing system usability. To increase system usability, needs of users with varying cognitive styles should be accommodated through the user interface or the interaction model of the KMS.

Figure 3: *Theoretical model on ways in which cognitive style may have influence on knowledge sharing behavior.*



Direction For Future Research

This study aims to provide a framework through which the relationship between cognitive styles (and/or learning styles) and knowledge sharing behavior in online communities of practice can be investigated. The link between cognitive styles (and/or learning styles) and knowledge sharing behavior does not yet appear to be investigated. However, previous work from many disciplines, such as information science, education, and psychology, to name a few, provides two strong directions for how cognitive styles may affect knowledge sharing behavior.

Before embarking on research on empirical support for the theoretical model, it would be useful to take into consideration several of the hypotheses in the model within the context of knowledge sharing and knowledge management systems. It is necessary to first take a further look at the effect of cognitive styles on knowledge sharing behavior in online communities of practice. Another point that deserves consideration is the relationship between system usability and self-efficacy: as the systems become easier to use, may self-efficacy increase?

A weakness of the literature in cognitive styles is the abundance of metrics available. Also, one must be careful not to confuse cognitive styles with learning styles. Even though the two terms are often interchanged, they have different metrics and they have different influences. The influence of both cognitive styles and learning styles on knowledge sharing behavior is worth investigating further; however, caution is needed so as not to confuse the two concepts.

Conclusion

This study drew on previous work in order to create a framework through which the relationship between individual styles (learning styles and cognitive styles) and knowledge sharing behavior can be investigated. There are two major ways individual styles may have influence on knowledge sharing behavior. Knowledge sharing is key to organizational success: the more we know about factors that influence knowledge sharing, the better environments we can create to share and create knowledge. Knowledge lies within people: without accommodating the needs of individuals in the process of externalizing and internalizing knowledge, creating and sharing knowledge becomes impossible. Looking at how individual styles, cognitive styles, or learning styles fit within the picture of knowledge management may take our understanding of knowledge sharing further.

References

Bandura, A. (1982). Self-efficacy mechanism in human agency. *American Psychologist*, *37*(2), 122-147.

Bock, G.W., & Kim, Y.-G. (2002). Breaking the myths of rewards: An exploratory study of attitudes about knowledge sharing. *Information Resources Management Journal*, *15*(2) 14-21.

Chen, I.Y.L., Chen, N.-S., & Kinshuk (2009). Examining the factors influencing participants' knowledge sharing behavior in virtual learning communities. *Educational Technology & Society*, *12*(1) 134-148.

Kulkarni, U., Ravindran, S., & Freeze, R. (2006). A knowledge management success model: Theoretical development and empirical validation. *Journal of Management Information Systems*, *23*(3) 309-347.

Lai, J. (2009). How reward, computer self-efficacy, and perceived power security affect knowledge management systems success: An empirical investigation in high-tech companies. *Journal of the American Society for Information Science and Technology*, *60*(2) 332-347.

Lee, J., & Boling, E. (2008). Information-conveying approaches and cognitive styles of mental modeling in a hypermedia-based learning environment. *Journal of the American Society for Information Science and Technology*, *59*(4) 644-661.

Lin, H., & Chen, L. (2008). Discovering learning pattern in different cognitive style of learners. Proceedings from ICCIT '08: *Convergence and Hybrid Information Technology, 2*, 268-273.

Lin,T.-C., & Huang, C.-C. (2009). Understanding the determinants of EKR usage from social, technological and personal perspectives. *Journal of Information Science, 35*(2) 165-179.

Liu, X., Magjuka, R.J., & Lee, S.-H. (2008). The effects of cognitive thinking styles, trust, conflict management on online students' learning and virtual team performance. *British Journal of Educational Technology*, *39*(5) 829-846.

Lo, J., & Chan,Y. (2008). Relationships between user cognitive styles and browsing behaviors of an online learning website. Proceedings from: *2008 International Conference on Cyberworlds,* 51-57.

Nelson, T. H. (1965). A File Structure for the Complex, The changing and the indeterminate. Proceedings from: *ACM 20th National Conference*, 84-100.

Palmquist, R., & Kim, K.-S. (2000). Cognitive style and on-line database search experience as predictors of web search performance. *Journal of the American Society for Information Science and Technology*, *51*(6) 558-566.

Offerman, L., Bailey, J., Vasilopoulos, N.L., Seal, C., & Sass, M. (2004). The relative contribution of emotional competence and cognitive ability to individual and team performance. *Human Performance*, *17*(2) 219-243.

Sternberg, R.J**.** (1997). *Thinking styles.* New York: Cambridge University Press.

Venkatesh,V., & Davis, F.D. (1996). A model of the Antecedents of Perceived Ease of Use: Development and Test. *Decision Sciences, 27*(3) 451-481.

Wenger, E. Communities of Practice. In Ettiene Wenger Home Page. Retrieved April 26, 2009, from http://www.ewenger.com/theory/index.htm

Organizational Knowledge Sharing on Corporate Blogs: The Case of the AMD Developer Blog

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Abstract

This study aims to explore how companies actively use corporate blogs to enhance knowledge sharing. A case study of "AMD (Advanced Micro Devices) Developer Blog" is conducted to examine how engineers from a technology company share their knowledge on the corporate blog they maintain. Three research questions examined in this study include: (1) what types of knowledge are shared on the AMD Developer Blog? (2) how do engineers use the AMD Developer Blog to enhance knowledge sharing and (3) what roles do the AMD Developer Blog play in enhancing knowledge sharing among engineers? Findings suggest that procedural knowledge, declarative knowledge, and causal knowledge, are all shared by engineers on the AMD Developer Blog. They also use this blog as a platform to provide some useful links, which can guide readers to some good resources, and to release news about events that might enhance knowledge sharing. The findings also suggest that the AMD Developer Blog prompts engineers to explicate their tacit knowledge and codify their tacit knowledge into explicit knowledge. It also helps prompt their individual knowledge to become collective/organizational knowledge. However, the lack of interaction on this blog indicates that this blog still needs to be improved to become a community of practice.

Introduction

The rapid development of new information technologies provides more and more alternative ways for organizations to enhance knowledge sharing. There are a myriad of theoretical and empirical studies examining the role information technology plays in organizational knowledge sharing. Among these studies, an important topic has been knowledge sharing in various online communities. As a type of technology, which might be used to promote the formation of online community, the corporate blog has been adopted by some organizations to enhance knowledge sharing. The main objective of this study is to explore how organizations use corporate blogs to enhance organizational knowledge sharing through a case study.

Literature Review

Knowledge Sharing in Online Communities

Factors Affecting Knowledge Sharing in Online Communities. Knowledge sharing in online communities has become an important research topic in recent years. Generally speaking, studies on knowledge sharing in online communities can be categorized into two types. First, many studies focused on examining the factors that might affect and motivate peoples' participation in knowledge sharing in online communities. Based on a wide range of literature review in the related area, Hall (2001) explored the factors that encourage intranet contributions. He found that those factors included achieving a critical mass, adopting the intranet, and developing organizational reward systems for knowledge sharing. The other factor was concerned with enabling conditions such as making knowledge sharing a key responsibility of staff, promoting communities for knowledge sharing, and encouraging experimentation. Also based on a literature review, Tedjamulia, Olsen, Dean, and Albrecht (2005) proposed a model that can help explain ways to motivate member contributions to online communities. According to Tedjamulia et al., factors that might affect members' knowledge contributions include some personal characteristics such as self-efficacy, intrinsic motivation, need to achieve and trust, and some environmental factors such as usability, group identity, and personal responsibility. Similarly, Sharratt and Usoro (2003) also proposed a research model to help understand knowledge sharing in online communities of practice. According to their model, factors affecting people's online knowledge sharing include organizational structure, ease of use of technology, perceived usefulness, integrity-based trust, benevolent-based trust, competence-based trust, career advancement, sense of community, and value congruence.

Hsu, Ju, Yen and Chang (2007) found that self-efficacy, personal outcome expectations, and identification-based trust affect people's knowledge sharing behavior in virtual communities (VCs). Based on examining the factors that motivated individuals competing to win an award to interact collectively in a Yahoo e-group, Hall and Graham (2004) found that the initial motivation for competitors to join the group was to discover information for personal gain. Over time, the members desired the reciprocity of help from other members in their interactions. Ma and Agarwal (2007) conducted a study of 650 members of two online communities and found that perceived identity verification from other people had great impact on community members' perception of satisfaction and their knowledge contribution behavior.

Wasko and Faraj (2005) applied theories of collective action to explore how individual motivations and social capital influenced people's knowledge contribution in electronic networks. They found that people would contribute their knowledge when they perceive that it would enhance their reputations in a profession, when they enjoyed helping others, and when they had higher levels of network centrality. Their findings also provided evidence that cognitive social capital played a vital role in people's knowledge contribution. However, their

findings suggested that high levels of relational capital did not predict knowledge contribution and there was a negative relationship between their commitment to the network and the helpfulness of their contribution. In another study, Wasko and Faraj (2000) explored why people contribute to the provision of knowledge as a public good in electronic communities of practice. Their findings suggested that when knowledge was considered a public good, knowledge exchange and knowledge contribution was motivated by moral obligations and community interest rather than by narrow self-interest.

Knowledge Sharing Process in Online Communities

Some other studies described the real-world knowledge sharing process in online communities. Many researchers adopt case studies as their main research method. For example, Baalen, Bloemhof-Ruwaard and Heck (2005) carried out a case study of a knowledge portal in the agricultural industry in the Netherlands. They found that the knowledge portal could bridge structural roles, led to the exchange of project-domain knowledge and reciprocity in knowledge sharing, which then contributed to the emergence of the network of practice. Their findings also suggested that the emergence of the network of practice resulted from a higher sense of urgency to tackle specific problems of practice and the fragmented awareness in a dispersed industry. They found that an active knowledge broker would lead to the development of a knowledge portal and then contribute to the emergence of a network of practice.

In order to develop a community-based model of knowledge contribution instead of a firm-based model, Lee and Cole (2003) conducted a case study of the Linux kernel development project. They examined how thousands of volunteers across different countries and organizations collaborated via Internet in the Linux kernel development. They observed that criticism operated as a cultural norm in the development project, which increased the likelihood of uncovering error. Their findings demonstrated a two-tier task structure, which consisted of a small core and a large periphery. The core was composed of a project leader and hundreds of maintainers, while the periphery was composed of thousands of developers organized into "the development team" and "the bug reporting team". They found that the norm of critique, which was manifested in this two-tier task structure and implemented in a peer review process, played a vital role in identifying and criticizing errors.

Pan and Leidner (2003) carried out a case study to examine a multi-national organization's (Buckman Labs) efforts to implement an organizational knowledge management system. They identified several phases involved in this process. Phase 1 was the beginning of global knowledge transfer initiative, in which a single global forum was established. In Phase 2, the organization started moving from a single forum approach to a multiple region-based approach. And in Phase 3, the management decided to reorganize its forum into a single global industry-based forum. The researchers also discussed four lessons which could be learned from this case study, including: "(1) the possibility of a flexible KM strategy; (2) providing multiple channels for diverse knowledge sharing needs and preferences; (3) continuous expansion of communities of practice; and (4) exploring issues and concerns regarding the change role or IT" (p. 81).

In order to understand how people share knowledge in their everyday work in a project-based company, Ruuska and Vartianinen (2003) conducted a case study in an Internet consultancy company. They focused on the social structures that might affect knowledge sharing and found sixteen different structures. They characterized them as formal, informal, and quasi-informal structures. Their findings suggested that these structures might share the same or different space and communication in the structures might be based on either face-to-face or virtual interaction.

Gongla and Rizzuto (2001) from IBM described the process of how IBM Global Services implemented a business model that included support for the growth and development of communities of practice. They presented an evolution model based on observing over 60 communities and they also discussed the evolution in terms of people and organizational behavior, supporting processes, and enabling technology factors. Hemetsberger and Reinhardt (2004) carried out a case study of the KDE (The K Development Environment) project to investigate online knowledge sharing and creation processes. They identified several processes that they claimed were fundamental in creating and sharing organizational knowledge. These processes include: (1) enabling re-experience by decreasing complexity and transactive group memory; (2) enabling re-experience by guidance, openness and legitimate peripheral participation; and (3) enabling re-experience by asynchronous communication and virtual experimentation.

Studies on Corporate Blogs

As one of the tools to form online communities, corporate blogs can also be used to enhance organizational knowledge sharing. However, studies examining how companies use corporate blogs to promote knowledge sharing are extremely limited. Most academic studies on corporate blogs are from communication studies, owing to the fact that many companies nowadays realize that corporate blogs can be utilized as an effective public relations tool (Cho & Huh, 2007). Fleck, Kirchhoff, Meckel and Stanoevska-Slabeva (2007) conducted a thorough review on the typologies and different classifications of corporate blogs. They defined corporate blogs as "Blogs in the context of corporate communications" (p. 228). One classification provided is based on the mutual relationship between readers and authors in terms of internal and external stakeholders. According to this classification, there are four types of corporate blogs: (1) corporate social responsibility blogs, sales blogs, campaign blogs, and topic blogs; (2) fan or critic blogs, and third party campaign blogs; (3) knowledge blogs, collaboration blogs, project blogs and some types of employee blogs and (4) some other types of employee blogs and union blogs.

To explore how corporations obtained benefits from blogs, Lee, Park and Hwang (2008) analyzed content and design features of corporate blogs launched by the Fortune 500 companies to identify whether different categories of blogs would employ different features. They found that there are different adoption patterns of content and design features in terms of corporate blog type. They introduced a new classification system of corporate blogs, according to which there are five types of corporate blogs: employee blog, group blog, executive blog, promotional blog and newsletter blog. An employee blog is maintained by an employee in the company.

It is "applied only to the ones maintained under the corporate influence. Typically there are a large number of employee blogs in a corporate hosted blogosphere" (p. 136). A group blog is "also called collaborative blog, has shared authorship among two or more people and typically deals with a specific topic. The main theme of the group blog tends to be a technical or industry-specific issue and the authors usually are experts in the area" (p. 136). An executive blog is the blog written by the executive managers of a company, usually the CEO. A promotional blog is "intended to create 'buzz' about products and events using the word-of-mouth effect among bloggers" (p. 137). A newsletter blog is "similar to the press release section of traditional corporate websites…companies send out newsletter-type messages to the readers in a blog format" (p. 137).

It is quite explicit that the third type of blog defined by Fleck et al. (2007), which includes knowledge blogs, collaboration blogs, and project blogs, and the group blog defined by Lee et al. (2008), can provide good platforms for organizations to enhance knowledge sharing. It is quite meaningful to examine the knowledge sharing process on these blogs. This study aims to fill in the empirical gap existing in the literature and the research questions in this study include:

RQ1: What types of knowledge are shared on corporate blogs?

RQ2: How do organizations use corporate blogs to enhance knowledge sharing?

RQ3: What roles do corporate blogs play in enhancing knowledge sharing among organizational members?

Methods

The case study method is adopted in this research. As suggested by Yin (2002), the case study is the most appropriate method when, "a 'how' or 'why' question is being asked about a contemporary set of events, over which the investigator has little or no control" (p.9). Through providing vivid illustrations, the case study can be used to present the process of a social phenomenon. Obviously, this study puts forward a "how" question: how do organizations use corporate blogs to enhance knowledge sharing. Thus, the whole process of knowledge sharing on corporate blogs is emphasized in this study. Moreover, the researcher is not able to and does not intend to control the process of knowledge sharing on corporate blogs. In this respect, the researcher is observing a "naturally occurring" phenomenon. Therefore, based on Yin's discussion, the case study is the most appropriate method to be adopted in this study.

The case examined in this study is from a cross-national high-tech company: Advanced Micro Devices (AMD). Owing to their familiarity with technologies, engineers from high-tech companies are often the pioneers to write corporate blogs. Different from public relational professionals whose main objective to write corporate blogs is to build a positive organizational image, engineers often consider writing corporate blog as a way to enhance knowledge

sharing. This case study aims to examine engineers' activities of knowledge sharing on their corporate blogs.

As described on its website (http://www.amd.com/us-en/), AMD considers itself "an innovative technology company dedicated to collaborating with customers and partners to ignite the next generation of computing and graphic solutions at work, home, and play". It claims that its mission is "to enable affordable, accessible Internet connectivity and computing capabilities for 50 percent of the world by 2015". Based on its description of the company and the company's mission, we can infer that engineers who develop and design the products and who deal with most of the technological issues play a central role in the operation of the company. As experts in technology, these engineers proactively adopted various types of social media such as blogs and online forums to enhance communication among them, and more specifically, to enhance the knowledge sharing in the process of product development.

Engineers in AMD maintained a corporate blog: AMD Developer Blog (http://forums.amd.com/devblog/). This blog was started on June, 27, 2007 and it is still active now. As of April 3, 2009, there have been 97 posts on this blog. All of them are publicly available. This blog is maintained by multiple authors with different positions and from a wide range of departments. The topics on the blog are very diverse and some examples are shown on Table 1.

Based on the three research questions proposed above, this case study aims to answer three questions: (1) what types of knowledge are shared on the AMD Developer Blog? (2) how do engineers use the AMD Developer Blog to enhance knowledge sharing? and (3) what roles does the AMD Developer Blog play in enhancing knowledge sharing among engineers? A qualitative thematic analysis approach is used to analyze those 97 posts.

Table 1: *Examples of Topics on the AMD Developer Blog*

Examples of Topics	Date Posted
AMD CodeAnalyst Workshop Summary	April 2, 2009
Libsst.so: super-fast string scanning functions	April 2, 2009
Using Apache JMeter in non-GUI mode	March 31, 2009
Accurately profiling code with Instruction Based Sampling	March 27, 2009
Java Object Trimming	March 10, 2009
Is String Immutable?	March 3, 2009
Builders instead of Constructors for Immutable Objects	February 6, 2009
Which Java GC Collectors is right for you?	February 3, 2009
SANS/MITRE Top 25 Most Dangerous Programming Errors	January 29, 2009
Huge Pages and NUMA issues on Linux	January 23, 2009
PDC 2008 Highlights	December 1, 2008
How to Make Sure That Benchmarks Aren't a Horror Story for you	August 13, 2008
Mandelbrot and 16-bit fixed point multipliers (Part II)	July 9, 2008
Mandelbrot and 16-bit fixed point multipliers (Part I)	July 1, 2008

Results

Classification of Knowledge

There are several sets of classifications of knowledge. The most widely known one is the Nonaka's (1994) classification of tacit and explicit knowledge. Nonaka defined explicit (also codified) knowledge as the type of knowledge "that is transmittable in formal, systematic language" (p.16). And he defined tacit knowledge as the type of knowledge with the personal quality "which makes it hard to formalize and communicate" (p.16). He further argued that "tacit knowledge is deeply rooted in action, commitment, and involvement in a specific context" (p.16).

Different from Nonaka (1994), Hara (2007) categorized types of knowledge as book knowledge, practical knowledge, and cultural knowledge. Book knowledge is statutes, policies, or standards regarding a particular issue or problem; practical knowledge deals with how to use book knowledge in practice; and cultural knowledge deals with cultural meanings about how professionals should do their work and build their professional identities.

Another categorization of knowledge is provided by Zack (1999), who proposed three types of knowledge: declarative knowledge, procedural knowledge, and causal knowledge. Declarative knowledge is the description of something; procedural knowledge "is about how something occurs or is performed" (p.46); and causal knowledge "is about why something occurs" (p.46).

In this study, Zack's (1999) categorization of knowledge is adopted in analyzing the types of knowledge shared on the AMD Developer Blog.

Types of Knowledge Shared on the AMD Developer Blog

Procedural knowledge. It is not surprising that procedural knowledge is often shared on the AMD Developer Blog, since these engineers are often engaged in writing computer programs. A most frequently seen scenario is engineers' descriptions of how to solve some specific technological problems which most of them might encounter in their everyday work. They usually displayed their code in their articles, with clear descriptions of the meanings of the code. Sometimes they pointed out the problems existing in the code and then displayed other sets of code after making some suggestions to improve it. In doing this, they provided very clear descriptions on the technological procedures to deal with specific problems.

For example, an engineer pointed out that when dealing with a technical problem, there might be some ways to improve the overall performance of the whole system by modifying some codes and adopting a new set of code. He initially displayed the typical code in his post:

```
size_t strlen(const char *src) {
   size_t length = 0;
      while (*src == 0)) {
      src++; length++;
   }
```

```
   return length;
}
```

Then he suggested a more sophisticated approach, as shown by the following quotes:

> "A more sophisticated approach is to use general purpose integer registers, read 8 bytes at a time, and then check the entire register for a zero byte."

Then he displayed the pseudo code he designed in the article, which looks like this:

```
        PXOR %xmm1, %xmm1          // build a
mask of all zeroes
do {
        MOVDQA    %xmm2, srcp;          //
load the next 16 bytes
        PCMPEQB   %xmm2, %xmm1;         //
compare data vs. zeroes
        PMOVMSKB  %rax, %xmm2;          //
put result mask into integer register
        srcp++;
        length += 16;
        } while (%rax == 0);
```

So how does this work?

Through asking, "how does this work?" he continued to explain the meaning of this code and finally made some generalized conclusions based on his discussion. Through his writing, readers could clearly observe the procedures of how he developed his code.

Declarative Knowledge. It is also not hard to find declarative knowledge on the AMD Developer Blog. Engineers might describe the new functions of some familiar technological tools or introduce new tools on this blog. In the following example, an engineer was describing some new functions of some tools (Huge Pages and NUMA on Windows Operating Systems). Here are some quotations from his post:

> "Many of us are familiar with Apache's JMeter tool, an open source tool which can help load test and measure the performance of web applications. JMeter has an excellent GUI mode and this is the mode that is presented if you invoke JMeter with no arguments. During script development, this GUI mode is the way to go. New configuration elements,

> thread groups and samplers can be added and edited and the results from runs can be viewed with a number of different listeners which helps with debugging."

He then described what these functions are in great details. Here is another example. An engineer was describing some settings on Windows Operating Systems that can be helpful in Java applications.

> "…if you are specifically using huge pages in a multi-processor NUMA environment and you intend to run multiple JVMs each affinitized to a node, which means we are pinning that JVM's threads to one node, then for maximum performance you would like to make sure that the huge pages you allocate for each affinitized JVM's heap are local to that node."…

> "…On Windows, as described in the Supersizing article, you do not need to (in fact you cannot) reserve the huge pages before an application like a JVM can use them. You just need to enable the user's rights to "Lock Pages in Memory" and the requesting application will acquire the huge pages at runtime. Note that the allocation policy should thus be different from the Linux allocation policy because the Linux policy happened outside of the process context at page reserve time."…

Sharing declarative knowledge is often mixed with sharing procedural knowledge in this case. Sometimes, when engineers were introducing a step, they usually described and explained what the meaning of this step was before they continued to introduce the next step. In the first example given above, the engineer paused for a while to explain what the first set of code meant to his colleagues before he displayed the second set of code.

Causal Knowledge. Causal knowledge is also a typical type of knowledge shared on the AMD Developer Blog. As just mentioned, procedural knowledge is frequently shared on this blog, so it is not surprising that causal knowledge is also frequently shared. When sharing procedural knowledge, engineers usually briefly introduced the problems they had encountered or identified some technological issues in the first paragraph of their posts. Since the procedures they subsequently introduced dealt with how to solve those problems and issues, they needed to find the reasons why those problems and issues emerged. Thus, in this process, they were engaged in sharing both causal and procedural knowledge in a single post. In the first example mentioned above, only until the engineer found out why the initial code was not an appropriate one to solve the specific technological problems could he propose effective procedures to solve them.

Engineers can also be engaged in sharing causal knowledge when sharing declarative knowledge on the AMD Developer Blog. In the third example mentioned above, the reason why this engineer introduced to his colleagues "Huge

Pages and NUMA on Windows Operating System" is that he found that this function of Windows System can help them in Java applications.

Procedural knowledge, declarative knowledge, and causal knowledge all are the types of knowledge shared on the AMD Developer Blog. Engineers usually shared these types of knowledge simultaneously when writing their blogs.

How Engineers Use the AMD Developer Blog to Enhance Knowledge Sharing

Generally, engineers use this blog to enhance knowledge sharing in following ways. First, they shared their original personal knowledge through writing blogs. The three examples mentioned above both demonstrate that engineers were sharing their original personal knowledge. Second, they used this blog as a platform to provide some useful links, which can guide readers to some good resources. For example, an engineer described a wonderful social event designed for software developers (Sun Tech Days, Hyderabad) in his post. He mentioned that the objective to conduct this event is to explain to Java developers from or not from AMD why AMD cares about Java, what contributions they have made to the Java community, some useful tips for improving the performance of Java applications, and how AMD works with many software partners to optimize their applications. In addition to this introduction, the engineer pasted some useful resources links such as "performance analysis tools" for those who missed the event. Under this circumstance, the engineer was using the links on this blog as a kind of knowledge map.

Third, engineers also use this blog as a platform to release news about the workshops, events, and lectures that might enhance knowledge sharing. Sometimes they described in detail the contents of those workshops, events, and lectures. If just one engineer attended those activities, which were not so official, this engineer might still write a brief of the activities and share it with others on the AMD Developer Blog. For example, an engineer happened to give a series of workshops on AMD CodeAnalyst Performace Analyzer. He thought that this information might be helpful to other software developers. So he wrote a very long overview of some of the most useful features of this workshop on the AMD Developer Blog. Sometimes engineers just released the news and provided some related links. People who got the information might participate in those events, workshops and lectures.

Roles the AMD Developer Blog Plays in Enhancing Knowledge Sharing

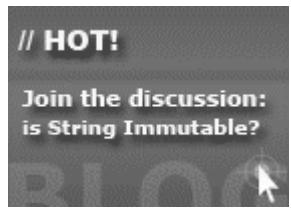
In this case, we can find that the AMD Developer Blog has several functions in enhancing knowledge sharing among engineers. First, it can prompt engineers to explicate their tacit knowledge and try to codify the tacit knowledge into explicit knowledge. The behavior of writing itself can prompt engineers to organize their thoughts and reflect their activities in a creative way. In Nonaka and Takeuchi's (1995) model, there is an externalization process in which tacit knowledge is transformed into explicit knowledge. Writing blogs can stimulate the externalization process. Engineers sometimes rely on their experience, sixth sense, or commitment (tacit knowledge) to find out the solutions to some problems. Although they cannot clearly describe those experiences, sixth sense or

commitment, they can reflect on them through writing and provide some kind of explicit knowledge based on their tacit knowledge on corporate blogs.

Second, the AMD Developer Blog provides a good platform for engineers to share their personal practice and prompt their individual knowledge to become collective/organizational knowledge. Many posts on this blog are on engineers' personal practice of using technical tools and programming, or on some tips to solve some problems they encountered in their daily work. As soon as they posted them on this blog, their individual knowledge became collective/ organizational knowledge, which is automatically saved for future reference.

Third, the AMD Developer Blog enhances communication among engineers, which subsequently prompts the knowledge sharing among them. Once being posted on this blog, engineers' posts can be seen by all of their colleagues. It is quite obvious that writing blog prompts the authors to share their knowledge with others. However, from the AMD Developer Blog, it is hard to find any evidence of interactions. It seems that the communication enhanced by the AMD Developer Blog is a one-way, rather than two-way, process. Most posts on this blog received zero comments. A good function of a blog is that it provides a good platform to enhance interactions through the function of posting comments. However, this function is not sufficiently utilized by AMD engineers. For example, an engineer initiated a discussion on the topic of "whether string is immutable or not" on the AMD Developer Blog. On the left side of the webpage, the hyperlink of this post was highlighted with a mark of "HOT!" on it (see Figure 1). However, this post just received two comments.

Figure 1



Discussion and Conclusions

This study explores how engineers use corporate blogs to enhance knowledge sharing based on a case study of the AMD Developer Blog. The findings suggest that engineers shared procedural knowledge, declarative knowledge, and causal knowledge on their blog and this often happened simultaneously. They shared their personal practice, released news about some workshops and events, which were designed to promote knowledge sharing and creation, and provided some kind of knowledge map on their blog. Writing blog not only prompts them to externalize

their tacit knowledge to explicit knowledge but also prompts their individual knowledge to become collective/organizational knowledge.

As demonstrated by the literature review, many studies examining knowledge sharing in online communities were conducted under the framework of Communities of Practice (CoPs) (e.g., Baalen et al., 2005; Gongla & Rizzuto, 2001; Pan & Leidner, 2003; Sharratt & Usoro, 2003). Thus, an immediate question is whether the AMD Developer Blog can be considered as a community of practice or not. A community of practice is defined as a group of people "informally bound together by shared expertise and passion for a joint enterprise" (Wenger & Synder, 2000, p. 139). Wenger (1999) identified three features of communities of practices: mutuality, joint enterprise, and shared repertoires. Mutuality refers to the reciprocity of relations between members; joint enterprise refers to the sharing of a common sense of belonging; and shared repertoires refer to the production of a common repertoire of languages, routines, artifacts, instruments, and styles.

Can the AMD Developer Blog be considered as a community of practice? Maybe. Based on the 97 posts, it can be concluded that engineers writing on this blog shared a common repertoire. It is hard to imagine that without a common repertoire, this blog would still be alive and active even today. However, we cannot conclude that there is reciprocity of relations between members based on these 97 posts. We can find very few comments on those posts. This is an indication of lack of interaction on the blog. In this case, we can just acquire the information about the activities of knowledge senders, without getting the information of knowledge receivers' activities. Thus, at least in this respect, we cannot make an argument that the AMD Developer Blog is a community of practice. Furthermore, we can get a sense that these engineers hold a high level of identification with their organization, but we cannot confidently conclude that they have a common sense of belonging. We need further evidence (e.g. evidence from a survey) to make intelligible judgment. Therefore, in AMD's case, we do not consider it as a typical community of practice. The AMD Developer Blog possesses some characteristics of communities of practice, but it still needs to be improved to become a community of practice.

Implications

This study has several practical implications. First, the findings of this study could prompt companies to realize that a corporate blog can serve as a good tool for knowledge sharing. As suggested by the study, a corporate blog can enhance communication among organizational members, prompts them to externalize their tacit knowledge, and prompts their individual knowledge to become collective/organizational knowledge. Companies will benefit from using corporate blogs properly to enhance knowledge sharing.

Second, this study also has significant implications on how to design a good corporate blog to enhance knowledge sharing. Is the AMD Developer Blog a good design? Through the analysis of messages posted on this blog, the researcher found that it is quite straightforward that this blog is voluntarily maintained by engineers. There are some good design elements on this blog. For example, based on the themes and topics of posts, they categorized those posts into various categories

such as "Inside Dev Central", "Hard-Core Software Optimization", "AMD High Performance Computing" (HPC), and "AMD Java Labs". If engineers want to browse all the posts on a special topic, they just need to click the hyperlinks attached to those categories. Moreover, the findings of this study suggest that there are some elements of knowledge mapping on this blog. For example, when engineers were discussing some technological issues, they often included some useful hyperlinks to guide their colleagues to some good resources. However, there is space for improvement regarding how to design "knowledge map" on this blog. Since this blog is maintained by engineers, in different positions and from different departments, it will be quite helpful to add a section on this blog to describe those engineers' positions, departments, contact information, and their expertise. It is technologically possible to link engineers' names appearing on the blog to the corresponding descriptions through hyperlinks. In so doing, a knowledge map can be established on this blog. Readers can find authors' information quite easily. If they want to further discuss the topics with the authors, they can contact them directly and refer to the knowledge map to gain a better understanding on their expertise.

As discussed above, there is a lack of interactions on the AMD Developer Blog. This might be because AMD not only has a developer blog, but also has some developer forums, on which there are a quite a lot of interactions. Sometimes, an issue raised on the blog might be discussed on the forum. Thus, engineers might find it is not necessary to leave comments on the blog, because they have some alternative means for interactions. Therefore, when examining corporate blog's functions in enhancing organizational knowledge sharing, it is important for researchers to locate this special technological tool in the context of this company's information systems. Different technological tools might have some common affordances for enhancing organizational knowledge sharing and might be replaceable with each other. The information systems of an organization might affect how a tool will be adopted and implemented in the organizational context. Examining the whole information context of the company will help researchers gain a better understanding of the functions of the corporate blogs.

Limitations

This study has several limitations. First, since this study just examined the messages posted on the AMD Developer Blog, it is hard for the researcher to examine why those engineers are willing to share their knowledge, namely, their motivations to share knowledge on this blog. Moreover, simply based on the examination of messages, the researcher does not know whether organizational members read those posts or not. If not, it is hard to conclude that this blog plays a significant role in enhancing organizational knowledge sharing. Even if this blog is read by many organizational members, by simply examining the posts the researcher still does not know why those readers did not leave comments on the blog. Future studies can adopt other research methods such as a survey or qualitative interviews to explore the motivators prompting engineers to share their knowledge on their corporate blogs. Future studies can also examine the communicative effects of this blog to answer

questions such as “do organizational members really read the blog?” and “why didn’t they leave comments on the blog?”

The other limitation of this study is concerned with the generalization of the findings. Since a qualitative method is adopted in this study, it is hard to generalize the results to a wider population. Moreover, since the case study just examined how engineers from a technology company shared their knowledge on their corporate blog, it would be naïve to apply the findings to explain how employees in other professions from other types companies share their knowledge on corporate blogs. Future studies can make some efforts to fill in this gap.

References

Baalen, P. V., Bloemhof-Ruwaard, J., & Heck, E. V. (2005). Knowledge sharing in an emerging network of practice: The role of a knowledge portal. *European Management Journal, 23(3),* 300-314.

Cho, S., & Huh, J. (2007, May). *Corporate blogs as a public relations tool: A content analysis applying the relational maintenance framework.* Paper presented at the annual meeting of the International Communication Association, San Francisco, CA.

Fleck, M., Kirchhoff, L., Meckel, M., & Stanoevska-Slabeva, K. (2007). Applications of blogs in corporate communication. *Studies in Communication Sciences, 7,* 227-245.

Gongla, P., & Rizzuto, C.R. (2001). Evolving communities of practice: IBM Global Services experience. *IBM Systems Journal, 40(4),* 842-862.

Hall, H. (2001). Input-friendliness: Motivating knowledge sharing across intranets. *Journal of Information Science, 27 (3),* 139-146.

Hall, H., & Graham, D. (2004). Creation and recreation: Motivating collaboration to generate knowledge capital in online communities. *International Journal of Information Knowledge Management, 24,* 235-246.

Hara, N. (2007). IT support for communities of practice: How public defenders learn from winning and losing in court. *Journal of the American Society for Information Science and Technology, 58 (1),* 76-87.

Hemetsberger, A., & Reinhardt, C. (2004). *Sharing and creating knowledge in open-source communities: The case of KDE.* Paper presented at The Fifth European Conference on Organizational Knowledge, Learning, and Capabilities, Innsbruck, Austria.

Hsu, M., Ju, T.L., Yen, C., & Chang, C. (2007). Knowledge sharing behavior in virtual communities: The relationship between trust, self-efficacy, and outcome expectations. *International Journal of Human-Computer Studies, 65,* 153-169.

Lee, G.K., & Cole, R.E. (2003). From a firm-based to a community-based model of knowledge creation: The case of the Linux Kernel Development. *Organizational Science, 14(6),* 633-649.

Lee, H., Park, S. R., & Hwang, T. (2008). Corporate-level blogs of the Fortune 500 companies: an empirical investigation of content and design. *International Journal of Information Technology & Management, 7,* 134-148.

Ma, M., & Agarwal, R. (2007). Through a glass darkly: Information technology design, identity verification, and knowledge contribution in online communities. *Information Systems Research, 18 (1),* 42-67.

Nonaka, I. (1994). A dynamic theory of organizational knowledge creation. *Organization Science (Providence, R.I.), 5(1),* 14-37.

Nonaka, I., & Takeuchi, H. (1995). *The knowledge creating company: How Japanese companies create the dynamics of innovation.* New York: Oxford University Press.

Pan, S.L., & Leidner, D.E. (2003). Bridging communities of practice with information technology in pursuit of global knowledge sharing. *Journal of Strategic Information Systems, 12,* 71-88.

Ruuska, I., & Vartianinen, M. (2003). Communities and other social structures for knowledge sharing: A case study in an Internet consultancy company. In M. Huysman, E. Wenger & V. Wulf (Eds.), *Communities and technologies* (pp.163-183). Deventer, The Netherlands.

Sharratt, M., & Usoro, A. (2003). Understanding knowledge-sharing in online communities of practice. Electronic Journal of Knowledge Management, 1(2), 187-196. Retrieved April 12, 2009, from http://www.ejkm.com/volume-1/volume1-issue-2/issue2-art18-sharratt.pdf

Tedjamulia, S.J.J., Olsen, D.R., Dean, D.L., & Albrecht, C.C. (2005). Motivating content contributions to online communities. *Proceedings of the 38th Hawaii International Conference on System Sciences, USA,* 193b - 193b.

Wasko, M.M., & Faraj, S. (2000). "It is what one does": Why people participate and help others in electronic communities of practice. *Journal of Strategic Information Systems, 9,* 155-173.

Wasko, M.M., & Faraj, S. (2005). Why should I share? Examining social capital and knowledge contribution in electronic networks of practice. *MIS Quarterly, 29(1),* 35-57.

Wenger, E.C. (1999). *Communities of practice: Learning, meaning, and identity.* New York: Cambridge University Press.

Wenger, E.C., Snyder, W.M. (2000). Communities of practice: The organizational frontier. *Harvard Business Review, 78,* 139-145.

Yin, R.K. (2002). *Case study research: Design and methods* (3rd ed.). Sage Publishing.

Zack, M. H. (1999). Managing codified knowledge. *Sloan Management Review, 40(4),* 45-58.

Generational Preferences for Knowledge Transfer

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Abstract

Due to the varied generations present in today's workforce, knowledge managers may need to consider generational learning preferences when determining the optimal methods for knowledge transfer. The author uses a literature review as well as survey data to define the generations and their learning preferences. The generations under consideration are the Traditionalists (born in 1945 or earlier), the Baby Boomers (1946-1964), Generation X (1965-1979) and the Millennials (born from 1980 onwards). Statistical data is used to verify or negate the findings of previous research. The results of the statistical analysis show that the majority of learning preferences have no relation to generation, with the notable exceptions of lecture and technology preferences. Storytelling, as expected, showed some of the highest ratings across the generations.

Introduction

Generational issues are a rising concern in many organizations. As Sharon McNamara (2005) explains:

> Never before have there been four distinct generations active in the workplace. The unique experiences of these generations can create not only age discrepancies but also value differences, gender issues, tension between cultures, and problems with team building and active participation in general. The events in members' lives and how they are perceived mold unique work attitudes. If you fail to accommodate these differences, your staff turnover rates, chapter membership, or Association membership could spiral downward (p. 1149).

Knowledge managers need to consider these observations when they are determining how to transmit knowledge throughout their organizations. We now have a workforce and population consisting of four distinct generations, generally defined in fifteen to twenty year categories, and formed and influenced by the massive changes that occurred in their childhoods. One of the questions we, as knowledge managers, must ask, is whether these formative events and generational differences will affect the manner in which our workers learn. Does each generation have its own learning preferences, or will the underlying commonality

of human nature create a learning preference with little variation based on age? Will the younger generations prefer technological methods that can be accessed asynchronously? Will the older generations prefer face-to-face learning experiences? Kogan (2001) writes:

> Accommodating the needs of employees ranging in age from 18 to 80, and motivating such a diverse workforce, are not easy tasks…But they are increasingly important as many managers and employees in the top two [Traditionalists and Baby Boomers] generational tiers contemplate the possibility of retirement within the next few years (p. 17).

North America is developing a workforce where grandparents and even great-grandparents are working with individuals the same age as their grandchildren and great-grandchildren (Kogan, 2001). Because of this close association, many managers are observing that an individual's generation can influence expectations and learning as much as gender or culture. This paper will attempt to uncover whether there are generational variations in learning preferences and, therefore, whether knowledge managers should approach the process of transferring knowledge differently based on the generation of the individual or if we can safely base our processes on uniform instructional methods.

Methodology

A review of current research and literature was necessary to begin the exploration of this question. The research was used to gain information and insight about the generations as well as to examine any previous results from studies concerning generational difference. The literature was also used to formulate questions for the survey. The survey is descriptive and designed to compare generational learning preferences amongst the sample population. The total sample size is small, including 23 individuals, with varying levels of education. Of those sampled, 10 are male and 13 female. There were 4 members of the Millennials, 5 members of generation X, 5 Baby Boomers, and 9 members of the Traditionalists. The majority of individuals who took the survey were drawn from the friends, family and acquaintances of the surveyor.

Data collection was conducted in several manners, mostly based on the preferences of the individual being surveyed. Some individuals were given surveys by email, other surveys were conducted in phone conversations, some surveys were distributed using a Facebook application, and one was conducted face-to-face. The phone and face-to-face surveys gave added benefit to the surveyor due to more immediate and complete feedback on all questions. All responses to the survey questions were voluntary. The email questionnaires included a brief paragraph with instructions for the survey.

The survey was created following the Likert scale model, with the respondent being asked about their level of agreement to a statement. The scale includes a rating of 1 to 5 with a rating of 1 being 'strongly disagree' and a rating

of 5 being 'strongly agree.' In total, the survey included eight questions that rated preference for: storytelling, mentoring, lectures, observation, brainstorming/group work, face-to-face learning, at-your-own-pace learning (by whatever method), web-based learning and media tools for learning purposes (videos, PowerPoint, etc.). There was also a free response question where the respondents were directly asked about their conscious learning preferences.

The results of the survey were then subject to descriptive summaries, statistical testing, and age demographic correlation.

Literature Review

According to the literature, there are four defined generations in our current workforce (Gibson, 2009). For the purposes of this paper, we shall call the generations the Traditionalists, the Baby Boomers, Generation X and the Millennials. First, we will define these four groups according to their general data, preferences, and characteristics as well as some observed learning preferences (note that these are generalizations and will not necessarily reflect every individual from each generation).

The Traditionalists. The Traditionalists are the oldest members of our workforce (born prior to 1946) (Walker, Martin, White, Elliott, Norwood, Mangum, & Haynie, 2006). This generation grew up during the Depression, WWII, the Korean War and the Vietnam War. Many of the men from this cohort served in the military during young adulthood. When they came back home, they often followed the then-contemporary ideals of a nuclear family with a home in the suburbs. Many, though certainly not all, of these individuals have little experience with computers and often have no desire to become 'wired' (Fox, 2001). Because of their experiences, the Traditionalists developed an attitude and reputation that included the following characteristics: respect for authority, loyalty, conservative, patriotic, faith in institutions, strong work ethic, and respect for rules (Gibson, 2009; McNamara, 2005). According to the current literature, some Traditionalist preferences are: scheduled meetings rather than drop-in conversations, thorough presentations of background information, defined goals/objectives, frequent updates and question and answer sessions (Gibson, 2009).

While most Traditionalists are at or near retirement age, many of these individuals are electing to remain in the workforce after retirement either as part-time workers or as consultants. Other members are electing to continue working full-time well past the traditional retirement age of 65. These individuals also "have vast experience, competence, wisdom, and knowledge" (McNamara, 2005, p. 1150). Due to their continued presence in the workforce as well as their immeasurable repositories of tacit knowledge, the Traditionalists remain a concern for knowledge managers.

The Baby Boomers. The Baby Boomers are probably the most discussed generation in American history. These were the children born between 1946 and 1964 and are approximately 80 million in number (Walker et al., 2006). This generation grew up during the supremacy of the suburbs, the nuclear family, women's liberation, the civil rights movement, space travel, the assassinations of

JFK and Martin Luther King, Jr., and the Vietnam War (Gibson, 2009; McNamara, 2005). Baby Boomers are seen as the most competitive of all the generations, with a massive drive to succeed and a willingness to work very long hours (they are said to have invented the 60-hour workweek) (Gibson, 2009). Like the Traditionalists, many of these individuals, especially the older members of the cohort, have little experience or training with computers and many only use technology because of job requirements (Fox, 2001). However, the Boomers differ from the Traditionalists on computers because among their numbers they include some of the first adopters and greatest enthusiasts of computer technology, such as Bill Gates. Over time the Boomers have developed an attitude and reputation that include the following characteristics: optimistic, questioning of authority, overworked (they live to work), living life in the fast lane, willing to challenge the status quo, and craving of recognition and respect (Gibson, 2009; McNamara, 2005). In the current literature, some Baby Boomer preferences are personal communication and rapport building rather than formal procedures, face-to-face communication, and flexibility of learning options (Gibson, 2009).

While most Baby Boomers are still in the workforce, many are suffering from burnout due to working long hours for many years. This is creating a need for more flexible schedules and working situations for the Baby Boomers to help them balance their lives and retain their knowledge for their organizations (McNamara, 2005). These flexible thinkers will continue to be the backbone of many organizations for at least the upcoming decade and knowledge managers cannot risk losing their skills and experience prematurely.

Generation X. Generation X is the smallest of all the generations, with approximately forty-six million members. The Gen-Xers were born between 1965 and 1979 (Walker et al., 2006) and their formative years spanned one of the most chaotic periods of American history, with most traditional societal bastions discredited or failing (including healthcare, the military, the presidency, and corporate America). This generation grew up during the disintegration of the traditional nuclear family, recession and the resulting massive corporate layoffs, inflation, AIDS, the Challenger explosion, the advent of the personal computer, the rise of technology in everyday life, and the supremacy of the media (Gibson, 2009; McNamara, 2005). Gen-Xers are considered to be, by far, the most cynical of all the generations, with little faith in corporations, company loyalty, or authority (Gibson, 2009). However, an independent spirit and a willingness to embrace change (especially concerning computers and technology) closely accompanied the cynicism developed by Generation X. The characteristics most commonly attributed to Generation X include: skepticism, independence, the belief in a work/life balance (unlike the Boomers, Gen-X works to live), adaptable, technologically savvy, efficient, lifelong learners, and multi-taskers (Collins & Tilson, 1999; Gibson, 2009; McNamara, 2005). In the current literature, some Generation X preferences are: no unnecessary meetings, preference/willingness to build relationships electronically, clear explicit instructions, mentors/coaches, storytelling, short lectures followed by group work, self-directed learning options, and online/media assisted learning options (Collins & Tilson, 1999; Gibson, 2009).

The Gen-Xers are some of the most dedicated learners in the workforce, especially when new technology is being introduced (McNamara, 2005). The independent nature, technological know-how, and willingness to take risks that define this generation will be a driving force in organizations for some to come.

Millennials/ Generation Y. The Millennials (also known as Generation Y) is the youngest generation. They are currently entering our workforce with the oldest members of the 76 million strong cohort being 29 years old. The Millennials were born from 1980 onwards (some sources begin cutting this generation off somewhere between 1995 and 2000) (Bennett, Maton & Kervin, 2008; Walker et al., 2006). The major events and developments for the Millennials were the prevalence of merged families, the ubiquitous presence and increasing prominence of technology, constant media coverage of all aspects of life, the Columbine shootings, cultural diversity, September 11, and the Iraq and Afghan wars (Gibson, 2009; McNamara, 2005). Millennials are generally associated with technology, as exemplified by McNamara's (2005) statement, "personal cellular telephones for safety and communication are a part of this generation's wardrobe. This is the digital generation, although technology has made the world an unnerving place" (McNamara, 2005, p. 1151). These "digital natives" (Bennett et al., 2008), besides being seen as one with technology, also have the reputation for acceptance of cultural diversity, optimism, volunteerism, realism, collaboration, team activities, acceptance of authority and rules, focus on a work/life balance (like the Gen-Xers), multi-tasking/multi-processing and critical thinking (Bennett et al., 2008; Gibson, 2009; McNamara, 2005). Bennett, Maton and Kervin (2008), however, note that recent studies have shown that the Millennials' use of technology (especially emerging technology) is far less than generally assumed, presumably due to the socio-economic conditions, cultural background, gender and career training of the individuals. In the current literature, some Millennials learning preferences are: advanced technology as communications devices, flexible environments that allow creative alternatives, question and answer sessions, frequent feedback in both directions, collaborative experiences and interactive group sessions, clear expectations and goals, technology, rewards, discovery based learning and structure with defined roles (Bennett et al., 2008; Collins & Tilson, 1999; Gibson, 2009). It is extremely important for us to understand the general mindset of the Millennials, since they are the upcoming force in the workplace and educational institutions, and they will remain in that position for the near future.

Literature Observations and Recommendations. The standard claim is that, while there are differences between generations, they are surmountable if they are recognized. According to McNamara (2005),

> We can find ways to understand who members of the various generations are and the "clash points" or "hot spots" where generations are most likely to collide. We also can examine human resource trends that affect an organization' ability to bridge the gaps between generations (p. 1149).

Many researchers also recommend looking at the various strong points of the generations and organizing your teams and learning programs accordingly. As stated by Hill (2004), "Your management experiments in pairing teams on this basis may leave you — and your multigenerational team — pleasantly surprised" (p. 35). Many managers have had to adjust to the varied responses from the different generations. For example, while the Traditionalists and Baby Boomers are likely to sit during a lecture, taking notes or listening, Gen-Xers and Millennials may already be experimenting with the subject matter rather than waiting for specific instructions (Kogan, 2001).

Not all research agrees, however, with the prevailing opinion concerning the variation of learning preferences among the generations. In fact, three different articles included at least some verbiage either directly opposing this idea or negating it to some degree. In the Walker et al. (2006) article concerning a learning preference survey of nursing students, the authors found that while there were some minor differences between the Traditionalist/Boomer teachers and their students:

> No statistically significant differences were found between Generation X and Generation Y students regarding their preferences for teaching methods. The majority of students of both generations indicated they prefer the lecture method, particularly compared to group work or Web-based learning. They also prefer skill demonstration to lecture material (p. 373).

Walker et al's (2006) findings are pertinent to this article, since many of its survey questions are of a similar nature and address similar concerns. The current survey, however, covers a wider spectrum of the population and focuses on all four generations, rather than the most recent two.

Furthermore, in a 2007 Pew Research article, Horrigan revealed that results of the study showed that while there were some intergenerational differences in technology adoption and preferences, technology adoption itself has followed similar patterns intra- and inter-generationally. Horrigan (2007) states:

> Not all people in or near their 30's got online at the same time, and the same is true when looking at people in their 40's and 50's. Each age cohort appears to have its technology champions who adopt early, with others then following (p. 49).

This indicates that no generation in its entirety truly has different preferences for technologies. The Bennett et al. (2008), article concerning digital natives reflects these findings in the statement "To attribute a particular learning style or even general preferences to a whole generation is…questionable" (p. 780).

Survey Expectations. The majority of sources in the current literature start from the standpoint that there is a difference in learning preferences and behavior between each of the generations. According to these observations, we can

expect to see some of the following results from our survey and from the free response questions/interviews (Hill, 2004; Kogan, 2001).

Traditionalists should exhibit:

1) Preferences for more traditional forms of learning, such as lecture and other face-to-face activities.
2) Lower levels of liking for online and media-assisted learning.
3) More interest in finishing set tasks with face-to-face interaction than more independent learning activities such as learn at your own pace or web-based options.
4) Ambivalence towards activities that are less structured, such as observation and mentoring.

Baby Boomers should exhibit:

1) Preferences for traditional forms of learning, such as lecture and other face-to-face activities.
2) Preferences for brainstorming and group-activity.
3) Lower levels of liking for online and media-assisted learning.
4) More interest in finishing set tasks with face-to-face interaction than more independent learning activities such as learn at your own pace or web-based options.

Gen-Xers should exhibit:

1) Preferences for independent activities and research.
2) A willingness and ability to use online tools and to include technology in learning.
3) Preference for learn at your own pace activities.
4) Less willingness to be involved in lecturing, group work, and mentoring programs.

Millennials should exhibit:

1) An increased interest in participative roles than in prior generations.
2) A willingness and ability to use technology and to include technology in learning.
3) Preferences for group work and team activities.
4) More interest in observing and experimenting.

It is this researcher's supposition that, since storytelling is a major factor in transmitting thoughts, beliefs and knowledge in most human cultures, all four groups will show preferences for storytelling (Dalkir, 2005).

Survey Results

Statistical Results. There were nine Likert scale questions in the survey. Listed below are the areas tested, with generational preference level recorded in order of highest preferences first. The average Likert scale score for each generation is written immediately after its title. Following the generational order of preference,

the data includes whether there was a significant difference between the averages. For this result, please note that, due to the small sample size, it was necessary to combine the 'older' generations (Traditionalists and Baby Boomers) into one group and the 'younger' generations (Gen-Xers and Millennials) into another. The number necessary for a recognized significant difference was .05. (See Appendix A for a graphical presentation of this data.)

Storytelling

Baby Boomers – 4.8
Traditionalists – 4.67
Gen-Xers – 4.6
Millennials – 4.5
No significant difference between Traditionalists/Boomers
and Gen-Xers/Millennials.

Lectures

Baby Boomers – 4
Traditionalists – 3.78
Millennials – 3.25
Gen-Xers – 2.4
There was a significant statistical difference between Traditionalists/Boomers
and Gen-Xers/Millennials. P is equal to .02.

Mentoring

Traditionalists – 4.33
Baby Boomers – 4
Gen-Xers – 3.6
Millennials – 3.5
No significant difference between Traditionalists/Boomers
and Gen-Xers/Millennials.

Group work

Traditionalists – 4.44
Baby Boomers – 4.2
Gen-Xers – 4
Millennials – 3.75
No significant difference between Traditionalists/Boomers
and Gen-Xers/Millennials.

Observation

Baby Boomers – 4.4
Gen-Xers – 4.2
Traditionalists – 4
Millennials – 3
No significant difference between Traditionalists/Boomers
and Gen-Xers/Millennials.

Face-to-Face Interaction

Traditionalists – 4.89
Baby Boomers – 4.6
Gen-Xers – 4
Millennials – 4
No significant difference between Traditionalists/Boomers
and Gen-Xers/Millennials.

Web-based Methods

Traditionalists – 4.2
Gen-Xers – 3.4
Millennials – 2.5
Baby Boomers – 2.2
There was a significant statistical difference between Traditionalists/Boomers
and Gen-Xers/Millennials. P is equal to .01.

Media Tools

Traditionalists – 4.4
Baby Boomers – 4.2
Gen-Xers – 4.2
Millennials – 3.25
No significant difference between Traditionalists/Boomers
and Gen-Xers/Millennials.

Learn-at-Your-Own-Pace/Independent Study

Gen-Xers – 4.2
Traditionalists – 4.1
Millennials – 4
Baby Boomers – 3.6
No significant difference between Traditionalists/Boomers and
Gen-Xers/Millennials.

Free Response Questions. The free response question (How do you like to learn new information?) present on all surveys was placed to see if there were any conscious intergenerational learning preferences. Some responses that seemed to fit the expected preferences, such as one Traditionalist's comment about paper-based tools versus online tools:

> I like having reference materials available at hand such as a thesaurus, Reader's Encyclopedia, etc. The hands-on feel of my own reference books is empowering to me and I like the feeling of being connected to objects that are familiar to me. I enjoy using the Internet to gather information, but sometimes find it frustrating when what I'm looking for is not readily available or not in a format that I'm familiar with.

For the most part, however, there was little commonality of preferences within generations. Visual learning and hands-on learning were mentioned by individuals from each generation, as well as independent learning methods and media tools. This question, in the end, revealed little statistically relevant data, but significant details as to how some people think of learning. One aspect that came up repeatedly in the answers was that everything depended on subject matter and its perceived importance or interest to the student. As stated by a 36-year-old Gen-Xer, "It depends if it's interesting or not. If I'm interested, I will learn in any way. If it is something I'm forced to learn, I find it hard to retain any information I see as useless—For example, calculus, trig and statistics." This may indicate that the best way to encourage learning amongst our workforce is not finding the appropriate teaching/knowledge transfer method, but instead finding ways to show the interesting aspects and/or importance of the knowledge we need to transfer.

The respondents who were interviewed in person or on the phone were given a second free response question. This question (Do you feel that other generations have different learning preference?) was designed to see how individuals from various generations viewed each other. In addition, if the respondents did exhibit generational expectations, were these expectations reflected in the survey or in the literature? This question received various and animated responses, two-thirds of which reflected the belief that there is a significant difference in learning preferences between the generations. The majority felt that the younger generations were much more inclined towards technology and technological options, possibly to the detriment of one-on-one interaction capabilities. These assumptions led to comments such as: "The modern generation is more visual, they like more visual aids. It is something they have gotten used to…they like push buttons and technology." Older generations were thought to prefer group work, formal learning processes, and memorization drills.

There were, however, individuals who disagreed with the prevailing sentiment. One Traditionalist, aged 67, felt that "The younger generations now are born with a keyboard in their hands. But all people have to keep up with the times.

For example, I don't know how to use a plow, but I do know how to use a car." She further indicated that, in her opinion, learning preferences were based mostly on personality with generational characteristics only reflected in the ability to access different methods, not the preference for different methods. A Gen-Xer, aged 39, took this idea in a different direction:

> No [there is no difference], because [learning preferences] depend on what you want to learn and what is the purpose of learning. You can see a good example when learning about a trade. For hundreds of years, this was not about reading or manuals but about liking, practicing, mentoring, witnessing, mastering…and if the purpose of learning is actually to get a job, you need to know where you have to follow certain procedures, and then you have to read manuals. For me, nothing has changed…it depends on what you want to learn about. I guess the point would be, actually, what is getting to be the most popular method nowadays compared to back in time. There is a big difference between the past and the present about how fast we get information, but…preferences…pretty much depends on the purpose.

These final opinions reflected the minority opinion observed in the literature review, which claimed that there was no significant intergenerational difference in learning preferences.

Discussion

In seven out of nine questions asked in the learning preferences survey, no significant difference was found between generations. In the case of storytelling, this result had been predicted in the literature, since storytelling was considered an important part of all cultures. In fact, storytelling had the highest overall learning preference of all the options. It should be examined as a major and preferred method for knowledge transfer. Formal knowledge transfer was predicted to be preferred by the older generations, such as the Traditionalists, and this prediction had a strong statistically significant confirmation. Lectures, however, are one of the least preferred forms of knowledge transfer for most Gen-Xers and Millennials. Training seminars should consider this fact when designing their procedures, so as to intersperse traditional lecture and presentation formats with other learning methods, preferably of a more informal nature. On the other hand, independent learning methods were surprisingly popular across all the generations, a result that is opposite the predictions formed by the literature review.

Interestingly, according to the survey results, there was a statistically significant difference between generations concerning web-based learning preferences, but it was exactly opposite the expectations of the literature and of the voiced expectations of the respondents. Older individuals showed a significantly higher preference for web-based learning, with the Traditionalists leading the pack.

Gen-Xers did show some liking for web-based methods, but they ultimately preferred other methods, such as storytelling. Millennials actually showed some of the lowest preferences for both web-based learning methods and media tools, contrary to all expectations. This, however, may be due either to sample size or to the fact that technology has become so ubiquitous in the lives of Millennials that it has become part of the background, like electric lights…something they don't even notice until it is missing.

While the responses to the majority of the statements did not show significant differences in preference, some level of disagreement between generations can be seen in many the results, including media tool use, observation and mentoring (several younger respondents stated that they "didn't like someone looking over their shoulder"). These results may be due to sample size error. With a larger sample size, the slight differences may disappear, or conversely, they may increase into more statistically significant results.

Summary

This article attempted, through a literature review and a survey, to determine if there were generational preferences for learning methods between the four generations currently present in our workforce. According to the majority of the literature, generational preferences are a reality for today's knowledge managers, especially concerning web-based technologies, formal lectures/presentations, independent methods, and group work (although there are some intergenerational commonalities such as storytelling). The survey results agreed that the older generations appreciate lectures much more than younger individuals and that storytelling bridges the generations. However, web-based methods showed the exact opposite preference predicted, with Traditionalists showing the most enthusiasm. The majority of individuals believe, rightly or wrongly, that there are distinct generational preferences.

Call for More Research

The need to know more about generational learning preferences is immediate in today's organizations and educational institutions. This paper was intended merely as a preliminary study and should be expanded upon in the near future. Of particular importance would be the creation of a new survey that would have a much larger sample size and reach a much greater slice of the population. For the current paper, one of the largest problems was the lack of diversity in the sample and the bias in sampling (family, friends, and acquaintances). For the best results, this survey should be repeated in diverse locations across the country with more random samplings of individuals.

Conclusion

Our current workforce is the first in history to include members from four generations, all of which play an important part of any knowledge management

program. The findings in this article show some definite considerations for knowledge managers and training professionals in the realm of web-based applications, storytelling and lectures. A helpful tactic, therefore, for any knowledge management program will be the skillful and appropriate incorporation of all these methods, especially since there is always a degree of intra-generational difference in learning preferences. The most positive results for knowledge managers, however, may stem simply from encouraging input so as to quickly identify and rectify any knowledge transfer issues in a multigenerational learning environment.

References

Bennett, S., Maton, K., & Kervin, L., (2008). The 'digital natives' debate: A critical review of the evidence. *British Journal of Educational Technology 39*(5), 775-787.

Collins, D., & Tilson, E., (1999). Profiling the Generation X learner. *Radiologic Technology, 70*(6).

Dalkir, K., (2005). *Knowledge Management in theory and practice*: Elsevier Butterworth-Heinemann.

Fox, S., (2001). Wired seniors. *Pew Internet & American Life Project*, 14.

Gibson, S. E., (2009). Intergenerational communication in the classroom: recommendations for successful teacher-student relationships. *Nursing Education Perspectives, 30*(1), 37-40.

Hill, K. S., (2004). Defy the decades with multigenerational teams. *Nursing Management, 35*(1), 4.

Horrigan, J. B., (2007). A Typology of information and communication technology users. *Pew Internet & American Life Project*, 55.

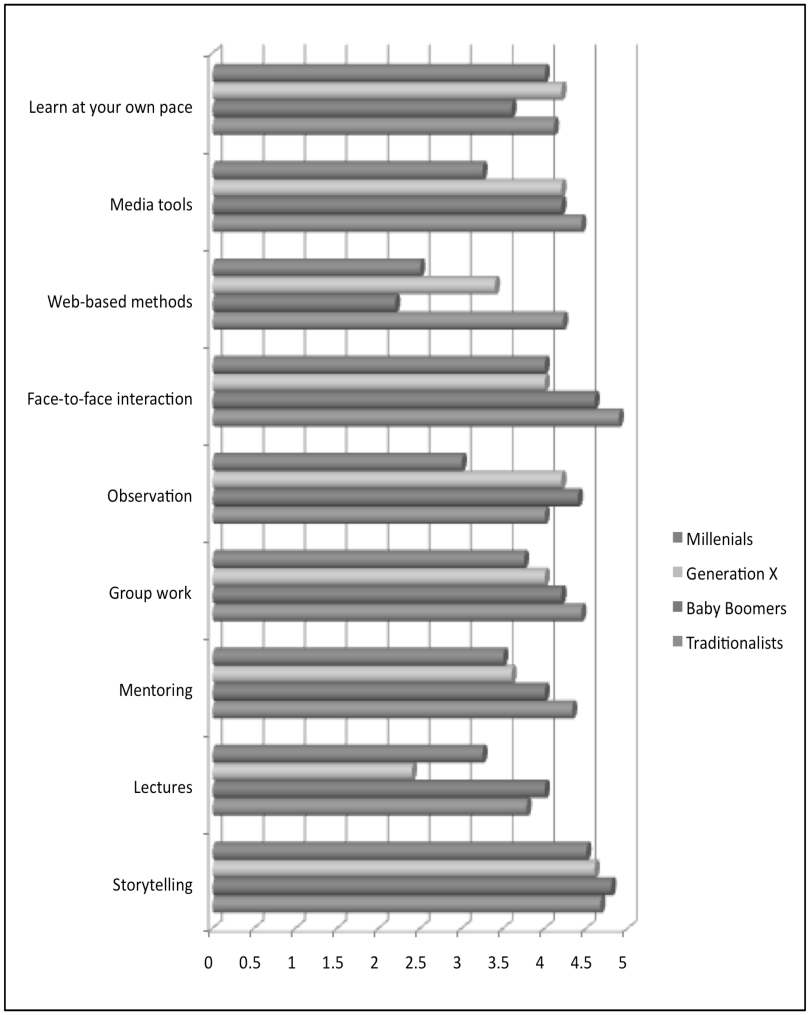
Kogan, M.. (2001). Bridging the gap across the generation divide in the federal workplace. *Government Executive, 33*(12), 16-21.

McNamara, S. A., (2005). Incorporating generational diversity. *Association of Operating Room Nurses, 81*(6), 1149-1152.

Stein, D. (2007). Selling across generation gaps. *Sales and Marketing Management, 159*(8), 9.

Walker, J., Martin, T., White, J., Elliott, R., Norwood, A., Mangum, C., & Haynie, L. (2006). Generational (Age) differences in nursing students' preferences for teaching methods. *Journal of Nursing Education, 45*(9), 371-376.

Appendix 1: *Generational Preferences for Knowledge Transfer*



A Proposal of the Topic Maps for Knowledge Management

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Abstract

This study aims to develop and propose a model to be used in organizing knowledge objects that can effectively support knowledge management. The proposed model, Topic Maps for Knowledge Management (TMKM) is developed based on topic maps, which is the international standardization that provides a way to represent information about knowledge structure of information resources. Topic maps have many strong traits in organizing information resources. This paper develops and proposes TMKM by applying several important characteristics of knowledge. When organizing knowledge objects by using TMKM, it is expected that it may encourage sharing and creation of both tacit and explicit knowledge and that it will eventually encourage knowledge management of any organization.

Introduction

There is a great deal of research about knowledge organization. However, even though those research studies use the term "knowledge," they often deal with organizing information resources rather than organizing knowledge objects. As Davenport (2000) notes, knowledge management is different from information management. Unlike information management, knowledge management includes sharing and creation of knowledge objects and it handles both tacit and explicit knowledge. McInerney (2002) defines knowledge management as an "effort to increase useful knowledge within an organization by encouraging communication, offering opportunities to learn and promoting the sharing of appropriate knowledge artifacts" (McInerney, 2002, p. 1014). To increment useful knowledge and encourage its smooth flow within an organization, knowledge should be structured in a way that encourages both creation and sharing of tacit and explicit knowledge. Thus, although both information and knowledge organization aim to make information easy to preserve, transfer, find, use, and reuse, organizing information resources and organizing knowledge artifacts should be differentiated.

A topic map is a relatively new way of organizing information; however, it works as a powerful tool to organize information resources and has a potential to be used as an effective tool to organize knowledge objects for knowledge management. The purpose of this paper is to develop and suggest a new model that can be used for organizing knowledge objects for knowledge management by

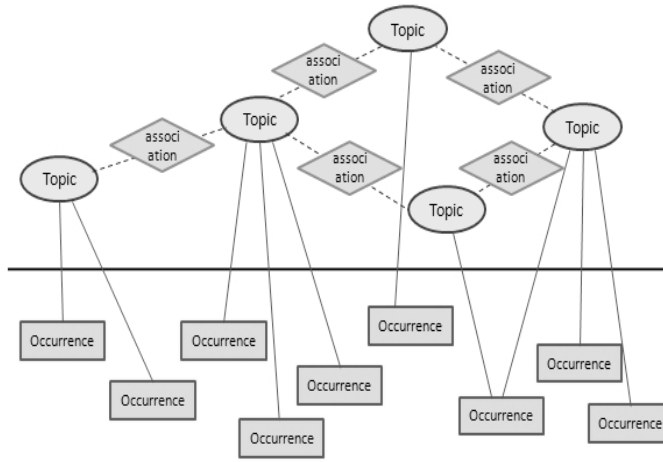
proposing a modified version of a topic map. This paper is organized as follows: In the next section, topic maps and related works are reviewed. In the third section, characteristics of knowledge are briefly described. The fourth section proposes a new topic map named TMKM, which is designed for knowledge management and supports creation and sharing of tacit and explicit knowledge. Finally, the last section draws conclusions.

Topic Maps for Information Organization

There are several ways to organize information, such as a thesaurus, taxonomy, ontology, metadata, and faceted classification (Alwert & Hoffmann, 2003; Garshol, 2004). Rather old and new, those ways of organizing knowledge objects all try to help users in finding and understanding the information resources. However, they only facilitate finding and understanding the knowledge partially, as they do not offer the whole picture of the structure of the information resources. For instance, classification certainly groups similar information resources together; however, it cannot show the relationship between categories other than a direct hierarchical relationship. Similarly, metadata gives good information about certain resources, yet it does not offer the structure and the relationships of all the information resources. A thesaurus offers controlled vocabularies that facilitate information retrieval, but does not provide the context and the intention of the search that merely information resources that use the same term are retrieved irrespective of the relevance of the context. On the other hand, topic maps let people understand the whole structure of the information and allow people to find information based on the individual context and meaning.

Topic Maps. There are two representative technologies for the semantic web. The first one is RDF (Resource Description Framework) and the second one is Topic Map. While RDF is a W3C (The World Wide Web Consortium) standard framework for encoding information on the Web (W3C, 2004), topic map is the international standardization that provides a way to represent information about knowledge structure of information resources (ISO 13250, 2002, p.iii). Topic maps organize information resources by using three main elements: topics, associations and occurrences. To be more specific, topics are subjects, associations are relationships among topics, and occurrences are individual information resources (ISO 13250, 2002). Topics can be any conceptual or physical object. Associations can describe any kind of relationships among topics. Occurrences can be in any format such as document files or video files. Topic maps consist of two different layers that are the knowledge layer and information layer. Topics and associations compose the knowledge layer, while occurrences form the information layer. The diagram, which shows conceptual structure of topic maps, is presented in Figure 1.

Figure 1: *Diagram of Topic Maps*



There are many advantages of using topic maps in organizing information resources. For instance, people can easily search and browse since resources are organized by topics (Garshol, 2004). Venkatesh et al. (2007) also asserted that topic maps provide flexible and powerful methods of searching and browsing contents. Moreover, topic maps represent the structure and the relationships among information resources that allow users to understand the whole picture of the knowledge structure, and also enable users to gain new knowledge and information by acknowledging related topics. In addition, topic maps provide user-centered interface that allow users to reflect their context and meaning when finding information resources.

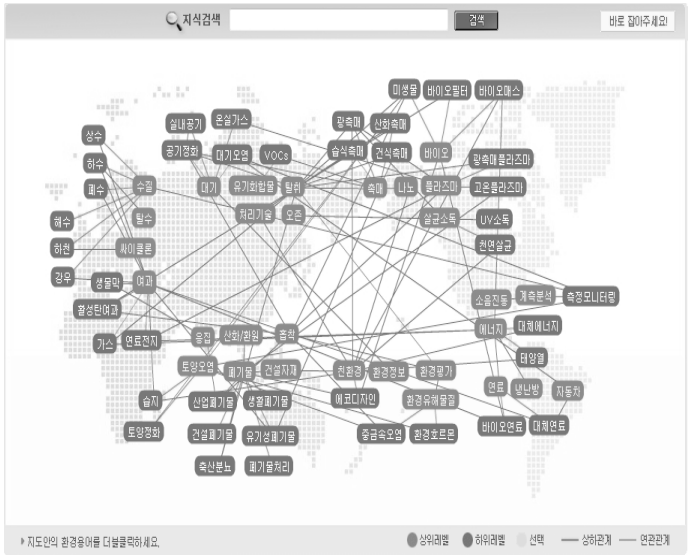
Related Studies. There are several studies that are related with topic maps. As a theoretical study, Garshol (2004) stated how topic maps can be used in organizing websites while explaining and comparing the relationships between topic maps and other traditional library science techniques such as metadata, subject-based classification, controlled vocabularies, taxonomies, thesauri, and faceted classification. The author also described some advantages and disadvantages of topic maps. Garshop concluded that topic maps can implement traditional library science techniques such as taxonomies and thesauri. In addition, faceted classification can be represented and reproduced by topic maps.

There are also studies about effectiveness of topic maps in information retrieval. Yi (2008) conducted an information retrieval experiment to explore how a topic map-based ontology approach has an impact upon user's searching performance. The author developed a topic map-based ontology information retrieval system and a thesaurus-based information retrieval system and compared their performances by measuring recall and search time. After the experiment, the

author found that a topic map-based ontology information retrieval system had a more positive effect on both recall and search time than a thesaurus-based information retrieval system. Thus, the author concludes that a topic map-based information retrieval system has the potential to let users easily and quickly access the contents of the web. Venkatesh et al. (2008) also conducted an information retrieval experiment by comparing a topic map condition and a search engine condition. After letting participants perform the tasks, the researchers compared the accuracy of performances and asked participants questions related to the search experience. The researchers found that participants who retrieved in the topic map condition had more accurate answers, and participants responded that they prefer topic maps to the search engine in researching a topic and answering questions about certain topics. Oh and Park (2006) also conducted a similar information retrieval experiment. The researchers analyzed an existing Korean folk music website, designed a topic map-based Korean folk music website and compared those two sites by retrieving various information queries. They concluded that the performance of the topic map-based website was better than that of the existing site in terms of searching time and steps. Moreover, a topic map-based website allowed users to easily access the web content even if they did not have specific knowledge about Korean folk music.

Related Cases. Currently, some web designers started to organize their web content by using topic maps. KONETIC (http://www.konetic.or.kr/) is a web portal that is developed and maintained by the Korea Institute of Environmental Science and Technology (KIEST), which is a subsidiary government institute. The main goal of the institute is making contributions to environmental preservation and the growth of environmental industries by promoting environment technology development. The web portal, KONETIC, is developed to provide professional environmental knowledge systematically. KONETIC collects information from official environmental information agencies, professional environmental institutions and many other environmental organizations and associations. According to the survey results present on the website, the main user populations of the website KONETIC are people who are either specialized or interested in environmental science and 93 percent said their job or study is related with environmental science. Users can search databases to find articles, specialists, technologies, reports, news, policies, and laws about environmental science and technology. In 2009, KONETIC renewed its website and implemented a new service called the Environmental Knowledge Map, which uses topic maps in organizing information resources so that users can browse the topics at a glance through the map. The main page of the Environmental Knowledge Map is presented in Figure 2.

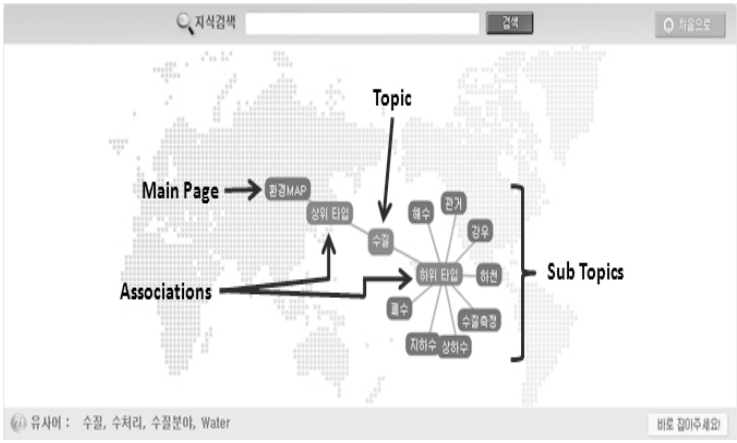
Figure 2: *The main page of the Environmental Knowledge Map*



Source: *http://map.konetic.or.kr/index.do*
(colors can be seen by accessing the websites)

The orange rectangles represent the topics and the gray rectangles are subtopics. The topics in the orange rectangles include nanotechnology, energy, atmosphere, ozone, the quality of water, etc. The subtopics in the grey rectangles include alternative energy, solar heat, air pollution, green house gases, sewage, wastewater, etc. As the space is limited, the site only shows two different levels of the topics and does not go further in the main page. The lines that connect topics represent the associations, which are the relationships among topics. The orange lines show that one topic is a subtopic of the other, while green lines indicate that two topics are related. Thus, through the topic map, users can see the whole structure of the knowledge and information, easily find the topics of their interests, and browse related topics. In addition, other topics that are related with their interest topics can be explored. When the user double clicks the topic, it shows only the associations that are directly related with the selected topic. In addition, the names of the associations are provided in green rectangles as shown in Figure 3. Among the topics, “the quality of water” is selected as an example.

Figure 3: *Topics and associations in the Environmental Knowledge Map*

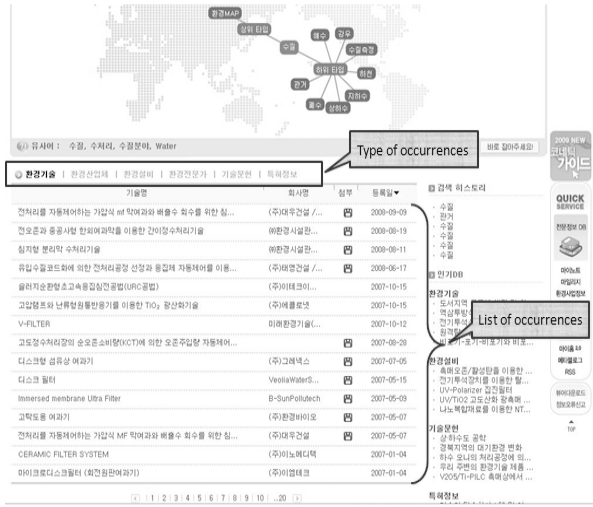


Source: *(http://map.konetic.or.kr/komap.do?topicid=lex1q3aklfk9-0)*

In Figure 3, at the left of the selected topic, the grey rectangle says "environmental map" which lets users go back to the main page. The green rectangle just next to it says "general," which offers the name for the association. The orange rectangle between green rectangles is "the quality of water," which is the selected topic for an example in this paper. The green rectangle next to it says "specific," which is the name for the association. Seven grey rectangles around the green rectangle named "specific" include sea water, water pipe, rain, river, measuring the quality of water, sewage, subterranean water, and waste water, which are all specific topics of "the quality of water." When the user double clicks on one of the subtopics, it shows sub-subtopics or related topics that are not shown in the main page with the names of associations.

Below the knowledge map, occurrences of each topic are listed and classified by the types, which are environmental technology, environmental industry, environmental equipment, environmental specialist, scholarly articles, and patent information, as shown in Figure 4.

Figure 4: *Types and list of occurrences*



When the user clicks on specific occurrences from the list, the knowledge map represents this occurrence in a blue rectangle as shown in Figure 5. Below the knowledge map, the occurrence file opens, replacing occurrences list.

Figure 5: *Topics, associations and occurrence in the Environmental Knowledge Map*

Source: *(http://map.konetic.or.kr/kopatentview.do?topicid=lex1q3aklfk9-0&viewtopic=lex1ptl45irl-0&kodbname=PATENT&koviewnum=21498)*

Another case is the Treasure Island of Wisdom, which is the service provided by Dongdaemun-Gu Public Digital Library in Korea. To use the service, signing into the site is necessary. In the Treasure Island of Wisdom, books are organized under the name of some famous scholars, and scholars who are related are grouped into the same village. Thus, in the Treasure Island of Wisdom, the village is "topic type," which is a group of certain topics, and each famous scholar is a topic. Occurrences are books related to the scholar. The main page of the Treasure Island of Wisdom is displayed in Figure 6.

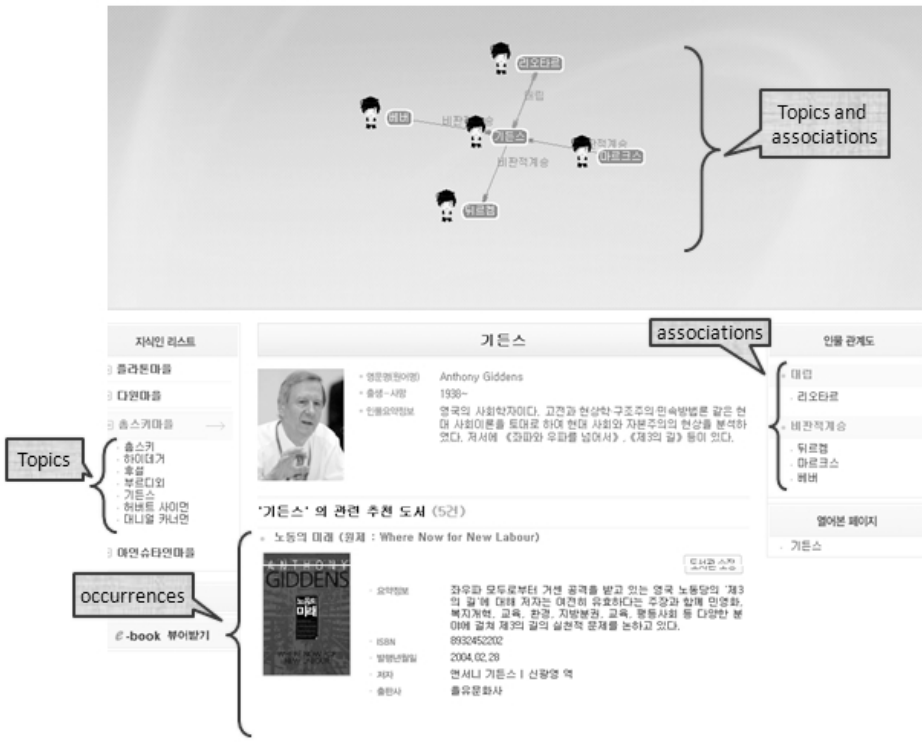
Figure 6: *The main page of the Treasure Island of Wisdom*

Source: *http://www.l4d.or.kr/dlsearch/new_ddl/homedata/topicmap.asp*

In the Treasure Island of Wisdom, there are four villages, which are the village of Chomsky, the village of Darwin, the village of Plato, and the village of

Einstein. When users click on the village of Chomsky, for instance, and choose Giddens, for example, the knowledge map shows the relationships between Giddens and other scholars, which are associations. Also, below the map, information about Giddens and the books related to Giddens show up for the users. In addition, other related scholars (topics) and the relationships among them and Giddens (associations) are presented at the side of the website. Thus, in this page, topic, association, and occurrences can be seen at a glance as shown in Figure 7.

Figure 7: *Topics, associations and occurrence in the Treasure Island of Wisdom*



As presented, there is literature about the usefulness and effectiveness of topic maps in organizing websites. However, most research evaluated the efficiency of topic maps in terms of information retrieval rather than knowledge management, which has its emphasis on sharing and creating explicit and tacit knowledge. Similarly, most websites that organized their contents by using topic maps such as the Environmental Knowledge Map and the Treasure Island of Wisdom, organized

information resources for searching and storage, but not for knowledge management.

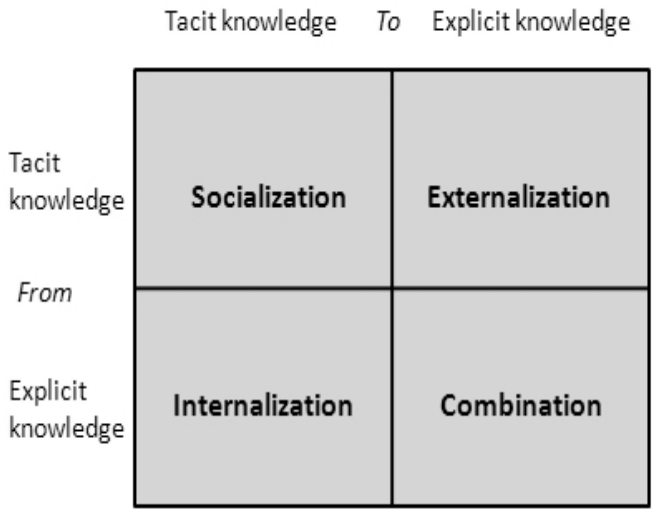
To sum up, even though current cases that use topic maps showed the usefulness of topic maps in organizing web contents, they did not support knowledge sharing or creation and could not elicit tacit knowledge. In other words, it seems quite evident that topic maps facilitate accessing, retrieving and even gaining knowledge objects. However, topic maps for knowledge management should support knowledge sharing and creation as much as accessing, searching and gaining knowledge. Moreover, they need to deal with both tacit and explicit knowledge. Therefore, to effectively organize knowledge objects for knowledge management, it is necessary to understand and reflect characteristics of knowledge. The next section will explain some important characteristics of knowledge.

Characteristics of Knowledge

Davenport and Prusak (1998) explained that knowledge resides inside of the knower, a person who has that knowledge. In addition, knowledge is often embedded not only in physical documents or repositories, but also in the routines, processes, and practices. This explanation reveals fundamental characteristics of knowledge. Firstly, knowledge originates and is embedded inside the knower, which is a human being.

Secondly, knowledge can be embedded in documents or in repositories, as well as routines, processes, and practices. Here, the former kind of knowledge is called explicit knowledge while the latter is called tacit knowledge. Tacit knowledge is the knowledge that is not clearly revealed, shaped and articulated. It is developed from experiences, reside in the mind of human, and usually shared through storytelling, informal communication, and imitation. (Wagner-Dobler, 2004; Zack, 1999). On the other hand, explicit knowledge is knowledge that can be easily articulated, explained, and documented (McInerney, 2002; Zack, 1999). Thus, for knowledge management, it is important to have access to, create, and share both kinds of knowledge. Nonaka and Takeuchi (1995) proposed a popular model called SECI model, which is displayed in Figure 8. This model shows the process of creating and gaining knowledge through the interactions between tacit and explicit knowledge. Nonaka and Takeuchi explain that there are four modes of knowledge conversion as shown in Figure 8.

Figure 8: *The SECI model*



Source: *Adapted from Nonaka & Takeuchi (1995, p.62).*

The first mode of conversion is from tacit knowledge to tacit knowledge, which is socialization.; the second mode of conversion is from tacit knowledge to explicit knowledge, which is externalization; the third mode of conversion is from explicit knowledge to explicit knowledge, which is combination; and the fourth mode of conversion is from explicit knowledge to tacit knowledge, which is internalization (Nonaka & Takeuchi, 1995). Through these four conversions, knowledge is created. Among the aforementioned four conversions, two conversions are directly related to knowledge organization: externalization and combination. When organizing knowledge, it is impossible to organize knowledge itself because it resides in people. Thus, conversions such as internalization and socialization that transform knowledge into tacit knowledge, are not directly related to organizing knowledge. What can be organized are knowledge objects, the artifacts that contain knowledge as they are created by people who have knowledge. Examples of such knowledge objects are books or documents. Thus, as knowledge cannot be organized when it is not expressed or represented in forms of objects or artifacts. The SECI model shows how the conversion to explicit knowledge through externalization and combination, are directly related with knowledge organization. Therefore, to organize knowledge for knowledge management, that is creation and sharing of both explicit and tacit knowledge, tacit knowledge should be externalized, and explicit knowledge needs to be combined.

While combining explicit knowledge has been done through other information organization tools, the knowledge organization tool that supports externalizing tacit knowledge is rare. Considering that tacit knowledge is usually embedded in routines, practices, experiences, and processes, and as Wagner-Dobler and Zack stated, it can be expressed somehow in a form of stories or imitations; tacit knowledge could be expressed through demonstration of the knower's practices and processes in a form of stories.

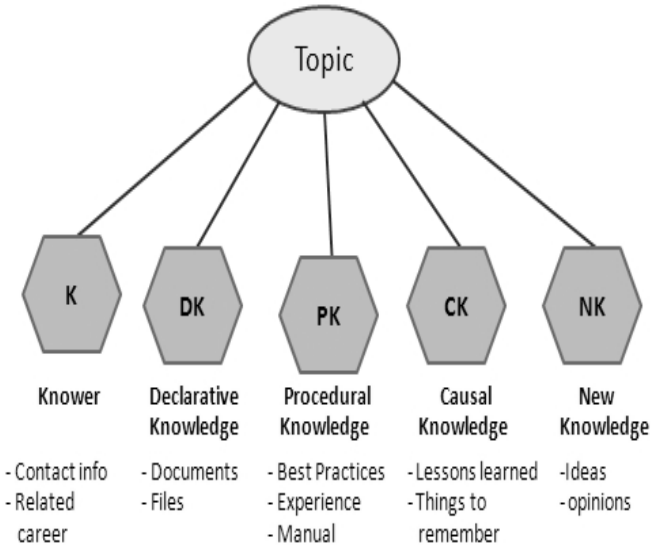
Besides tacit and explicit knowledge, Zack introduced three different types of knowledge: declarative knowledge, procedural knowledge and causal knowledge. Declarative knowledge includes explicit information and knowledge about certain concepts or objects. Procedural knowledge contains a process of something such as how something occurred, performed or done. Causal knowledge includes the reasons for some happenings and events. Thus, all three different types of knowledge should be organized for the knowledge management.

To sum up, knowledge rests in people, knowledge can be tacit and explicit, as shown in the SECI model where externalization and combination are directly related to knowledge organization. There are three different types of knowledge: declarative, procedural and causal. In addition, creative ideas and opinions are crucial in knowledge management. Therefore, to organize knowledge objects for knowledge management, it is important to lay emphasis on people who have knowledge about certain topics or issues who can handle both explicit and tacit knowledge. They should provide an environment that facilitates externalization of tacit knowledge and combination of explicit knowledge and support the creation and sharing of declarative, procedural and causal knowledge. In the following section, a model that reflects those characteristics of knowledge is developed and proposed.

Proposal of the Topic Map for Knowledge Management (TMKM)

In this section, a new topic map model is developed and proposed—the Topic Map for Knowledge Management (TMKM). The TMKM shares some basic structure of topic maps in that it uses topic, association, and occurrence as main elements. However, the TMKM is further developed to reflect characteristics of knowledge that may emphasize the knower, facilitate creation and sharing of both tacit and explicit knowledge, and handle declarative, procedural and causal knowledge. In addition, the TMKM has four elements: topic, types of knowledge, association, and occurrence, while the topic map has only three main elements: topic, association, and occurrence. Thus, the "types of knowledge" element is added on the existing topic map elements. This new element is placed under each topic and is composed of five different categories: the knower, declarative knowledge, procedural knowledge, causal knowledge, and new knowledge. The new element, "types of knowledge" with five categories is shown in Figure 9.

Figure 9: *Types of knowledge in the TMKM*

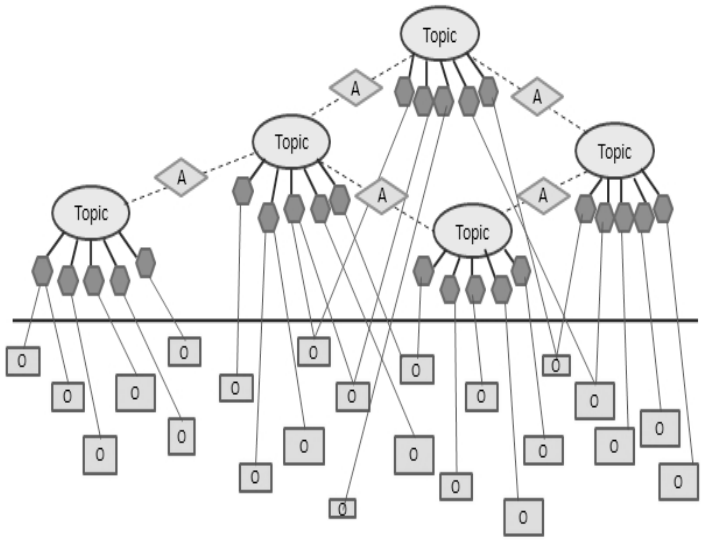


As shown in Figure 9, "types of knowledge" is composed of five categories and is placed under a topic. In Figure 9, the letters in the hexagons are initials of those five categories. In this model, the first category, the "Knower," represents the experts or specialists of the topic. Each topic needs to have the link to the expert of the topic so that people can recognize whom they should consult with when they have any issues or questions about the topic. Thus, unlike a topic map, which deals with "human" as one of the topics, in the TMKM, "human" is not a topic but a category of the "types of knowledge." The specific occurrences of the knower may include contact information of the knower and the knower's career of specialties that are related to the topic. There can be more than one knower to each topic and a knower can be an expert in more than one topic.

The second category, "Declarative Knowledge," is knowledge that is explicit. This type of knowledge is most common in current information systems and databases. Hence, the occurrences of declarative knowledge may include various formats such as documents, video files, images, presentations, and so on. The third category, "Procedural Knowledge," is knowledge about "know how," which can externalize tacit knowledge. Any best practices, i.e. experiences that are related to the topic, can be represented as a procedural knowledge in a form of stories, manuals, and cases. This category might be useful in facilitating creation

and sharing of tacit knowledge. The fourth category, “Causal Knowledge” is the reason for some happenings and the events. The occurrences of this category may contain lessons learned through certain process of events, tips or things to remember that are related with a certain topic. This knowledge may be quite informal compared to other categories of types of knowledge, yet it is crucial as this type of knowledge also can externalize tacit knowledge. Finally, the fifth category, “New Knowledge,” encourages suggesting and sharing any new ideas and opinions that are related to the topic. This category may also be informal; however, this category is included as one of the five categories as sharing new ideas and opinions would facilitate knowledge creation and sharing. The whole structure of the TMKM that includes topics, associations, types of knowledge, and occurrences is represented in Figure 10.

Figure 10: *Topic Map for Knowledge Management (TMKM)*



In Figure 10, ovals represent topics, which are subjects including any conceptual or physical objects. Diamond shapes with the letter “A” indicate associations, which are relationships among topics. Five hexagons under each topic represent five categories of types of knowledge that are the Knower, Declarative Knowledge, Procedural Knowledge, Causal Knowledge, and New Knowledge. The rectangles with a letter “O” indicate occurrences, which are individual knowledge objects. In the TMKM, topics, associations, and types of knowledge form the knowledge layer, while occurrences compose the information layer.

Conclusion

This paper developed and proposed the Topic Map for Knowledge Management (TMKM). A topic map is a relatively recent way of organizing knowledge objects; however, its effectiveness in organizing web contents is now being recognized. Topic maps facilitate access, browsing and searching of the web content, provide holistic structure of the contents, and helps users to gain new knowledge through the associations. Moreover, topic maps allow users to reflect their context and meaning when finding knowledge objects.

However, current topic maps do not stress the knower who has knowledge and do not support sharing and creation of both tacit and explicit knowledge. In addition, they do not reflect three different types of knowledge—declarative, procedural, and causal knowledge. Additionally, current topic maps do not provide effective ways of organizing knowledge objects for knowledge management.

Thus, this paper developed and proposed the TMKM, which is a topic map for knowledge management, by applying some important characteristics of knowledge. When organizing knowledge objects by using the TMKM, it is expected that it may encourage knowledge sharing and creation that will eventually encourage knowledge management within the organization.

References

Davenport, E. (2004). Organizations, knowledge management and libraries: Issues, opportunities and challenges. In H. Hobohm (Ed.), *Knowledge Management: Libraries and Librarians Taking Up the Challenge*. (pp.81-89). Munchen: Saur.

Davenport, T., & Prusak, L. (1998). *Working knowledge*. Boston: Harvard Business School Press.

Garshol, L. M. (2004). Metadata? thesauri? taxonomies? topic maps! making sense of it all. *Journal of Information Science, 30(4)*, 378-391.

International Standards Organization ([ISO], 2002). *ISO/IEC 13250- Topic maps*. Retrieved March 9, 2009, from www.y12.doe.gov/sgml/sc34/document/0322_files/iso13250-2nd-ed-v2.pdf

McInerney, C. R. (2002). Knowledge management and the dynamic nature of knowledge. *Journal of the American Society for Information Science and Technology, 53*(12), 1009-1018.

Nonaka, I. & Takeuchi, H. (1995). *The knowledge-creating company*. New York: Oxford University Press.

Oh, S. G. & Park, O. N. (2006). A study of developing and evaluating a pansori retrieval system using topic maps. *Journal of Korean Library and Information Science Society, 36*(4), 77-98.

The World Wide Web Consortium. ([W3C], 2004). Resource description framework (RDF): Concepts and abstract syntax. Retrieved March 31, 2009, from http://www.w3.org/TR/rdf-concepts/

Venkatesh, V., Shaw, S., Dicks, D., Lowerison, G. Zhang, D., & Sanjakdar, R. (2005). Topic maps: Adopting user-centered indexing technologies in course management systems. *Journal of Interactive Learning Research 18*(3), 429-450.

Yi, M. (2008). Information organization and retrieval using a topic maps-based ontology: Results of a task-based evaluation. *Journal of American Society for Information Science and Technology, 59*(12), 1898-1911.

Zack, M. H. (1999). Managing codified knowledge. *Sloan Management Review, 40*(4), 45-58.

How Technology Will Save the World! A Study of the Implementation of Decision Support Systems (DSS) in Environmental Planning

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Abstract

State, local, and national governments often struggle to balance competing demands for residential, commercial, and industrial development with imperatives to minimize *environmental* degradation. In order to effectively manage this development process on a sustainable basis, planners and government agencies are increasingly seeking better tools and techniques. Decision Support Systems (DSS) are almost invariably designed to function in rational, or rationalized, decision making environments. With the future of our environment a forerunner in many prominent public issues, DSS have already been put in place to help with environmental decision-making. In this paper, we will see two case studies of DSS implementation into better future planning in terms of our environment.

Introduction

Environmental information and DSS have emerged over the last few decades as important tools for environmental planning and management. Environmental problems, from urban and industrial pollution to natural and technological hazards, keep growing, driven by local and global population growth and an ever-growing consumption of energy and materials. However, especially in the most advanced and industrialized countries, most of the simple decisions with large pay-offs have already been taken and implemented into society. What remains in most cases is the need for fine-tuning of the relationship among technology, the economy, and the environment.

In order to effectively manage this process on a sustainable basis, local government planners increasingly rely on the use of information technologies, spatial modeling techniques, Spatial Decision Support Systems (SDSS), Environmental Decision Support Systems (EDSS) and Web-based Spatial Decision Support Systems (WEBSDSS), for their combinations of remote sensing, spatial modeling, and Internet Technology (Fedra, 1995).

What is Knowledge Management?

For starters, in the simplest terms possible, knowledge management (KM) refers to the acquiring, organizing, storing, sharing, and using knowledge by organizations. KM is a branch of management that aims at attaining the optimum business performance through the synergy of people, processes, and technology in creating and sharing relevant knowledge (Nonaka, 1991). It is a universally accepted idea that to succeed in any venture, a certain amount of knowledge is required. KM is a tool used to discover what an organization already knows through the codifying of tacit knowledge and data mining, and building upon that basic knowledge present.

What are Decision Support Systems?

DSS are a specific class of computerized information systems within the KM realm that supports business and organizational decision-making activities. A properly designed DSS is an interactive software based system intended to help decision makers compile useful information from raw data, documents, personal knowledge, and/or business models to identify, solve problems, and of course, make decisions (Power, 2007).

There are numerous different kinds of DSS, including, but not limited to, model-driven DSS, data-driven DSS, document-driven DSS, as well as Web-based DSS. Beginning in approximately 1994, the World Wide Web and a global Internet provided a technology platform for further extending the capabilities and deployment of computerized decision support, what would later be coined as DSS. DSS Research Resources was started as a web-based collection of bookmarks. By 1995, the World Wide Web was recognized by a number of software developers and academics as a serious platform for implementing all types of DSS (Bhargava & Power, 2001).

Spatial Decision Support Systems (SDSS) are interactive, computer-based systems designed to support a user or group of users in achieving a higher effectiveness of decision making while solving a semi-structured spatial problem. SDSS are designed with the idea of assisting the spatial planner with guidance in making land use decisions (Bhargava & Power, 2001). SDSS are more commonly associated with environmental planning and management, however in most cases, DSS that deal directly with environmental issues and decision making are commonly just referred to as Environmental Decision Support Systems (EDSS).

A large variety of EDSS have been developed for water management decisions in particular over the years. EDSS developed thus far could be divided into two broad types in terms of function. The first type includes the Geographic Information System (GIS) based decision support systems developed for regional system analysis. Most EDSS belong to this type. The second type of EDSS is a graphic-based environmental information system (Leung, 2005).

Implementation of DSS in Environmental Planning

Case Study 1

China's Pearl River Delta in the Guangdong Province. In China, as in many other developing nations, achieving economic growth frequently seems to come at the expense of environmental quality. In order to achieve sustainable economic growth and to protect the environment, China needs to integrate environmental planning into economic planning and to allow the former to guide the latter. In recent years, the combination of favorable natural conditions, enticing regional development policies, and overseas Chinese investments, have brought on rapid and tremendous population and economic growths in the Pearl River Delta of China. Unfortunately, but not unexpectedly, accompanying rapid economic development and urbanization in the Delta region has been a series of environmental problems; most noticeable is the serious pollution of the river water (Hu & Lin, 1991).

For managing complex tidal river networks, like the Pearl River Delta area, it is necessary for the DSS to include a river network environmental database management system, the local river hydraulics and water dynamics models, an environmental impact assessment model, a query system, and a problem analysis and processing system. In order to make complicated mathematical models user-friendly for environmental decision-making, it is necessary for the capability of model manipulations to be enhanced and incorporated into an EDSS (Leung, 2005).

In the Pearl River Delta area, they use a Tidal River Network Water Quality (TRNWQ) EDSS. The major functions of the TRNWQ include:

- To predict seasonal tidal flow conditions at various river sections, such as the time and elevation of high tides and low tides and the upper boundary of tidal current, and the locations where tidal waves from different entrances meet.
- To predict the routing of floods under tidal influence utilizing methods beyond the traditional upstream to downstream flood routing in hydrology. The model takes into consideration the interaction of river flows and tidal waves in order to achieve more accurate prediction.
- To forecast and analyze the impact of channel construction and water diversion projects upon downstream saltwater boundary and water quality.
- To estimate low flows of the river network, which is important to the calculation of environmental carrying capacity of water and water quality planning, such information cannot be obtained from conventional statistical methods in the context of a tidal river network.
- To analyze the impact on water quality from major pollution sources. This is crucial to all environmental impact assessments.
- To determine, through back calculation using a trial and error method, the permitted effluent loadings for the cities or the disposal sites. These provide a basis for the control of total loadings (Leung, 2005).

TRNWQ stores the calculation results in a set of temporary binary working files. The EDSS then provides the user with four manipulations for the purpose of performing query and generating visual display of the calculation results. As a decision support system, the EDSS has gained wide acceptance in water quality analysis and environmental decision-making for the Pearl River Delta. The EDSS has also been used to study temporal tidal currents in Hong Kong, site selection of sources for water supplies in Xi Jiang, Dong Jiang, and Bei Jiang, the impact of water transfer from Xixianjiao for pollution flushing on the downstream movement of the saltwater boundary, and the impact of the Dong-Shen water transfer scheme on the upstream movement of the saltwater boundary (Leung 2005).

Implementation of DSS in Environmental Planning

Case Study 2

Columbia, Missouri. As per the Missouri Census Data from 2001, Columbia, Missouri, is one of the fastest growing Metropolitan Statistical Areas in Missouri with a population increase of over 20.5 percent between 1990 and 2000. In response to this development pressure, local planners and stakeholders need assistance in developing smart growth policies that allow for growth while preserving water quality, reducing storm water runoff problems, and protecting local natural areas. To do this, it is necessary to evaluate a wide range of information and to analyze alternative development strategies (Sugumaran & Meyer, 2004). Therefore, in an attempt to confront storm water management issues, a Web-based Environmental Decision Support System (WEBSDSS) must be used to identify and prioritize local watersheds using multiple environmental criteria.

The WEBSDSS design is based on the client/server model in which clients send requests to services running on a server and receives appropriate information in response. Client-server architecture was used because it facilitates maintenance of the application and its data layers. In addition, the functionality of the application can be upgraded or replaced at any time without affecting the user's computer system (Sugumaran & Meyer, 2004). In addition, this application utilized a Java applet-based AcIMS. The Java functionality used here is integral to the Web browser's Java Virtual Machine and does not require the user to install any additional components. This is particularly helpful to users in large organizations and government institutions who often do not possess user access permissions to install software or web browser plug-ins on their own workstations.

Unlike the EDSS that was used for decision-making in China, this WEBSDSS was available for the public to use, undoubtedly one of the major factors in its easy to navigate format and interface. While this project underwent development and management, the WEBSDSS homepage was available to the general public at http://maproom.missouri.edu/analysis/esi/index.asp. The homepage explained the intended goals of the project. Clicking the "start program" that was located at the top of the homepage started WEBSDSS. Upon entering the interactive page, the user could display the data layers and also, perform analysis. WEBSDSS

used standard image/GIS data browsing tools such as zoom in, zoom out, pan, all built into MapCafe to allow its users to interact with the map display; in fact, it operated more like a game than an EDSS (Sugumaran & Meyer, 2004). When used to query a watershed in the GIS layer, the tool brought up a table showing the model results and other attribute information for the selected watershed.

This web-based system provided the user with a simple decision support tool to identify and prioritize local watershed environmental sensitivity using a simple point source MCE model. This system could be viewed and implemented by planners and mangers within local government, the general public, real estate developers, environmental analysts, and basically anyone else who was interested.

Conclusion

Most metropolitan areas around the world are rapidly growing; therefore, many kinds of urban problems related to land use, transport, and the environment are emerging. To improve urban management in the region, a top priority is to strengthen the capacity for planning and policy implementation through better coordination among related planners, managers, agencies, etc. This would be aided by an effective analysis tool for planning with which related agencies could substantially discuss policies and implementing measures. DSS provide a practical approach for the integrated planning of land use, transport and the environment in a developing metropolis. It stresses operational and conceptual simplicity as well as flexibility for applicability. As in the two case studies in this paper, DSS can vary in design, interface, usability, and numerous other factors. However the end result is the same: DSS offer the answers we need in the simplest ways.

References

Bhargava, H. & Power, D. J. (2001). Decision support systems and Web technologies: A status report. *Decision Support Systems, 19*(3), 193-214.

Fedra, K. (1995). Decision support for natural resources management: Models, GIS, and expert systems. *AI Applications,* 9, 13-19.

Hu, K. P. & Lin, K. (1991). Study on the economy development and environmental decision making support system. *Academic Reports Collection of South China Institute of Environmental Science,* translated online.

Leung, Y. & Lee, Y. (2005). An environmental decision support system for the management of water pollution in a tidal river network, *International Journal of Geographic Information Science, 19*(4), 483-500.

Nonaka, I. (1991), The knowledge creating company. *Harvard Business Review,* 69 (6 Nov-Dec.), 94-104.

Power, D. J. (2007 March). A brief history of decision support systems, *DSSResources.com*.

Sugumaron, R., Meyer, J. C. (2004). A Web-based environmental decision support system (WEBSDSS) for environmental planning and watershed management. *Journal of Geographical Systems, 6*, 307-322.

Tacit Knowledge Transfer Through the Use of Storytelling

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Abstract

Storytelling allows tacit knowledge to be quickly acquired by individuals. Studies have shown that storytelling helps individuals remember facts more easily than reading charts or hearing a manager divulge statistics. "Most people seem to find it easier to remember complicated relationships and conditions when they are presented, integrated, and structured in the form of stories" (Wiig, 2004, p. 106). Storytelling can be as formal as a CEO recounting a story while giving a speech to a group of stakeholders regarding the state of the organization; or as informal as employees gathering around the water cooler and discussing how to handle difficult customers. Storytelling is an ancient form of passing information between individuals; however, it remains a cost effective and efficient tool for passing information from individual to individual in modern times. Organizations can use storytelling in order to enhance their knowledge transfer processes, thereby becoming a more competitive and innovative.

Introduction

Once human beings began to verbally communicate, they started telling stories. "The oral tradition of the remembering and telling of stories was once a vital way of preserving cultural community in preliterate societies" (Watson, 2003, p. 10). In the past, important knowledge was passed from generation to generation in the form of stories. In modern times, storytelling remains an efficient tool for passing information from individual to individual. It is an effective tool that organizations can use in order to enhance their knowledge transfer process, thereby becoming more competitive and innovative. Stephen Denning defines the organizational story as "a detailed narrative of management actions, employee interactions and other intraorganizational events that are communicated informally within the organization," and as "a story can be defined as the telling of a happening or a connected series of happenings, whether true or fictitious" (Dalkir, 2005, p. 86).

In order to obtain a good definition of what storytelling is, one needs to break the word "storytelling" down into two parts. The on-line Merriman-Webster dictionary (2009) defines "story" as "an account of incidents or events" and it defines "tell" as "to relate in detail." Therefore, "storytelling" can be defined as an account of incidents or events that are recounted to other people in detail.

Employees tell each other personal incidents or stories on a daily basis. They share stories regarding what they experienced in a meeting, how to create documents a certain way, what their boss likes and dislikes, who just received a promotion and why, etc. They even share information on who was just dismissed and why. In the right context, storytelling can be a powerful tool for organizations to use and implement within their organization. According to David Snowden (2000), "stories can be a very powerful way to represent and convey complex, multi-dimensional ideas. Well-designed, well-told stories can convey both information and emotion, both the explicit and the tacit, both the core and the context (Sole & Wilson, p. 3).

Dalkir (2005) writes that, "stories can greatly increase organizational learning, communicate common values and rule sets, and serve as an excellent vehicle for capturing, coding and transmitting to valuable tacit knowledge" (p. 86).

Everyone "creates and shares stories" about events that have happened to them (Sole & Wilson, 2002, p. 1). Because stories are a powerful way to communicate information, and employees share stories on a regular basis, organizations should harness this power by creating areas for employees to share information and/or programs that will facilitate the sharing of stories. If organizations harness the power of storytelling, they will become more innovative and competitive in the marketplace. Storytelling is an effective and entertaining conduit for knowledge management transfer.

Methodology

This paper begins by exploring the role that tacit and explicit knowledge have in relation to storytelling. It explores the SECI (Socialization, Externalization, Combination, and Internalization) process model, developed by Nonaka and Takeuchi (1995) of how knowledge is created and used (and how this process is similar to the storytelling process. This paper then explores the process of internalization, which is the process of how explicit knowledge is turned into tacit knowledge. At this point, this paper touches upon methods that organizations can use to facilitate storytelling, how storytelling helps individuals remember ideas and facts more clearly, and the different types of stories: formal and informal.

Literature Review

One individual who has done extensive research regarding storytelling in relation to knowledge management is Stephen Denning. Denning has written numerous articles and books on storytelling. Three of his most notable books are *Secret Language of Leadership: How to inspire action through narrative* (2007), *Leaders Guide to Storytelling: Mastering the Art and Discipline of Business Narrative* (2005) and *Springboard: How Storytelling Ignites Action in Knowledge-Era Organizations* (2001). *In the Springboard*, Denning (2001) writes that:

> Storytelling gets inside the minds of individuals who collectively make up the organization and affect how they

> think, worry, wonder, agonize, and dream about themselves and in the process create—and re-create—their organization. Storytelling enables the individuals in an organization to see themselves and the organization in a different light, and accordingly take decisions and change their behavior in accordance with these new perceptions, insights, and identities (p. xiv-xv).

In *The Leaders Guide to Storytelling*, Denning (2005) asserts that most "of what we know is composed of stories." He writes that a large part of our "expertise is in narrative" (p. 178). Narrative, in this context, is defined by our experiences in the past and how we managed each situation. We turn these events into stories so that we can recall them and pass them on to other people. In this book, Denning defines all of the different types of stories that an organization can tell, and he provides information on how to write each type of story and how to vocally present the different types of stories.

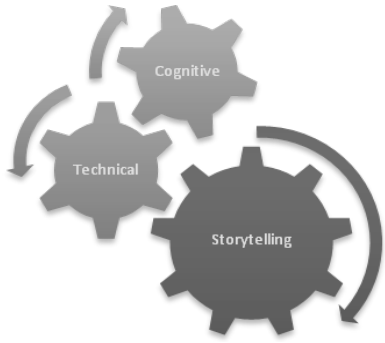
Types of Knowledge and the Role of Storytelling

In order to understand the use of storytelling in organizations, one must understand what types of knowledge there are and how that knowledge is captured. There are two types of knowledge: explicit and tacit. Takeuchi and Nonaka (2004) define explicit knowledge as knowledge that is "… expressed in words, numbers or sound and shared in the form of data, scientific formulas, visuals, audiotapes, product specifications or manuals…" (p. 3). Organizations tend to store this type of knowledge in spreadsheets and databases. Tacit knowledge is more difficult to define. According to Takeuchi and Nonaka (2004), this type of knowledge is "… highly personal and hard to formalize, making it difficult to communicate or share with others" (p. 3). Tacit knowledge is social in nature; therefore, it is passed verbally from person to person. The process of storytelling is similar to how tacit knowledge is communicated.

Takeuchi and Nonaka (2004) break tacit knowledge down into two dimensions. The first dimension is the technical dimension and it consists of "… informal and hard-to-pin-down skills or crafts often captured in the term 'know-how'" (p. 4). This is the type of knowledge that a "master craftsman" or a "three star chef" possesses (p. 4). Both of these people would have their knowledge so deeply ingrained within them that they might find it hard to articulate it to another person. However, anyone who has worked for an organization for a significant length of time will have the same amount of know-how technical knowledge. Any employee who fits this description will have "… difficulty articulating the technical or scientific principles behind what they know" (p. 4). The second type of tacit knowledge is cognitive. This type of knowledge is embedded inside of a person. "It consists of beliefs, perceptions, ideals, values, emotions and mental models [that are] so ingrained in us [them] that we take them for granted" (p. 4). Storytelling helps individuals to express the technical and cognitive knowledge that resides within them. Because technical and cognitive information is hard to articulate, it is

easier for some individuals to tell a story about what they do (or did) in certain work-related situations rather than break the elements down into explicit (written) forms. Because of this, stories are built upon technical and cognitive knowledge (see Figure 1).

Figure 1: *Aspects of Storytelling*



SECI Process Model and Storytelling

Storytelling is comprised of elements that combine tacit and explicit knowledge. Japanese culture tends to view tacit and explicit knowledge as objects that complement each other. According to Nonaka and Takeuchi (1995), tacit and explicit information "interact with and interchange into each other in the creative activities of human beings" and "human knowledge is created and expanded through the social interaction between tacit and explicit knowledge" (p. 61). This interplay between tacit and explicit knowledge is known as knowledge conversion.

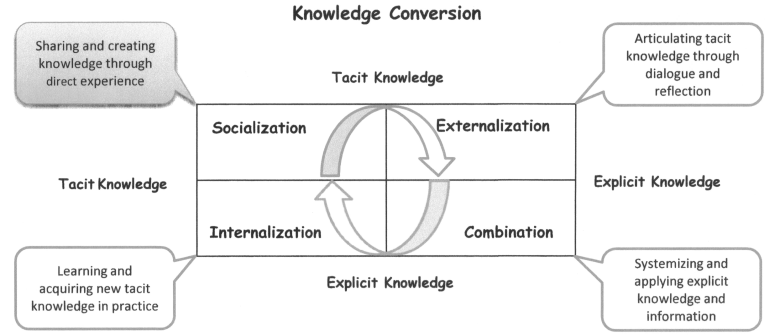
The knowledge conversion process, called the SECI process model, formulated by Takeuchi and Nonaka (2004), describe how tacit knowledge is converted into explicit knowledge and how explicit knowledge is translated into tacit knowledge. Organizations "create and use knowledge" through the knowledge conversion process (p. 8). The process of creating and telling of stories falls into this same pattern.

According to Takeuchi and Nonaka (2005), there are "four modes of knowledge conversion" (p. 9). The four modes are:

1. **Socialization**: Sharing and creating tacit knowledge through direct experience.
2. **Externalization**: Articulating tacit knowledge through dialogue and reflection.
3. **Combination**: Systemizing and applying explicit knowledge and information.
4. **Internalization**: Learning and acquiring new tacit knowledge in practice.

Knowledge conversion begins at the socialization mode and continues through the other modes. As the process finishes, it begins again thus creating a knowledge spiral (see Figure 2).

Figure 2: *The Knowledge Spiral*



Source: Adapted from Nonaka and Takeuchi, 1995

The four modes of knowledge conversion follow the pattern of tacit-to-tacit, tacit-to-explicit, explicit-to-explicit, and then explicit-to-tacit (Nonaka & Takeuchi, 1995, p. 62). The breakdown of the four patterns is:

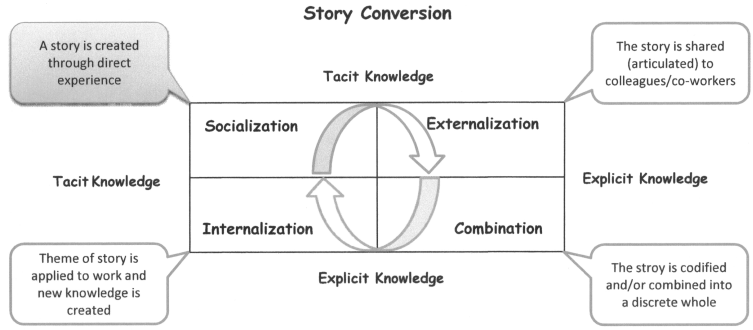
1. **Tacit-to-tacit**: An individual shares information with another individual.
2. **Tacit-to-explicit**: When information is allowed to be articulated, it is shared with other individuals "thus allowing it to be shared" with other people. When this knowledge is shared, it is "converted into explicit information."
3. **Explicit-to-explicit**: Pieces of information are "combined into a discrete whole."
4. **Explicit-to-tacit**: "…as new knowledge is shared throughout an organization, other employees begin to internalize it. That is, they use it to broaden, extend, and reframe their own tacit knowledge"(Takeuchi & Nonaka, 2004, p. 34).

The creation and sharing of stories follow a similar pattern (Figure 3):

1. **Socialization**: A story is created through direct experience which creates a form of tacit knowledge.
2. **Externalization**: The story is shared (articulated) to colleagues/co-workers.
3. **Combination**: The story is then codified and/or "combined into a discrete whole" (Takeuchi & Nonaka, 2004, p. 34).

4. **Internalization**: As other people read or hear the story, they begin to apply the moral/theme of the story to their work. At this point, they begin to create new tacit knowledge from the meaning that they get from the story and the knowledge spiral begins again.

Figure 3: *Story Conversion Spiral*



Source: Adapted from Nonaka and Takeuchi, 1995

Internalization and Storytelling

Nonaka and Takeuchi (1995) write about the process of internalization. This process is the end result of the socialization, externalization and combination modes of the SECI process model. They describe internalization as the "process of embodying explicit knowledge into tacit knowledge" (p. 69). They state that this process is closely related to the process of "learning by doing." Nonaka and Takeuchi write that:

> For explicit knowledge to become tacit, it helps if the knowledge is verbalized or diagrammed into documents, manuals, or oral stories. Documentation helps individuals internalize what they experienced, thus enriching their tacit knowledge. In addition, documents or manuals facilitate the transfer of explicit knowledge to other people, thereby, helping them experience the experiences of others indirectly (p. 69).

The process of internalization can occur by "reading or listening to a success story." Nonaka and Takeuchi (1995) write that:

> If reading or listening to a success story makes some members of the organization feel the realism and essence of the story, the experience that took place in the past may change into a tacit mental model. When such a mental model is shared by most members of the organization, tacit knowledge becomes part of the organizational culture (p. 69-70).

Stories, therefore, told verbally (tacit) or read (explicit), enable an organization to share knowledge. This knowledge becomes part of the organizations culture and is shared between other members of the organization. When stories are internalized, the knowledge creation spiral begins all over again and new knowledge is formed.

Methods for Facilitating Storytelling

"Most storytelling is done in conversation…" (Broje, 1992, p. 2). Therefore, in order to facilitate storytelling among employees, organizations need to create places or situations that are conducive to sharing stories. According to Takeuchi and Nonaka (2005), "Knowledge is created only by individuals…" Therefore, an organization should "… support and stimulate the knowledge creating activities of individuals to support and stimulate the knowledge-creating activities of individuals or to provide the appropriate contexts for them" (p. 11).

Creating a group or a space for employees to gather and share stories is an investment that will pay off for organizations. In *Knowledge Management in Theory and Practice*, Dalkir (2005) writes about a study completed by Cross and Parker in 2004. In this study, Cross and Parker discovered that people are indispensable when it comes to conveying information and knowledge. According to the study, employees spend about one third of their time looking for and/or helping their co-workers find information. In fact, "a knowledge worker is five times more likely to turn to another person rather than an impersonal source such as a database or a knowledge management systems" in order to find information (p. 111). If an organization creates a space for the transfer of this type of knowledge, then employees can share information as a group, thus, allowing more employees to find information at the same time. Employee A may talk to Employee B about a certain situation that Employees C and D may soon encounter. By creating a group environment, A, B, C, and D can discover the information that they need at the same time, thereby saving the organization time and money. Also, if the information is shared in a group context, this information can be captured and codified for future reference. According to Nonaka and Takeuchi (1995):

> Unless shared knowledge becomes explicit, it cannot be easily leveraged by the organization as a whole. Also, a mere combination of the discrete pieces of explicit information into a new whole—for example, a comptroller of a company collects information from throughout the company and puts it together in a financial report—does not really extend the organization's

> existing knowledge base. But when tacit and explicit knowledge interact . . . an innovation emerges (p. 70).

Dalkir (2005) writes about an incident that happened at Xerox, which illustrates that group environments promote storytelling (tacit information) and are conducive to employees working more efficiently. Xerox has created many different avenues for their employees to share knowledge. One such avenue is a database called, The Eureka Project (Eureka). Eureka is a database that employees can use to enter information that will help other people find solutions to their problems. At first, employees were not using Eureka. In response, Xerox created an incentive program that allowed employees to earn points every time they solved a customer related problem. The winner of the program was an employee named Carlos who had worked at Xerox for eight years, but had never used the database. His knowledge was similar to the "master craftsman" discussed by Takeuchi and Nonaka (2004). Carlos' eight years with Xerox gave him insight that most other employees in his group did not have. What was most surprising, however, was the second runner up. This employee had only been with Xerox for a couple of months and never used the database either. It was soon discovered that this person sat right across from Carlos. She listened to him talk with other people and went on breaks with him during which she would ask many questions. She also asked her other co-workers for information, as well. Because this individual was able to elicit information from her co-workers, she had accumulated in a very short time almost as much information as Carlos had accumulated over eight years with the company (p. 87). The Eureka database is a powerful tool, but as a standalone program, it does not facilitate the knowledge spiral; however, when the database and the tacit sharing of stories were/are combined, innovation was allowed to emerge. In this case, employees were allowed to socialize with each other, which allowed the transfer of knowledge between individuals.

A community of practice group is another method of transferring knowledge through storytelling. A community of practice group is defined as, "a group of people having common identity, professional interests and that undertake to share, participate and establish a fellowship" (Dalkir, 2005, p. 112). According to Watson (2003), "A storytelling approach and the interaction with peers in a social context can be a prerequisite to efficient generalization from experience" (p. 10).

Blogging is another way that people can share stories. "Blogs encourage story-telling and foster[s] understanding because they usually offer context" (Rao, 2005, p. 18). When a person blogs, he/she usually tell stories about events that happened to them, as well as how they handled that event. It is as if the blogger is talking to a silent partner, who is in reality, their audience. According to Darlene Fischter, library coordinator at the University of Saskatchewan Library:

> Blogs encourage storytelling and foster understanding because they offer context. Knowledge blogs help encourage brain dumps, exploration, and think-aloud behavior. They create connected content, break down silos, allow comments and can

> also be measured as useful searchable archives (as cited by Rao, 2005, p. 18).

Because of its low maintenance and lost cost to mange, blogs are an effective way for organizations to share tacit knowledge.

Storytelling and Memory

One reason organizations should employ the use of storytelling is that people have a tendency to remember stories. According to Dalkir (2005), "Conveying information in a story provides a rich context, causing the story to remain in the conscious memory longer and creating more memory traces than is possible with information not in context" (p. 86).

Galbraith, Downey, and Kates in *Designing Dynamic Organizations* (2002), write about how people only have the ability to remember "five to seven facts" at a time; however, they have the ability to remember "five stories full of facts" (p. 201). Someone can have a superior memory in relation to stories because "when people recall experiences, they recall them in images" and "linking facts or information to a mini-story provides an image that can be recalled easier than words" (Galbraith, Downey & Kates, 2002, p. 201).

In *Using Mentoring and Storytelling to Transfer Knowledge in the Workplace*, Swap, Leonard, Shields, and Abrams (2001), write that "… if aspects of corporate culture or systems are made more vivid, such as through a story, the availability heuristic predicts they will become more memorable, more thoroughly processed, and judged to be more true than those supported only by probabilities or abstract data" (p. 106). Swap et al. relates a story of an experiment completed by Joanne Martin and Melanie Powers. In this experiment, Stanford MBA students were shown an advertisement for a bottle of white wine that was just being added to the market. After reading the advertisement, the groups of students were broken down into four groups. The first group was allowed to only read the advertisement for the wine, the second group was given a story about how the wine was produced, and the third group was given numerical data with the advertisement, while the fourth group was given the story and the data. Out of all of the students, the ones who were given stories to read were more convinced that the advertisement, and the subsequent information were more likely to be true. This story proves that using stories make information more vivid, believable and memorable. "Because stories are more vivid, engaging, entertaining, and easily related to personal experience than rules or directives … they would be more memorable, be given more weight, and be more likely to guide behavior" (Swap, Leonard, Shields & Abrams, 2001, p. 103).

Types of Stories

There are two types of stories: informal and formal. Informal stories are usually passed between employees. Seven types of informal stories have been defined. These types of stories are usually used for teaching purposes (Swap, Leonard, Shields & Abrams, 2001, p. 103). They are:

- The rule breaking story
- Is the big boss human?
- Can the little person rise to the top?
- Will I get fired?
- Will the organization help me when I have to move?
- How will the boss react to my mistake?
- How will the organization deal with obstacles?

According to Karl Wiig (2004):

> Most stories illustrate causal chains: 'This is what was done and this is what happened,' often with associated explanations of why the consequence happened. Other stories may be static descriptions of situations, such as an illustration of the positions of opposing forces on a battlefield…" (p. 107).

The story that Wiig describes is the sequence that all informal stories fall into. Formal stories are usually created by organizations. The vision story and the springboard story are two types. The vision story asks 'people to tell a story about a time they or someone else in the organization did something that illustrates the vision in action'. These stories might illustrate trust, risk taking, or learning. By linking the element of the vision to a story, people can recall and relate the story to their own experience. These stories tend to build an understanding of what "behaviors the organization values most" (Galbraith, et al., p. 201). Springboard stories are stories that "… communicate a complex idea and springs people into action" (Denning, 2006, p. 43). These stories are short and are about an event/change that is in the past. In *The Leader's Guide to Storytelling*, Denning lists the different types of stories that organizations tell, and the purpose and goals that they achieve (2005, p. 12-17). These purposes and goals are:

- To spark action (change)
- To communicate who you are (trust)
- To communicate who the company is (branding)
- To transmit values
- To foster collaboration
- To tame the grapevine
- To share knowledge, and
- To lead people into the future (vision)

Each of these stories has a different pattern that they follow in order to achieve optimum results.

Call for More Research

Stories are told by executives at large corporations, and they are told by employees who work at the corporations. Most of the research that has been done in regards to storytelling focuses on storytelling that is done by executives. However, from the small research that has been done, it has been shown that employees pass knowledge to each other by telling stories and this knowledge has the ability to improve the skill level of each employee. More research needs to be completed in regards to how employees share information and in creating information sharing zones for employees.

Internalization, from the SECI process model, is another area that needs more research. There is a proliferation of books or material in the market that are written by executives detailing their experience. In most cases, the sharing of this knowledge is positive for organizations, but each method/experience does not fit with all organizations. There needs to be further research regarding what happens to an organization when they internalize stories that have a negative impact on them and how organizations can avoid internalizing the wrong stories.

Summary

Stories are an effective way to transmit knowledge in organizations. However, stories that share knowledge do not take the same format of stories that individuals are familiar with, such as stories with a plot, a protagonist, and an antagonist. "Knowledge sharing stories tend to be about problems and adversities, how they were taken care of and what method was used to take care of them" (Denning, 2005, p. 185). The hallmark of these types of stories is that they always have meaning. "Storytelling enables the individuals in an organization to see themselves and the organization in a different light, and accordingly take [sic] and change their behavior in accordance with these new perceptions, insights, and identities" (Denning, 2001, p. xv). Stories allow organizations to be more innovated because they allow participants to "fill in the gaps… and go beyond the story" (Klein, 2007, p. 42). Japanese organizations have understood the use of storytelling and its relation to innovation for centuries. Western organizations need to follow the lead of their eastern counterparts and incorporate storytelling into their companies. If an organization wishes to remain competitive and to be innovative, they need to create areas, which allow their employees to tell stories to each other. When one views the success of the Japanese auto companies compared to American auto companies, one cannot deny the effectiveness of storytelling.

References

(2009). *Merriam-Webster Online*. Retrieved April 20, 2009, from Merriam-Webster Online: http//www.merriman-webster.com/.

Boje, D. M. (1991 March). The storytelling organizations: a study of story performance in an office-supply firm. *Administrative Science Quarterly*, 36, 106-127.

Dalkir, K. (2005). *Knowledge management in theory and practice*. Burlington, MA: Elsevier.

Denning, S. (2006). *Effective storytelling: strategic business narrative techniques*. *Strategy & Leadership, 34*(1), 42-49.

Denning, S. (2005). *The leaders guide to storytelling*. San Francisco, CA: John Wiley & Sons.

Denning, S. (2001), *The springboard: How storytelling ignites action in knowledge-era organizations*. Boston: Butterworth-Heinemann.

Galbraith, J., Downey, D., & Kates, A. (2002). *Designing dynamic organizations: A hands-on guide for leaders at all levels*. Retrieved from: http://books.google.com/books?id=_QQZcklVspYC&printsec=frontcover&dq=designing+dynamic+organizations&ei=C78ASo6BMojYMOqLrNAD#PPP1,M1

Klein, J. (2008). *Some directions for research in knowledge sharing*. *Knowledge Management Research & Practice, 6*, 41-46

Nonaka, I., & Takeuchi, H. (1995). *The knowledge-creating company: How Japanese companies create the dynamics of innovation*. New York: Oxford.

Rao, M. (2005). *Knowledge management tools and techniques: Practitioners and experts evaluate km solutions*. (M. Rao, Ed.) Burlington, MA: Elsevier

Ruggles, R. (2002). *The role of stories in knowledge management*. Retrieved April 21, 2009 from Storytelling Foundation International: http://www.providersedge.com/docs/km_articles/The_Role_of_Stories_in_KM.pdf

Snowden, D. (2007). *Articles by Dave Snowden*. Retrieved April 27, 2009 from Cognitive Edge: http://www.cognitive-edge.com/articlesbydavesnowden.php

Snowden, D. (2000 December). The Art and science of Story or 'Are you sitting uncomfortably?' *Business Information Review, 17*(4), 215-226.

Sole, D., & Gray-Wilson, D. (2002). *Storytelling in organizations: the power and traps of using stories to share knowledge in organizations*. Retrieved April 20, 2009, from Harvard Lila: http://www.providersedge.com/docs/km_articles/Storytelling_in_organizations.pdf

Swap, W., Leonard, D., Shields, M., & Abrams, L. (2001 Summer). Using mentoring and storytelling to transfer knowledge in the workplace. *Journal of Management Information Systems, 18*(1), 95-114.

Takeuchi, H., & Nonaka, I. (2004). *Hitosubashi on knowledge management*. Singapore: John Wiley & Sons (Asia).

Watson, I. (2003). *Applying knowledge management: techniques for building corporate memories*. San Francisco, CA: Morgan Kauffmann Publishers.

Wiig, K. (2004). *People-focused knowledge management*. Burlington, MA: Elsevier.

Modifying Knowledge Creation and Sharing for Online Learning Environments

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Abstract

In today's world, online learning has become increasingly popular. There is a definite convenience factor to online learning, but this educational venue is not without its faults. Concepts such as knowledge creation and knowledge sharing have become a routine procedure in the traditional classroom, but have yet to be perfected for the online learning environment. This paper will discuss ways to modify knowledge creation and sharing within the context of online education. It will reveal that with the proper tools, adaptations to Nonaka's four active learning processes (Nonaka & Toyama, 2007) and strong, skilled leadership, online learning can improve by leaps and bounds.

Introduction

Knowledge is an essential part of learning. Students take information they gather in the classroom and convert it into knowledge. This knowledge is then applied to other projects in the classroom and, one hopes, in the student's experience outside the classroom as well. In a classroom setting, the hope is that students will also bring in outside knowledge, or life experience, and share it with their fellow students. Over time, traditional ways of practice have been established for both the sharing and creation of knowledge. However, in our constantly changing world, we have now moved to an educational system where classes are no longer always held in person, but rather online. This paper will discuss the modifications that can be made to traditional methods for knowledge creation and sharing in order to apply them to online learning environments.

Online Learning

Online learning is becoming increasingly popular in the world we live in. There are a number of reasons why this has become the trend. There are universities that push online classes because the classes are cheaper for them. The universities pay for a professor, but they do not have to pay for the classroom space, electric bills, or building maintenance. With these classes being cheaper for the universities to offer, the universities can, in turn, make them a bit cheaper for students and still walk away with a profit if that is their goal. In a struggling economy, where loans are

hard to come by, the idea of cheaper classes is appealing to students. Another reason for increased popularity of online classes is the convenience factor. Online classes are, by nature, frequently less time consuming for students. There is no need to commute and sit in hours of traffic or rush to get to class early to get a good seat; everyone gets a front row seat in the virtual classroom.

Convenience is a huge factor for those who are trying to juggle taking classes with other responsibilities such as working and/or raising a family. The desire to take classes while already working is becoming increasingly common. In today's world, working adults no longer have a psychological contract of fixed employment with one company; they are increasingly aware of their responsibilities for their own careers. This causes a deep need among workers to ensure that they have the means for a successful career path. (Burnside 2001, Defining the New Space of Learning section, para. 2) For many people, this means going back to school.

So, all of this makes online learning seem pretty appealing, right? Sure, on the surface it looks pretty good, but is online learning really everything it is worked up to be? Many would argue that e-learning is not quite there yet. Burnside (2001) stated that locations that offer online learning "lack understanding of adult learning methodology and produce courses that dull the user's experience instead of expanding it" (Delivering Education: Online Providers Versus Universities section, para. 4). It is possible, even likely, that "the technology is there, but it is often put to poor use, such that the experience does not interest the learner or solve the business problem being addressed. E-Learning instructional design is still in its rudimentary stages" (Burnside, 2001, Delivering Education: Online Providers Versus Universities section, para. 4). Now, that does not make e-learning sound too appealing.

On the other hand, "traditional universities have a well-developed sense of effective adult learning" (Burnside, 2001, Delivering Education: Online Providers Versus Universities section, para. 5). Universities have been providing education for centuries and have pretty much mastered the technique. So, now the question becomes: what can be done to improve online learning so that online students are not at a disadvantage as opposed to those who attend classes in person? Knowledge creation and knowledge sharing seem to be the areas where online education is failing. The key here is to modify knowledge creation and sharing, adapting them for more appropriate use in an online learning environment.

Defining Knowledge

In order to understand how knowledge creation and sharing can be adapted and modified for online learning environments, one must first understand what knowledge is. One might think that words such as data, information and knowledge are pretty much synonymous. However, there are definite distinctions among them. Data are the simplest form: "a set of discrete, objective facts about events" (Davenport & Prusak, 1998, p. 2). Data by themselves are not always very useful. Examples of this are random sets of numbers. These numbers would not be useful until they are put into context. This is where information plays a hand. Davenport and Prusak (1998) explained information as a message of sorts, stating that it is

"meant to change the way the receiver perceives something" (p. 3). For example, someone could take the random sets of numbers and place them into spreadsheets, giving them a context and creating information. This information will not become knowledge until it is processed by a human. Knowledge is different than data or information; "while we find data in records or transactions, and information in messages, we obtain knowledge from individuals or groups of knowers, or sometimes organizational routines" (p. 6). Davenport and Prusak (1998) explained that knowledge "originates and is applied in the mind of knowers" (p. 5). They also explain that knowledge is not simple, it "exists within people, part and parcel of human complexity and unpredictability" (p. 5). An example of knowledge would occur if one took the spreadsheets and presented the information in them, taking the time to learn the information from presenting and sharing it with others.

Exploring Knowledge Creation and Sharing

Now that knowledge has been explained and the difference among data, information, and knowledge has been clarified, it is imperative to explore the process of knowledge creation and sharing. Davenport and Prusak (1998) stated that "knowledge-creating activities take place within and between humans" (p. 6). Buchel (2007) discussed knowledge creation in the context of organizations. Universities are a type of organization and, since universities frequently are backing online learning, it seems appropriate to apply parts of Buchel's work. Buchel explained how knowledge creation can be difficult "due to the tacit nature of knowledge and the inability to understand knowledge because it is frequently tied to a particular context" (p. 44). However, she also stated that some firms seem to have caught on and "have successfully created and transferred knowledge within an organization" (p. 44). It is those firms whose examples must be followed and adapted for use in an online learning environment. Buchel stated "dense team networks foster shared understanding that leads to the creation of knowledge within the team" (p. 46). Dense, in this case, refers to how close the members of the team are to one another, not in terms of physical distance, but relationship-wise. As people become closer and create these networks, they tend to communicate more and share information. This information is applied to personal experiences and turned into knowledge.

Over time, within an organization, knowledge "becomes embedded not only in documents or repositories, but also in organizational routines, processes, practices, and norms" (Davenport & Prusak, 1998, p. 5). The process of knowledge creation and knowledge sharing essentially becomes second nature. Such an environment exists in what can be referred to as a learning organization. This is an organization "where people continually expand their capacity to create the results they truly desire, where new and expansive patterns of thinking are nurtured, where collective aspiration is set free, and where people are continually learning how to learn together" (Senge, 1990, p. 3). Universities, in both their real and virtual settings, can certainly be considered learning organizations.

Application in the Classroom

The procedure that Davenport and Prusak (1998) described where knowledge becomes embedded in the organization's processes is essentially what has happened when it comes to teaching in schools. Students have been learning from their teachers and peers in classrooms for years. The process of creating knowledge and sharing knowledge in a classroom is a topic that numerous researchers have explored. Daud, Eladwiah, Rahim, and Alimun (2008) tested knowledge creation processes in the classroom using Nonaka's four active learning processes, or modes of knowledge conversion: socialization, externalization, combination, and internalization, or the SECI model.

Socialization can be described as "the process by which tacit knowledge [personal knowledge such as insights or beliefs] of customers is accumulated and shared" (Nonaka & Toyama, 2007, p. 17). Sharing experiences create this tacit knowledge. The next step is externalization, or the expression of the tacit knowledge into concise ideas. These explicit concepts can include metaphors, models, or other similar notions. Combination is the next step. This includes piecing together explicit knowledge or knowledge that is conveyed through words and is easily communicated. This knowledge can be exchanged through documents or media. The last part of the SECI model is internalization. Internalization is the transformation of explicit knowledge to tacit knowledge. One of the best ways to internalize knowledge is to learn by doing. It is also helpful to document knowledge in stories or charts.

Daud, Eladwiah, Rahim, and Alimun (2008) explained how in a classroom, the active learning process socialization can be achieved "through information discussion among students or with the lecturer" (p.241). The second process, externalization can be achieved through "formal meeting or brainstorming session(s) in order to improve the initial ideas generated in socialization process" (p. 242). The next process, combination, or the "process of combining different bodies of explicit knowledge" can be accomplished in a classroom through "creative uses of computerized communication networks" (p. 242). The last process, internalization, is compared to learning by doing. It is explained that part of achieving internalization can be accomplished through knowledge being "verbalized or diagrammed into documents, manuals, or oral stories" (p. 242).

Daud et al.'s (2008) classroom application of Nonaka's four active learning processes reveals that there are methods that teachers are taught in order to help them instruct their students how to turn information into knowledge. Online learning environments, on the other hand, are relatively new territory. Techniques that teachers use in the classroom will not always be applicable or successful in an online learning environment. Therefore, these techniques must be modified. Brazelton and Gorry's (2003) article references creating a knowledge community as well as the concept of knowledge creation and sharing in an online learning environment. It states that "technology may support a knowledge-sharing environment, but getting users to participate in effective ways is key" (p. 23). So, what are those effective ways? This paper explores ways to modify current

techniques to compel users to participate in effective ways to aid in knowledge creation and sharing.

Adaptations for an Online World

Going back to Buchel's (2007) study, it is important to recognize that the physical distance between individuals does not seem to play a role here. This is important as the physical distances among learners and educators in online learning environments can oftentimes be significant. It is possible to create a dense team network, even online, by encouraging relationships among the different members of the class and among the learners and the educators. These relationships can be built by giving everyone tools to increase communication. These tools can include online discussion boards, synchronous chat functions, or perhaps even video conferencing. By creating these relationships, students are forming what Wenger, McDermott and Synder (2000) might refer to as a community of practice. A community of practice is a group "of people who share a concern, a set of problems, or a passion about a topic, and who deepen their knowledge and expertise in this area by interacting on an ongoing basis" (p. 142).

Nonaka's four active learning points can also be referenced in online learning. Daud et al.'s (2008) application of them in a classroom can be modified for use in an online learning environment. The socialization process can be adapted to be used through online discussions on WebCT, Blackboard, Sakai or eCompanion, just to name a few. Going above and beyond simple online discussion boards are the ideas of chat systems and chat rooms built right into the class websites or even video conferencing. A study performed by Barak and Rafaeli (2003) at the Massachusetts Institute of Technology supports this idea of socialization. In this study, they examined a hybrid online learning system. Their "findings indicated that even controlling for the students' prior knowledge or abilities, those who were highly engaged in on-line question posing and peer-assessment activity received higher scores on their final examination compared to their counter peers" (p. 84).

The second of Nonaka's processes mentioned in Daud et al.'s study, externalization, requires a formal meeting. Though formal meetings are easier in person, they can still be achieved online. To increase incentive for students to participate in a formal meeting, the meeting could be made part of their grade and students could conduct them through chat format or video-conferencing under the professor's monitoring. Brainstorming sessions are also listed as a component of externalization and can be achieved through online discussion boards by building on initial posts and commenting on classmates' ideas.

The next process, combination, or the "process of combining different bodies of explicit knowledge" (p. 242) should include "creative uses of computerized communication networks" (p. 242). This is one that is easily adaptable to an online learning environment, as many of the ideas listed above would be considered to fit into this category. In addition, the online tools that Marshall et al. (2003) mentioned would be helpful. A few of the recommended tools, including Blackboard and WebCT, are duplicates to the ones listed above.

However, this article also discusses an additional system called GetSmart, which "was built based on a model of how communities and individuals create and share knowledge" (p. 137). This system is meant to "help individuals, groups and communities develop knowledge" and works with the idea of learning by exploring (p. 138). A key aspect is the creation of a knowledge map, which users create in groups. They work to fit concepts together and explore their relationships.

The last process, internalization, is compared to learning by doing. It is possible to achieve this in online learning environments by creating papers and posting them in online environments to share with classmates. Another suggestion made for use in the classroom is oral stories; this could be adapted for use online by recording stories and posting them in forums such as YouTube for use by classmates as well as others.

If you consider an online learning environment to be a knowledge sharing community, Brazelton and Gorry's (2003) article can provide excellent insight into making this kind of endeavor a success. They explained that "in addition to appropriate technology [you need] leadership, alignment with business [or in this case 'classroom'] priorities, supportive organizational policies and practices, and measurement of benefits as critical to a successful effort" (p. 23). This further supports Davenport and Prusak's (1998) article, which states that,

> Technology alone won't make a person with expertise share it with others. Technology alone won't get an employee who is uninterested in seeking knowledge to hop on a keyboard and start searching or browsing. The mere presence of technology won't create a learning organization, a meritocracy, or a knowledge creating company (p. 142).

Leaders who are, in this case, teachers need to be trained how to use technology to help, not hinder, their instructional experiences.

While both Brazelton and Gorry's (2003) and Davenport and Prusak's (1998) articles stress that it will take more than just technology to improve online learning, they certainly do not discount the role that technology plays.

Some of the tools mentioned in Brazelton and Gorry's (2003) article could certainly help support knowledge creation and sharing in an online learning environment. These tools include things such as discussion areas, calendars that can be kept personal or shared with others, and chat ability. Brazelton and Gorry still found, even with great resources, "that face-to-face contact is an important factor in catalyzing the development of an electronic community" (p. 24). Since students enrolled in online courses can rarely, if ever, meet in person for that face-to-face contact, perhaps that contact can be created through a virtual face-to-face with the use of video chats.

Lastly, Wilson and Stacey (2004) wrote about an important component of the success of knowledge creation and sharing in online learning environments. This component is instructing educators how to teach online. Brazelton and Gorry's

(2003) covered the importance of strong leadership to the success of online learning, but in order to have strong leaders, teachers must be trained. As Wilson and Stacey state in their article, numerous studies have been done concerning the need for interaction in online education. They explain that "using group conferences as a central communication space provides a means of enabling the groups to socially construct knowledge" (p. 33). It was through these discussions that they were able to share resources, create new ideas, and therefore learn effectively. However, these discussions can be useless if not properly guided. An increased teacher presence online can often help to increase the student's success. Teaching online classes is a very different experience for a teacher, so making sure to provide them with proper support and resources is essential.

Conclusion

Knowledge creation and sharing in an online world hold a lot of potential. The idea behind online learning is a great one, but without proper implementation it will never come close to rivaling classroom learning. Leadership, in one form or another, is also a necessary component for achievement. With proper training, online instructors can become the accomplished leaders that online learning needs. In addition to leadership, with the resources listed above, such as video chats and WebCT, and the ideas set forth in Daud et al.'s (2008) article, online learning cannot only begin to succeed but can hopefully come to rival classroom learning so that valuable resources can reach those who may not have an actual classroom accessible to them.

References

Barak, M. & Rafaeli, S. (2004). On-line question-posing and peer-assessment as means for web-based knowledge sharing in learning. *International Journal of Human-Computer Studies, 61,* 84-103.

Brazelton, J. & Gorry, G. (2003). Creating a knowledge-sharing community: If you build it will they come? *Communications of the ACM, 46(2),* 23-25.

Buchel, B. (2007). Knowledge Creation and Transfer: From Teams to the Whole Organization. In K. Ichijo & I. Nonaka (Eds.) *Knowledge Creation and Management:New Challenges for Managers* (pp.44-56). New York: Oxford University Press.

Burnside, R. (2001, July/August) E-Learning for adults: Who has the goods? *The Technology Source.* Retrieved April 15, 2009, from http://technologysource.org/article/elearning_for_adults/

Daud, S., Eladwiah, R., Rahim, A. & Alimun, R. (2008). Knowledge creation and innovation in the classroom. *Proceedings of World Academy of Science, Engineering and Technology, 29,* 241-245.

Davenport, T. & Prusak, L. (1998). *Working knowledge: How organizations manage what they know.* Massachusetts: Harvard Business School Press.

Marshall, B., Zhang, Y., Chen, H., Lally, A., Shen, R., Fox, E., et al. (2003). Convergence of knowledge management and E-learning: the GetSmart experience. *IEEE.* 135-146.

Nonaka, I. & Toyama, R. (2007). Why Do Firms Differ? The theory of the knowledge-creating firm? In K. Ichijo & I. Nonaka (Eds.) *Knowledge creation and management: New challenges for managers* (pp.13-31). New York: Oxford University Press.

Senge, Peter M. (1990). *The fifth discipline: The art & practice of the learning organization*. NY: Current/Doubleday.

Wenger, E. C. & Snyder, W. M. (2000. Jan–Feb.). Communities of practice: The organizational frontier. *Harvard Business Review.* 139-145.

Wilson, G. & Stacey, E. (2004). Online interaction impacts on learning: Teaching the teachers to teach online. *Australian Journal of Educational Technology, 20(1),* 33-48.

A New View of Patient Education: How Information and Knowledge Management Can Contribute to Patient-centered Health Care

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Abstract

Information has been identified as a critical factor in improving health outcomes, self-management, and patient satisfaction. New ways of understanding how patients build knowledge for medical decision-making and self-care are needed. This paper presents a framework for potential contributions that information and knowledge management can bring to primary health care. A literature review was conducted to reveal concepts about information use and theories of knowledge management that are applicable to the study of patient education and may aid researchers in understanding information processes affecting individuals and their health. The search revealed information science and knowledge management theories had not previously been used to understand patient learning. This represents the first application of information behavior theories to the study of patient education. The theories discussed were used to create a model for examining and identifying enablers, critical processes, and consequences of patient learning in order to enhance the development of knowledge critical to informed medical decision-making and self-care. Patient education occurs beyond the boundaries of the healthcare system, so practitioners may wish to broaden their connections with diverse organizations that can enhance medical and health-related knowledge.

Introduction

John S. had intermittent lower abdominal pain. He kept altering his diet, but nothing helped. After a year of suffering he finally sought help and was diagnosed with advanced colon cancer. Even before he became a patient, the right information might have influenced him to seek help sooner. What if he had learned about the frequency and risk factors of colon cancer? What if he had understood the benefits of routine colonoscopy? Would such information have been enough for him to take action? Might it have affected the outcome? Perhaps, if critical information had reached John when he needed it, he would have been informed and motivated before he became a patient.

In another case Daniella G. a healthy, highly-educated woman, gave birth to a healthy baby. Breastfeeding was not going smoothly, the baby had a weak suck and was falling asleep too quickly while feeding. The lactation consultant was called in and taught the new mother ways to improve the latch and other techniques that seemed to help somewhat. The maternity floor nurse suggested that the mother rent a breast pump 'in case she needed it.' Though the baby was a lazy nurser, the new mother did not perceive a serious problem. Over the weeks and months that followed, the woman visited the lactation consultant several times, met with a post-delivery support group, saw a pediatrician, yet began to realize she was struggling with a low milk supply. She did a lot of research on her own using the Internet and medical journals and found studies showing that using the pump during the first few days may increase the production of prolactin receptors during the critical period when they are first laid down. This information was only available in research journals. What prevented this knowledge from reaching the patient in time for her to act so that it could have made a difference?

These cases highlight the fact that information at the right time can be critical to improving medical outcomes. The U.S. Agency for Healthcare Research and Quality (AHRQ) identified patient education as one important factor in improving patient safety, outcomes and satisfaction (Shojania, McDonald, Wachter, & Owens, 2004). These studies show that individual learning does not occur in isolation but within a context, so where, when, and how patients obtain information is critical to their care. In the current healthcare environment important relationships and information needed for learning frequently cross organizational boundaries and can include people and groups outside the healthcare system. Indeed, the complex nature of information sharing has been one of the barriers to efficient, effective, affordable healthcare in the U.S. (Chaudhry et al., 2006).

Patient education involves boundary spanning information flows that are not aided by the electronic medical record (EMR). For instance, a newly diagnosed breast cancer patient will be both a passive recipient of information supplied by doctors and others, and is also likely to become an active seeker of information from a variety of channels, e.g., friends and family, the Internet, the newspaper, the library. These sources of information are often found outside the spheres in which the doctors charged with the patient's care operate, and patients may bring the new information to their healthcare providers in repeated efforts to make sense of it. Many empirical studies have sought to understand when and why patient education is effective, with mixed results (Edwards, Davies, & Edwards, 2009). A new framework for understanding may be needed.

Information is critical to patient education because it is necessary for awareness, can lead to understanding, and, ultimately, action. The nature of information, its relationship to both data and knowledge has been a thread throughout the literature of information science (Bates, 2005). Bates and others, describe the three concepts of data, information and knowledge in a hierarchical relationship of increasing meaning, context, and understanding, moving from data, the simplest form, then to information, and finally to knowledge. Knowledge management (KM) is one concept that has been used since the 1990s to better understand information flows within organizations and as a tool for

knowledge creation, sharing and ultimately decision-making (Small & Sage, 2006). The definition of KM implies that the process for finding and sharing knowledge within organizations is key because it enables reasoned action (Nonaka, 1994). While KM research in healthcare has focused on provider organizations, the model presented here applies KM concepts to the study of patient education and its relationship to the various individuals, (doctors, nurses, pharmacists, friends and family), organizations (practices, clinics, hospitals, auxiliary medical services), and information systems (medical records, insurance records, medical information). Using a new model based on the patient's perspective can help identify critical processes, environments, and enablers of patient learning in order to enhance the development of knowledge critical to informed medical decision-making and self-care.

Methods

A literature review was conducted on the intersection of patient education research, with theories from human information behavior or KM theory to determine if the tools and terminology of information and knowledge management could be used to help analyze improvements in patient learning. Scholarly literature in the health, business, education, and information science research were searched.

Results

Patient education goals

There are three main reasons for patients to learn about conditions and issues affecting their health: compliance (Berkman et al., 2004; Gold & McClung, 2006; Redman, 2004), behavioral change (Basler, 1995; Prochaska, DiClemente, & Norcross, 1992), and medical decision-making (Charles, Gafni, & Whelan, 1997; Schifferdecker, Reed, & Homa, 2008). When patients truly understand the consequences of their behaviors, they are more likely to make the personal choices that result in improved outcomes (Redman, 2001). The process of making behavioral changes that involves 'unlearning' old habits is a concept that has been addressed by management studies on organizational change (Turc & Baumard, 2007). Neuroscientists have begun to elucidate molecular mechanisms that cause 'extinction' of learned behaviors in the brains of animals (Kitazawa, 2002), while social scientists in psychology, medicine, public health, and the communication disciplines focus on human behavioral change in context. In psychiatry it has been studied in relation to anxiety disorders or addictions that must be unlearned (Peters, Kalivas, & Quirk, 2009). For example, smoking cessation and weight loss, two health-related changes that involve the need for change, are costly to society, and have been the subject of investigation to find effective interventions among the chronically ill, e.g., diabetics or asthmatics. Behavioral changes ultimately rest on the flow of medical knowledge, a subject studied for more than a century, largely from the clinician's point of view (Coleman, Katz, & Menzel, 1966; Lin & Chang, 2008; Lin, Tan, & Chang, 2008; Rogers, 1995). The increasing complexity of medical knowledge has been driving practice teams and hospitals to share decision-

making responsibility through increased patient involvement and empowerment. Patient empowerment rests on increased access to information and understanding of available choices (Jonassen, 2003). Thus, considerable effort has been made to develop and evaluate aids to patient decision-making (Elwyn et al., 2006). Research shows that aids can reduce decisional conflict, increase patient satisfaction and improve knowledge, but no correlation has been found between decision aids and health (Leatherman & Warrick, 2008).

Over a decade ago, Larson, Nelson, Gustafson and Batalden (1996) showed a significant correlation between patient education and patient satisfaction and advised doctors to "ensure that they meet the information needs of patients with specific conditions" (p. 447). Since then patient education research has grown (O'Connor et al., 2007), and studies have measured the effects of patient education on outcomes such as satisfaction, compliance, decision-making and behavior change, but it has been difficult to show direct relationships between patient education and improved health outcomes. One likely reason for the difficulty of assessing the effectiveness of education interventions is their complexity and a tendency by caregivers to over-simplify the process. Despite substantial movement towards shared decision-making and patient empowerment, there is evidence that in physician practices, a simple transmission model of communication is still prevalent. This is the Shannon-Weaver (1949) transmission model of communication, a linear one that starts with an information source that is transmitted to a receiver at the other end.

Although patient educators are aware of the complexities of learning, clinicians often use a simplistic model of communication where information is transmitted to the patient rather than encouraging a patient-centered learning process. In addition, practitioners still frequently conflate information and knowledge. They may be unaware of widely accepted learning theories and models in communication, education, and cognitive and behavioral psychology of the last half century. In a case study of an exemplary primary care practice "patient education materials that might be needed are included" as part of the chart prep (Solberg, Hroscikoski, Sperl-Hillen, Harper, & Crabtree, 2006, p. 112). Waiting rooms commonly provide brochures and magazines, but they may or may not be relevant to the individual waiting. Using waiting room materials is a generalized information broadcast technique that may be only marginally useful. This experience of 'brochures in the waiting room' was confirmed by a large dataset documenting preventive care in eight primary care practices in the U.S. studied by the Future of Family Medicine Project (Crabtree, Miller, & Stange, 2001). In data from three practices that were reviewed by this author, patient education was only occasionally mentioned and typically framed as a one-way flow from practitioners or allied health professionals to the patient. It was often presented as the "brochure" given to the patient. Patient education is often viewed in a single dimension, largely as information transmitted to the patient rather than as an interactive and iterative process of patient learning. Although primary care clinicians are in an excellent position to identify patient information needs, they may be unable to address them adequately within current practice and system constraints. The current medical

education curriculum includes the importance of physician-patient communication, but the overload of diagnostic and treatment demands can crowd out extended doctor-patient interaction in practice (Merkel, Margolis, & Smith, 1990).

In old and new models of care an informed patient is seen as able to make better decisions. An informed patient is better at compliance and self-care (Allen, Iezzoni, Huang, Huang, & Leveille, 2008). How do they become informed and more knowledgeable? What conditions foster information sharing and learning and which inhibit them? What is the role of organizations vs. individuals in this endeavor? To help answer these questions, we may look outside the healthcare literature for tools to help understand the complex patterns of individuals seeking and using medical information relevant to their own well being. Fortunately, both the information science and business management communities have studied how information for knowledge building is found, shared and used. Combining theories from the study of human information behavior, as well as that of knowledge management (KM) can help illuminate factors that inhibit or facilitate the finding, sharing and development of relevant knowledge at the right time for people with health concerns.

Knowledge Management Research Can Inform Patient Learning Processes

Early work in knowledge management (KM) defined knowledge as a corporate asset that could be better utilized if it were better identified, shared, and used to build new organizational knowledge (Davenport & Prusak, 1998; Nonaka, 1994). Two underlying dimensions of knowledge were identified—tacit knowledge and explicit knowledge. In knowledge management theory, improved communication and benefits accrue when tacit knowledge can be made explicit, codified and shared. These foundational concepts rest on Polanyi's seminal work alluding to the tacit dimension of knowledge (Polanyi, 1966) and emphasizing the personal nature of knowledge as dependent upon an individual's unique experiences. The tacit dimension is understood as "know-how" that cannot be written down because it comes from experience or is innate, such as the ability to speak a language or hit a home run. These concepts can help enrich understanding of knowledge building.

Nonaka and Takeuchi's (1995) model describes the process of organizational knowledge building that incorporates the progressive development and integration of the tacit and explicit dimensions of knowledge. The process begins with *Socialization*, where tacit knowledge assets are shared within an organization through interaction with people. In the *Externalization* phase, tacit knowledge accessed through socialization is personalized, contextualized, and converted into something usable by others. In the *Combination* phase, knowledge is systematized through editing for one's own use. In the *Internalization* stage, learning takes place when explicit knowledge becomes part of an individual's tacit knowledge. Nonaka portrays these processes (abbreviated as SECI) as intertwined and iterative and describes them as framed by specific environments called 'ba': physical or metaphorical spaces conducive to knowledge creation (Nonaka & Konno, 1998). Table 1 summarizes Nonaka's first model and shows the characteristics of the processes and environments shaping the development of

knowledge. These concepts are used to describe knowledge building within organizations rather than individual patient learning, but the idea that there are certain environments conducive to knowledge building is an important transferable concept. In Nonaka's later work he reconsidered the boundaries of a firm and proposed the interpretation of ba as both internal and cross-organizational environments (Nonaka, Toyama, & Hirata, 2008). Another concept that is widely agreed upon in the KM community is that knowledge is difficult to measure and the processes for finding it, sharing, losing it, and using it, are complicated and influenced by cultural and environmental factors (Nonaka, 1994; McDaniel, Jordan, & Fleeman, 2003). Many factors have been identified such as culture, trust, motivation, and commitment, and these influences are likely to be relevant in patient education as well.

Table 1: *Nonaka's Processes for Developing Knowledge*

Process	**Characteristics**	**Type of Ba**
Socialization	Finding information thru sharing	Originating Ba (face-to-face sharing of mental models, experiences, etc.)
Externalization	Converting external info into something understandable by others	Interacting Ba (may be more formal such as teams or support groups)
Combination	Systematizing knowledge to make it usable by others	Cyber Ba (group-to-group-collaborative environment)
Internalization	Using explicit knowledge in practice	Exercising Ba (taking collective action)

Source: *Nonaka, 1998*

Knowledge Management and Healthcare

Increased attention to healthcare quality, accessibility, and financing in the U.S., has led to a body of work on the application of KM in the healthcare sector (Nilakanta, Peer, & Bojja, 2009; Nicolini, Powell, Conville, & Martinez-Solano, 2008), though it has largely been limited to fairly large corporations (Rundall et al., 2007). The field of medical informatics focuses on addressing knowledge within organizations through the use of technology, and a separate branch of KM studies focuses on social science and learning models affecting knowledge management in organizations (McElroy, 2000; Firestone & McElroy, 2005). Early KM studies discussed knowledge of individuals as contributing to organizational knowledge without clearly separating the two. Knowledge management theory has been applied to medical provider organizations such as multidisciplinary teams in

Australia (Wickramasinghe & Davison, 2004) and primary care physician groups in the U.S. (Alajmi et al., 2008; D. et al Cohen, 2004; Orzano, Tallia, McInerney, McDaniel, & Crabtree, 2007; Orzano, McInerney, Scharf, Tallia, & Crabtree, 2008), provider-sponsored virtual communities of patients (Winkelman & Choo, 2003; Gustafson et al., 1999), and application of the related concept of communities of practice (Li et al., 2009; Gabbay et al., 2003). Much of the literature on quality improvement in healthcare uses the KM concept of enablers without explicitly using KM terminology. For example, in discussing factors that affect the quality of healthcare delivery Solberg's (2006) organizational "attributes" identified in the primary care practice he studied might also be seen as KM "enablers." There is also substantial research that involves patient communication and knowledge where the literature does not employ KM terminology. Edwards, Davies, and Edwards (2009) review article discusses external influences on information exchange for decision-making within consultations, and focuses largely on the doctor-patient dyad. Discussing the increasingly active role patients are playing in their own decision-making and care, Bohmer (2009) briefly applies several ideas from KM such as the difference between tacit and explicit knowledge in the stages of knowledge in diabetes care. In conclusion, the literature shows limited use of KM analysis tools in healthcare, and almost none that use these ideas in relation to individual patient knowledge building.

Useful Theories from Information Science

Encouraging knowledge flow and patient education are similar in their joint purpose of gaining knowledge in order to take action. The goals of organizational KM are implementation of operational tools and provision of products and services for the benefit of the organization as a whole. The goals of patient education are decision-making, compliance and behavior change, but for the benefit of the individual. KM and patient education share the characteristic of continuous change. Nevertheless, KM leaves a serious gap in its arsenal of tools for understanding individual knowledge building, that is, the personal characteristics and the information use environments external to the organization (or in this case, the healthcare establishments). These characteristics of individuals and the environment correlate more closely with research in human information behavior emanating from scholars in library and information science. Most relevant are the cognitive approach taken by Taylor (1991), and Kuhlthau, Turock and Belvin (1998), a broader socio-cognitive approach taken by Dervin and Nilan (1986), an ethnographic approach epitomized by Chatman (1996), a social constructivist approach taken by Savolainen (1995), and Pettigrew, Fidel and Bruce (2001) and others.

For the study of patient knowledge to be comprehensive it must go beyond explicit medical knowledge. It should include both tacit and explicit personal and practical knowledge by the patient as well as the provider. How do people seek and make use of information? Information scientists have contributed significantly to the discussion of data, information, and knowledge, as well as the processes for their acquisition and use by individuals. In order to learn, one may have a question, seek to fill a knowledge gap, even if subconsciously, or have a

motivation for gaining new knowledge (Taylor, 1991). An authentic information need is one explicitly recognized by the individual and, consequently, the learner demonstrates interest and motivation to increase knowledge (Kuhlthau, 1993). This is especially true for people with health concerns since health information is one of the most frequently sought types of information with the need for health information increasing (Tu & Cohen, 2008).

Taylor (1991), a librarian, confined his investigation to explicit recorded information, however his categorization of types of users and use environments is helpful in creating a framework for understanding certain aspects of patient education He noted the importance of the context in which the user lives and works and looked at people in their 'use environments.' Thus a "set of people" with a similar set of information problems, could be studied so that their information needs could be better addressed. Sets of people such as engineers or physicians operate in similar 'use environments' using similar systems, sources, and techniques, and thus exhibit similar information behaviors. These groups could be studied for characteristic types of information needs and patterns of use (Taylor, 1991) such as Zipf's (1972) Principle of Least Effort. Research studies have corroborated the phenomenon described by Zipf, that people prefer to use information that is close at hand even when they know it may not be accurate (Bates, 2003).

Discussion and Conclusion

Making the connections

How can information science and knowledge management help provide a new framework for understanding and improving patient education? One can apply characteristics from both fields to the knowledge building processes of an individual by describing the types of activities that characterize these processes. First Taylor's (1991) categories provide insight into the patients as information users and their environment. The KM framework may be used to better understand tacit and explicit interactions. Combining them, the knowledge management processes of finding and sharing information may be connected with Taylor's use environments to determine the types of activities associated with each process. (See Table 2)

Table 2: *KM Processes, Environments and Activities for Health Education*

KM Processes	**Pathways to Knowledge Building**	
	Info Use Environments	***Activities***
Finding Information	**People** (doctors, nurses, other health care workers, relatives, friends, neighbors, librarians, acquaintances)	Interacting with people Asking questions Passively receiving info
	Organizations (physician provider organizations, clinics, hospitals, insurance companies, employers, schools, support groups)	Interacting with organizations or groups of people that provide information Asking questions Passively receiving info
	Information Sources & Repositories (brochures, bookstores, newspapers, libraries, Internet)	Seeking information through sources and systems
	Channels/Access systems (talking, reading, TV, radio, computer, phone, training/support programs)	All finding may use various media
Sharing Information	**People** (doctors, nurses, other health care workers, relatives, friends, neighbors)	Interacting with people
	Channels/Access Systems (interactive) (written, oral – talking, emailing, support groups in person or online)	All sharing may use various media
Developing Knowledge	**An individual** (in one's mind)	Take action

Using a KM model—from the perspective of the patient can help identify enablers, critical processes, and consequences in order to understand and improve individual and trans-organizational knowledge finding, sharing, and development of new knowledge. To do this, examples of enablers and barriers that affect the critical processes of finding, sharing and developing knowledge must be identified. Orzano's model of knowledge for primary care practices (see Fig 1.) (Orzano,

McInerney, Scharf, Tallia, & Crabtree, 2008) has been adapted to focus the individual patient's information activities at the center, whereas the KM model places the organization as the focus (see Fig. 2.). The person is part of various organizations or communities, shown to the right of the circle, and also outside them as an individual information user (the left side of the model). Some of the factors affecting the information activities of finding, sharing and developing knowledge are illustrated on each side. Any or several of these may inhibit or enable the personal learning that in turn results in action that can affect individual health outcomes.

Figure 1: *Orzano and McInerney's Knowledge Management Model*

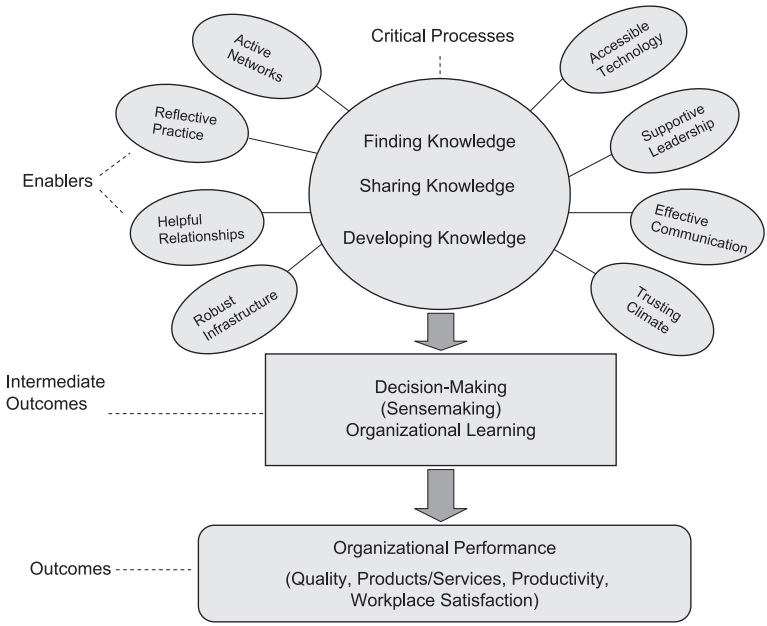
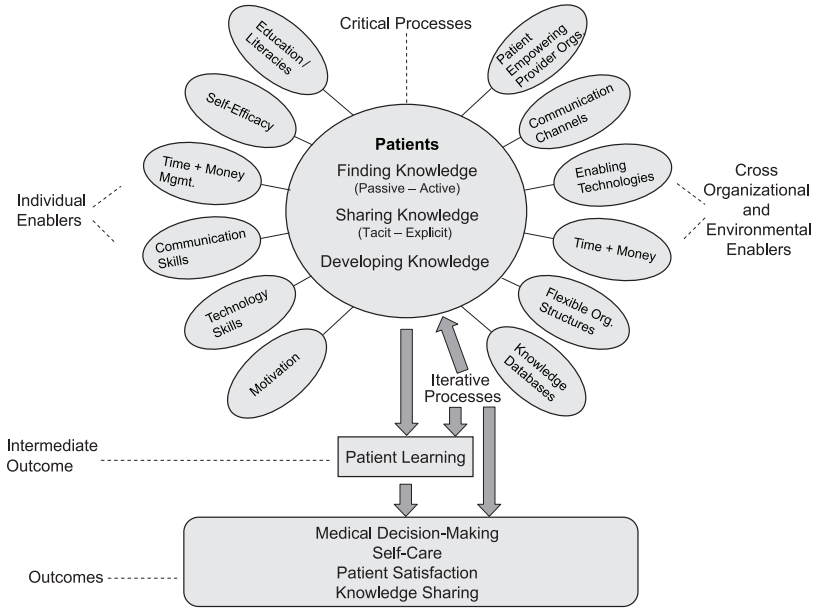


Figure 2: *Knowledge Management Model of Patient Learning*



Applying Nonaka's concept of the tacit dimension of knowledge creation to patient education helps further understanding of types of knowledge building activities. How can these ideas be used by organizations to improve knowledge building? Public health organizations might recognize barriers to health literacy or preventive care when designing preventive screening campaigns. Simply communicating that people over 50 should be screened for colon cancer, for example, may not address all the barriers to behavior change or compliance that may be responsible for lack of action based on the knowledge. Public health campaigns may be concentrating on the information transmission, the sharing part, without attention to the knowledge building for action. One subset of individuals, the uninsured, may routinely block all messages that relate to health screening since they assume they cannot afford it. With this understanding of cost as a barrier for individual action, public health officials might offer free screening to the uninsured.

Motivation is an enabler for individual action, so the information on the organizational side of the model, without the motivation on the individual side, may curtail the knowledge-building for individual action, in this case, making an appointment for a screening test. What might motivate a person at risk to undergo a colonoscopy? Perhaps a campaign targeting family members to take responsibility for

seeing that loved ones get screened would shift the effort to an information use environment closer to the person and to an individual better positioned to successfully intervene. Perhaps a wife or sister knows how to motivate a specific individual when advertising does not. In fact, a Pew Internet & American Life Project reports that 52 percent of the information queries on the Internet are on behalf of someone other than the person needing care, so there is evidence that many people receive health information from friends and family (Fox & Jones, 2009).

New Models of Patient Care

The Chronic Care Model (CCM) and the New Model of Family Medicine are new approaches to patient care that have in common an integrative, patient-centered approach and could also utilize the KM and information science approaches to further benefit patients (Allen, Iezzoni, Huang, Huang, & Leveille, 2008; Bodenheimer, Wagner, & Grumbach, 2002; Lorig, 1999; Wagner, 1998). One of the barriers to quality chronic care of asthma is poor patient education and limited continuing medical education for physicians (Goeman et al., 2005). A review of the empirical studies of patient education support the conclusion that chronic care succeeds when it is complex and an integrated and ongoing part of patient care, rather than an isolated intervention. Patient education works best when it fosters "productive interactions between prepared proactive teams, and well-informed motivated patients" (Tsai, Morton, Mangione, & Keeler, 2005; Bodenheimer, Wagner, & Grumbach, 2005). CCM includes the task of educating patients for behavior change and disease self-management. The model requires cooperation among organizations and individuals—the health system organizations, community-based organizations and individuals in it, the patient, and the practice team (Wagner, 1998). In CCM information plays a significant role since the first stage of learning is understanding why compliance in taking medications, smoking cessation, or dietary restrictions is important. Understanding how to operationalize the necessary behavioral change comes at a later stage (Basler, 1995). Just as it has been shown that simply increasing knowledge about nutrition does not produce long-term change in dietary habits, neither can the changes be undertaken without that knowledge (Molaison, 2002). As medicine becomes increasingly complex, so do the choices of treatment, and existing medical evidence may be insufficient for making clear-cut decisions. The New Model articulated by The Future of Family Medicine Project also proposes a patient-centered model, but continues to use the 'give 'em brochures' method (Cohen, Tallia, Crabtree, & Young, 2005). Similar to the hypothetical example given previously about public health screenings, provider organizations using the New Model may similarly concentrate on the information sharing aspect. The patient may receive the brochure, but without a motivational stimulus or follow-up. Did the patient acquire the information or use it in any way. Even in the new models of care, the old models of patient learning endure, however some New Model researchers and physicians in the family medicine community have begun to address different aspects of patient education in new ways (Orzano, McInerney, Scharf, Tallia, & Crabtree, 2008; Bohmer, 2009). Cohen discusses integrating behavior change education into primary care and others have conducted research on the effects of patient communication

training (Bodenheimer, Wagner, & Grumbach, 2002; Lorig, 1999). They focus on patient empowerment, another way to express patient self-directed learning and motivation (Aymé, Kole, & Groft, 2008). More research on an integrated approach to research in this area is needed.

Clinicians, allied health workers, and, less frequently, information professionals all may have occasion to interact directly with the learner, even if briefly. Physicians, especially primary care doctors are increasingly concerned with ways in which life interacts with health (Olesen, Dickinson, & Hjortdahl, 2000) and are often in a position where context and tacit information may be more accessible than to other healthcare professionals. A KM framework could help these physicians understand barriers and enablers.

The Effect of Technology Changes on Patient Education

There is mounting evidence that patient-centered approaches and patient empowerment are on the horizon in great measure due to technological and communication changes of the last decade (Kirschning & Von Kardorff, 2008). The Pew Internet & American Life Project reported that 61 percent of American adults look online for health information (Fox & Jones, 2009). MedlinePlus is an example of one heavily used consumer health information database freely accessible via the Web since 1998. It is run by the National Library Medicine (NLM) and represents an extension to consumers of the Library's mission to collect, preserve and disseminate biomedical research information through its Index Medicus and the subsequent online versions of the database currently known as Medline or PubMed. It is a high quality portal with collection policies that guide inclusion of information sources on the site. Great efforts have been made to ensure the site meets the needs of its users with varying degrees of literacy and accessibility and the site has had a high degree of success in many respects (Smalligan, Campbell, & Ismail, 2008). Yet despite many successes, the system can still result in a failure to connect an information seeker with the information needed to build knowledge. For example, many people need information that is available in the Medline and MedlinePlus systems, but they may be unaware of the existence of these information sources, thereby making health information via this channel inaccessible to them. Perhaps someone they know is aware of MedlinePlus, but doesn't share his or her tacit knowledge. In addition, even when using such online systems, tacit knowledge can still be a problem as illustrated in a study of search failure on two NLM databases, where researchers found that two of the three causes of failure were problems of scope and query formulation (McCray & Tse, 2003). Both causes are the result of the failure of the user to be aware of tacit information. The scope of a database is rarely explicit, and knowledge about scope usually comes from experience in searching, and, query formulation must follow protocols in any particular system that is not explicit or intuitive.

In addition to search failures due to tacit knowledge about systems, MedlinePlus has experienced a programmatic failure. From 2002-2005 the American College of Physicians Foundation (ACPF) and NLM conducted a program called Information Rx (Siegel et al., 2006). Participating physicians were

given information prescription pads on which to direct patients to locate information relevant to their condition on MedlinePlus as part of their treatment. In a follow-up analysis of the program, it was found that no patient indicated having received an info prescription although the physicians indicated they had indeed received them. The problem came about because of some tacit knowledge of the librarians who created the program. They predicated the program on the idea that the prescription format had power. That is, when a doctor gave a patient a prescription, it was a powerful directive. However, according to physicians participating in the focus groups, they did not specifically inform patients that their information recommendations were 'prescriptions' (Leisey & Shipman, 2007). The physicians believed they were delivering a good service, but did not know the "prescription pad" part was critical.

Conclusion

Getting the right information to the right person at the right time is a concept that has been articulated in other contexts, but one that can be applied to patient education. KM concepts of the tacit and explicit knowledge as well as the activities of finding, sharing and creating knowledge can be used to better understand and thereby increase the frequency, quality, and timeliness, of patient education. Patient learning and KM theory intersect where organizational and individual enablers impact patient knowledge that, in turn, affects medical outcomes in cases of decision-making or self-care. The organizational enablers may be communication channels, facilitating technologies, and organizational cultures. Examples of individual enablers could be motivation, existing knowledge, and literacy. These and many other individual characteristics, aptitudes and skills play a role in enabling or inhibiting knowledge finding, sharing, and creation. Even new models of primary care seem to rely on outdated assumptions about patient education. Though implementation may be difficult, it seems that complex multi-faceted education programs show the most promise.

Practice Implications

The informational pathways that support patient learning often cross organizational boundaries. Though the healthcare system in the U.S. is particularly fragmented, approaching the organizations involved in patient care and education as one system will facilitate analysis of patient education needs using the concept of knowledge management. Better analysis of patient information needs and learning pathways will help healthcare workers design services to meet those needs, as well as enable patients to help themselves learn. This framework can be used as a basis for more research. Many people seek health-related information for family and friends, especially when they must deal with an acute or chronic condition. Others are not yet patients when they most need health information. Since many of the people who need and use health information are outside the healthcare information environment, perhaps the term 'health education' would be a more accurate description that would widen the boundaries of patient education so that learning for health becomes just one part of lifelong learning.

References

Alajmi, B., McInerney, C., Vamanu, I., Orzano, A John, Tallia, Alfred F, & Meese, A. (2008). Knowledge sharing processes and toll in U.S.A primary health care: Analysis of four case studies. Columbus, OH.

Allen, M., Iezzoni, L. I., Huang, A., Huang, L., & Leveille, S. G. (2008). Improving patient-clinician communication about chronic conditions: description of an internet-based nurse E-coach intervention. *Nursing Research*, *57*(2), 107-112.

Aymé, S., Kole, A., & Groft, S. (2008). Empowerment of patients: lessons from the rare diseases community. *Lancet*, *371*(9629), 2048-2051. Retrieved from http://www.sciencedirect.com/science/article/B6T1B-4SRFCCJ-17/2/94f5cd2b0caa97ca81fb3f7819482342.

Basler, H.-D. (1995). Patient education with reference to the process of behavioral change. *Patient Education And Counseling*, *26*(1-3), 93-98. Retrieved from http://www.sciencedirect.com/science/article/B6TBC-3YF4H10-F/2/67da42bdfe92857d202618cd1b109f1c.

Bates, M. J. (2005). Information and knowledge: An evolutionary framework for information science. *Information Research, 10*(4), paper 239. Retrieved from http://InformationR.net/ir/10-4/paper239.html].

Bates, M. J. (2003). Library of Congress Bicentennial Conference on Bibliographic Control for the New Millennium Task Force Recommendation 2.3. Research and Design Review: Improving User Access to Library Catalog and Portal Information Final Report (version 3). Library of Congress.

Berkman, N. D., DeWalt, D. A., Pignone, M. P., Sheridan, S. L., Lohr, K. N., Lux, L., Sutton, S. F., Swinson, T., & Bonito, A. J. (2004 January). Literacy and Health Outcomes. Summary, Evidence Report/Technology Assessment No. 87 (Prepared by RTI International–University of North Carolina Evidence-based Practice Center under Contract No. 290-02-0016). AHRQ Publication No. 04-E007-1. Rockville, MD: Agency for Healthcare Research and Quality.

Bodenheimer, T., Wagner, Edward, H., & Grumbach, K. (2002). Improving primary care for patients with chronic illness. *JAMA*, *288*(14), 1775-1779.

Bodenheimer, T., Wagner, Edward H, & Grumbach, K. (2005). Planned visits to help patients self-manage chronic conditions. *American Family Physician*, *72*(8), 1454,1456.

Bohmer, R. (2009). *Designing care: aligning the nature and management of health care*. Boston: Harvard Business School Press.

Charles, C., Gafni, A., Whelan, T. (1997). Shared decision-making in the medical encounter: What does it mean?(or it takes at least two to tango). *Social Science & Medicine, 44*(5), 681-92.

Chatman, E. A. (1996). The impoverished life-world of outsiders. *Journal of the American Society for Information Science & Technology*, 47, 193-206.

Chaudhry, B., Wang, J., Wu, S., Maglione, M., Mojica,W., Roth, E., et al. (2006). Systematic review: Impact of health information technology on quality, efficiency, and costs of medical care. *Ann Intern Med, 144*, 742-52.

Cohen, D., McDaniel, R. R., Crabtree, B. F., Ruhe, M.C., Weyer, S.M., Talia, A., Miller, W. L., Goodwin, M. A., Nutting, P., Solberg, L. I., Zyzanski, S. J., Jaén C. R., Gilchrist, V., Stange, K. C. (2004). A practice change model for quality improvement in primary care practice. *Journal of Healthcare Management*, *49*(3), 155.

Cohen, D. J., Tallia, Alfred F, Crabtree, Benjamin F, & Young, D. M. (2005). Implementing Health Behavior Change in Primary Care: Lessons From Prescription for Health. *Annals of Family Medicine*, *3*(suppl_2), S12-19. doi: 10.1370/afm.334.

Coleman, J. S., Katz, E., & Menzel, H. (1966). Medical innovation: A diffusion study: Bobbs-Merrill Co.

Crabtree, B. F., Miller, W. L., & Stange, K. C. (2001). Understanding practice from the ground up. *Journal of Family Practice*, *50*(10), 881-887.

Davenport, T., & Prusak, L. (1998). *Working knowledge: How organizations manage what they know*. Boston: Harvard Business School Press.

Dervin, B. & Nilan, M. (1986). Information needs and uses. *Annual Review of Information Science & Technology, 21*, 3-33.

Edwards, M., Davies, M., & Edwards, A. (2009). What are the external influences on information exchange and shared decision-making in healthcare consultations: A meta-synthesis of the literature. *Patient Education And Counseling*, *75*(1), 37-52. Retrieved from http://www.sciencedirect.com/science/article/B6TBC-4V0VBXT-2/2/5e09e729e15fdc6de1d4fc3b6ae21611.

Elwyn, G., Edwards, A., O'Connor, A., Stacey, D., Volk, R., & Coulter, A. (2006). Developing a quality criteria framework for patient decision aids: Online international Delphi consensus process. *BMJ*, *333*(7565), 417-419.

Firestone, J. M., & McElroy, M W. (2005). Doing knowledge management. *Learning Organization*, *12*(2), 189-212. Retrieved from http://www.scopus.com/inward/record.url?eid=2-s2.0-19744377471&partnerID=40.

Fox, S., & Jones, S. (2009). The Social Life of Health Information: Americans' pursuit of health takes place within a widening network of both online and offline sources. Pew Research Center. Pew Internet and American Life Project. Retrieved from http://pewinternet.org/Reports/2009/8-The-Social-Life-of-Health-Information.aspx.

Gabbay, J., Le May, A., Jefferson, H., Webb, D., Lovelock, R., Powell, J., et al. (2003). A case study of knowledge management in multi-agency consumer-informed "communities of practice": Implications for evidence-based policy development in health and social services. *Health*, *7*(3), 283-310. Retrieved from http://www.scopus.com/inward/record.url?eid=2-s2.0-0041418101&partnerID=40&md5=f9f7506a7d6ea5b59eebcb75c73c7c55

Gold, D. T. & McClung, B. (2006 April). Approaches to patient education: Emphasizing the long-term value of compliance and persistence. *The American Journal of Medicine, 119*(4), s32-s-37.

Goeman, D. P., Hogan, C. D., Aroni, R. A., Abramson, M. J., Sawyer, S. M, . Stewart, K., et al. (2005). Barriers to delivering asthma care: a qualitative study of general practitioners. *Medical Journal of Australia*, *183*(9), 457-460.

Gustafson, D. H., Hawkins, R., Boberg, E., Pingree, S., Serlin, R. E., Graziano, F., et al. (1999). Impact of a patient-centered, computer-based health information/support system. *American Journal of Preventive Medicine*, *16*(1), 1-9.

Jonassen, D. H. (2003). The Vain quest for a unified theory of learning. *Educational Technology*, *54*, 504-511.

Kirschning, S., & Von Kardorff, E. (2008). The use of the Internet by women with breast cancer and men with prostate cancer-results of online research. *Journal of Public Health*, *16*(2), 133-143. Retrieved from http://www.scopus.com/inward/record.url?eid=2-s2.0-43349091079&partnerID=40.

Kitazawa, S. (2002). Ready to unlearn. *Nature, 416*, 270-73.

Kuhlthau, C. C. (1993). *Seeking meaning: a process approach to library and information services*. Westport, CT: Ablex Publishing Corporation.

Kuhlthau, C. C., Turock, B., & Belvin, R. (1988). Facilitating information seeking through cognitive models of the search process. Proceedings of American Society for Information Science 51st Annual Meeting, 25, 70-75.

Larson, C. O., Nelson, E. C., Gustafson, D., & Batalden, P. B. (1996). The relationship between meeting patients' information needs and their satisfaction with hospital care and general health status outcomes. *International Journal for Quality in Health Care*, *8*(5), 447-456.

Leatherman, S., & Warrick, L. (2008). Effectiveness of decision aids: A review of the evidence. *Medical Care Research and Review*, *65*(6). Retrieved from http://www.scopus.com/inward/record.url?eid=2-s2.0-55649093107&partnerID=40.

Leisey, M. R., & Shipman, J. P. (2007). Information prescriptions: A barrier to fulfillment. *Journal of the Medical Library Association*, *95*(4), 435-438. Retrieved from http://www.scopus.com/inward/record.url?eid=2-s2.0-36148980390&partnerID=40.

Li, L. C., Grimshaw, J. M., Nielsen, C., Judd, M., Coyte, P. C., & Graham, I. D. (2009). Use of communities of practice in business and health care sectors: A systematic review. *Implementation Science*, *4*(1), 27. Retrieved from http://www.scopus.com/inward/record.url?eid=2-s2.0-68049124957&partnerID=40&md5=cec5104df62dd71cc3b1dfc9b6f48ef4.

Lin, C., & Chang, S. (2008). A relational model of medical knowledge sharing and medical decision-making quality. *International Journal of Technology & Management, 43(*4), 320-48.

Lin, C., Tan, B., & Chang, S. (2006). An exploratory model of knowledge flow barriers within healthcare organizations. *Information & Management, 45*(5), 331-339.

Lorig, K. R. (1999). Evidence suggesting that chronic disease self-management programs can improve health status while reducing hospitalization. *Medical Care*, *37*, 5-14.

McCray, A. T., & Tse, T. (2003). Understanding search failures in consumer health information systems. *AMIA Annual Symposium proceedings*, 430-434. Retrieved from http://www.scopus.com/inward/record.url?eid=2-s2.0-16544392564&partnerID=40.

McDaniel Jr, R. R., Jordan, M. E., & Fleeman, B. F. (2003). Surprise, surprise, surprise! A complexity science view of the unexpected. *Health care management review.*, *28*(3), 266-278. Retrieved from http://search.epnet.com/login.aspx?direct=true&db=cmedm&an=12940348.

McElroy, M. W. (2000). Second-generation KM: a White Paper. *Emergence*, *2*(3), 90-100. Retrieved from http://search.epnet.com/login.aspx?direct=true&db=buh&an=4792742.

Merkel, W. T., Margolis, R. B., & Smith, R. C. (1990). Teaching humanistic and psychosocial aspects of care. *Journal of General Internal Medicine*, *5*(1), 34-41.

Molaison, E. F. (2002). Stages of Change in Clinical Nutrition Practice. *Nutrition in Clinical Care*, *5*(5), 251-257. Retrieved from http://dx.doi.org/10.1046/j.1523-5408.2002.05507.x.

Nicolini, D., Powell, J., Conville, P., & Martinez-Solano, L. (2008). Managing knowledge in the healthcare sector. A review. *International Journal of Management Reviews*, *10*(3), 245-263. Retrieved from http://www.scopus.com/inward/record.url?eid=2-s2.0-49749103180&partnerID=40.

Nilakanta, S., Peer, A., & Bojja, V. M. (2009). Contribution of knowledge and knowledge management capability on business processes among healthcare organizations. Systems Sciences, HICSS, 42nd Hawaii International Conference.

Nonaka, I., (1994). A dynamic theory of organizational knowledge creation. *Organization Science*, *5*(1), 14-37.

Nonaka, I., & Konno, N. (1998). The concept of "Ba": Building a Foundation for Knowledge Creation. *California Management Review*, *40*(3), 40-54.

Nonaka, I., Toyama, R., & Hirata, T. (2008). *Managing flow: A process theory of the knowledge-based firm*. Palgrave Macmillan.

Nonaka, I., & Takeuchi, H. (1995). *The Knowledge-Creating Company: How Japanese Companies Create the Dynamics of Innovation* (p. 225). New York: Oxford University Press.

Olesen, F., Dickinson, J., & Hjortdahl, P. (2000). General practice—time for a new definition. *BMJ*, *320*(7231), 354-357. doi: 10.1136/bmj.320.7231.354.

Orzano, A. J., Tallia, A F, McInerney, C. R., McDaniel, R. R., & Crabtree, B F. (2007). Strategies for developing a knowledge-driven culture in your practice. *Family Practice Management*, *14*(4), 32.

Orzano, A. J., McInerney, C. R., Scharf, D., Tallia, Alfred, F., & Crabtree, B. F. (2008). A knowledge management model: Implications for enhancing quality in health care. *Journal of the American Society for Information Science and Technology*, *59*(3), 489-505. Retrieved from http://dx.doi.org/10.1002/asi.20763.

O'Connor, A. M., Wennberg, J. E., Legare, F., Llewellyn-Thomas, H. A., Moulton, B. W., Sepucha, K. R., et al. (2007). Toward the 'tipping point': Decision aids and informed patient choice. *Health Affairs*, *26*(3), 716.

Peters, J., Kalivas, P. W., & Quirk, G. J. (2009). Extinction circuits for fear and addiction overlap in prefrontal cortex. *Learning & Memory, 16*, 279-88.

Pettigrew, K. E., Fidel, R., Bruce, H. (2001). Conceptual Frameworks in Information Behavior. *Annual Review of Information Science and Technology, 35*, 43-78.

Polanyi, M. (1966). *The Tacit Dimension*. Garden City, NY: Doubleday.

Prochaska, J. O., DiClemente, C. C., & Norcross, J. C. (1992). In search of how people change: Applications to addictive behaviors. *American Psychologist, 47*(9), 1102-14.

Redman, B. K. (2004). Advances in patient education. New York: Springer.

Rogers, E. M. (1995). Diffusion of innovations. New York: Free Press.

Rundall, T. G., Martelli, P. F., Arroyo, L., McCurdy, R., Graetz, I., Neuwirth, E. B., et al. (2007). The informed decisions toolbox: tools for knowledge transfer and performance improvement. *Journal of Healthcare Management*, *52*(5), 325.

Savolainen, R. (1995). Everyday life information seeking: Approaching information seeking in the context of "way of life". *Library & Information Science Research, 17*(3), 259-94.

Schifferdecker, K. E., Reed, V. A., & Homa, K. (2008 June). A training intervention to improve information management in primary care. *Family Medicine, 40*(6), 423-32.

Shannon, C. E., & Weaver, W. (1949). A mathematical model of communication. University of Illinois Press.

Shojania, K., McDonald, K., Wachter, R., Owens, D. (2004-2008). Closing the quality gap: A critical analysis of quality improvement strategies. AHRQ Publication No. 04-0051-3: U.S. Dept. of Health and Human Services. www.ahrq.gov.

Siegel, E. R., Logan, R. A., Harnsberger, R. L., Cravedi, K., Krause, J. A., Lyon, B., et al. (2006). Information Rx: Evaluation of a new informatics tool for physicians, patients, and libraries. *Information Services and Use*, *26*(1), 1-10. Retrieved from http://www.scopus.com/inward/record.url?eid=2-s2.0-33746332655&partnerID=40.

Small, C., & Sage, A. (2006). Knowledge management and knowledge sharing: A review. *Information, Knowledge, System Management, 5*(3), 153-69.

Smalligan, R. D., Campbell, E. O., & Ismail, H. M. (2008). Patient experiences with MedlinePlus.gov: A survey of internal medicine patients. *Journal of investigative medicine*, *56*(8), 1019-1022. Retrieved from http://www.scopus.com/inward/record.url?eid=2-s2.0-58149355115&partnerID=40.

Solberg, L. I., Hroscikoski, M. C., Sperl-Hillen, J. M., Harper, P. G., & Crabtree, Benjamin F. (2006). Transforming Medical Care: Case Study of an Exemplary, Small Medical Group. *Annals of Family Medicine*, *4*(2), 109-116. doi: 10.1370/afm.424.

Taylor, R. S. (1991). Information use environments. *Progress in communication sciences*, *10*, 217-255.

Tsai, A. C., Morton, S. C., Mangione, C. M., & Keeler, E. B. (2005). A meta-analysis of interventions to improve care for chronic illnesses. *Am J Manage Care*, *11*(8), 478-488.

Tu, H. T., & Cohen, G. R. (2008). Striking jump in consumers seeking health care information. *Tracking report/Center for Studying Health System Change*, 20, 1-8.

Turc, E., & Baumard, P. (2007). Can organizations really unlearn? C. R. McInerney & R. E. Day, (Eds). Rethinking Knowledge Management (pp. 125-46) Berlin: Springer.

Wagner, E. H. (1998). Chronic disease management: what will it take to improve care for chronic illness?. *Effective clinical practice*, *1*(1), 2.

Wickramasinghe, N., & Davison, G. (2004). Making explicit the implicit knowledge assets in healthcare: the case of multidisciplinary teams in care and cure environments. *Health Care Management Science*, *7*(3), 185-195.

Winkelman, W. J., & Choo, C. W. (2003). Provider-sponsored virtual communities for chronic patients: improving health outcomes through organizational patient-centered knowledge management. *Health Expectations*, *6*(4), 352-358.

Zipf, G. K. (1972). *Human behavior and the principle of least effort*. New York: Hafner.

Information Overload and its Effects on Workplace Productivity

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"Why am I so impatient when I write emails to others, but I don't have time to really write responses myself? How am I doing a job that didn't even really exist 20 years ago, but whose principles and practices change almost every 3 months? Why do I think everything is faster, faster, faster, but yet there is no clear direction that I can see? Why do I have the ability to scan and digest thousands of little snippets of information, but can't read one lengthy article without feeling the urge to check my email / Facebook account / cell phone, etc.?" (DiPasquale, 2008, Msg: "Immediacy").

Introduction

No matter how interested you are in this paper, odds are you will not be able to finish it in one sitting. There is a widely renowned problem within today's information society. This particular problem can be linked to mental and emotional stress, performance loss, and most importantly, decreased work productivity (Janssen & de Poot, 2006). As you sift through your eight instant messages, 328 e-mail messages, 96 e-mail listserv messages, and 827 RSS feed updates; the problem seems to become clearer. You begin to realize that we, as people, are far more adept in generating information than managing it. Some companies call this problem *informania*, *infoglut*, and *information anxiety*; others call it *data smog*. Its commonly preferred term is simply ***information overload*** (Spira, 2007).

What *information* is and does, and how it is used in today's society have been debated in various literatures. We try to get our work done, but somehow along the way information gets in the way. Does this make sense? Information can be categorized as anything and everything in the sense of literature, phone calls, letters, periodicals, wikis, RSS feeds, websites, instant messages, text messages, and the all-time favorite — e-mail. They all seem to keep piling up. You barely get rid of one, and another one is lurking about. There seems to be more information than we can possibly process.

Kanigel (2004) stated that according to researchers at the University of California, the world produces about one *quintillion* bytes of data a year [in 2002]. Recent studies suggest that the "amount of information on the Internet doubles every three months" (Kanigel, 2004, p. 4). According to BrightPlanet, a software company, the Internet is 500-times larger than what is actually indexed by popular

search engines, such as Google (Kennedy, 2001). Tidline (1999) claims that half of the U.S. labor force will soon be employed in occupations that require information processing. In addition, the innovation of new technologies increases the number of options available to society. We have dreamed about "24/7" technology — being able to find information any place, any time.

"Now we dance on the surface of a thousand texts, skimming over billions of words …, myriad flashing ads, and across the mesmerizing Web. The text is less the sacred keeper of the flame of knowledge. Data begin to outstrip the making of meaning, in part because our technologies create an unending stream of information …" (Jackson, 2008a, p. 161).

With their current growth, *information sources* such as blogs (Xanga, WordPress), social networking (MySpace, Facebook), and RSS feeds (news aggregators), instant messaging and e-mail have increased exponentially. According to the Website Optimization LLC, an Internet marketing firm, the broadband penetration rate is expected to break the 90 percent barrier this year — meaning that there are not many people who have not encountered some form of this digital pollution of information overload (Brandel, 2008). As one can see, the concept of information overload has been discussed for years, but never before has it seemed so pertinent.

Historical Background

Information overload may seem like a new concept in today's digital age, but it has been around since the sixteenth century. People objected to the vast amount of information they had to cognitively process in order to play a part in society. The new "intellectual" revolution occurred when books and documented materials became more widely produced. It is believed that this was the first stage of systemic societal information overload. Instead of cover-to-cover reading, scholars would browse and skim through text—methods that are still widely used today (Blair, 2003). Tjaden (2007) stated that ancient society dealt with information overload by using navigational tools, such as tables of contents, book wheels (mechanical book search engines), commonplace books (topic-based books), encyclopedias, and taxonomies.

Through the use of the telephone, developments in transport allowed communication to increase. Thus, developments and innovations in communication systems led promptly to the rise of information in workplaces. Though not technologically at an advantage, the problem from the sixteenth century is the same now—too much information and too many sources (Edmunds, 2000).

The concept of information overload was discussed for a while, and then remained dormant for centuries. However, it was never gone. It emerged again in the advent of the digital revolution. With newer technologies, more information found its way into more hands. Technology, in fact, is considered an autonomous system. It is omnipresent—"it touches *everything* and cannot be blamed for *anything*" (Bugeja, 2008, p.68). New, innovative technology has allowed users to create a remarkable amount of data, share that data with others, and connect with each other virtually anywhere, anytime.

Klapp (1986) noted that the first social scientist to notice the phenomenon of information overload was George Simmel. In 1950, Simmel wrote of the "overload of sensations in the urban world that caused city dwellers to become jaded and developed an incapacity…to react to new situations with the appropriate energy" (Edmunds, 2000, p. 20). Klapp (1986) also noted Richard Meier's prediction of an infiltration in communications flow and predicament of overload within the next half century. We have an abundant amount of resources made available to us every day, especially those that are accessible over the Internet. However, finding that information is not easy.

Information Literacy and Theory

The American Library Association (ALA) defines information literacy as a set of abilities requiring individuals "to recognize when information is needed and have the ability to locate, evaluate, and use effectively the needed information" (American Library Association, 1989, *Information Literacy Defined* section). When an individual is able to understand what is necessary to obtain relevant information, that understanding becomes an important component in the process of overcoming information overload. Some of the necessary skills that contribute to information literacy are problem solving, decision-making, critical thinking, information gathering, and interpretation (Nelson, 1994).

Today, we read to "gather"—trying to get that precise packaged answer. Carol Collier Kuhlthau, widely recognized researcher of the *information search process* (ISP), states that people read to gather information. Gathering information surely is not a problem, is it? Retrieving the most justifiable bits of text from the vast amount of information we have today would seem to follow Dervin's sense-making theory (Jackson, 2008a). Dervin based her principal idea of sense-making on focusing how people make sense of their own worlds. This particular approach and methodology allows a user to view how a person perceives a situation. As a person moves through time-space, she or he gains a personal point of view—which is obtained through observation and experiences. Dervin views information as a product of human awareness (Tidline, 1999). The person will eventually come to a gap (detour), where sense will come to an end. Bridging that gap becomes the essential task.

However, the sense-making theory is only part of the process, Kuhlthau declared. Kuhlthau discovered a process that our mind undergoes when searching for information. She simply articulated her ideas on the self-motivated relationship of the mind, body, and spirit that occurs during sense making. This process was not as simple as she thought it would be. What she found was a "messy, painful, emotional process that, like reading, takes great effect and attention to do well" (Jackson, 2008a, p. 172). She discovered that information-seekers do not go deeply enough into their search process. They are left with a collection of information-bits—a *cessation* of their task, not the *consummation* of their quest (Dewey, 1910).

From the previous paragraph it seems that "searching" is a difficult task. Therefore, how do we search and make meaning from the information we gather? No matter what we are looking for, ambiguity is a central factor of the search

process. Throughout the six steps of information seeking, Kuhlthau (1991) found that seekers experience apprehension as they conduct a research task. This is known as the *initiation* stage. A person will become aware of her lack of knowledge on the research subject. Feelings of uncertainty are present.

During the *selection* stage, identifying and selecting the generalized topic to be researched is performed. Since the user's topic is chosen, uncertainty decreases often, giving way to some optimism. The user is now considered in the *exploring* mode—the third stage. Strategies and actions are carried out. The user must investigate the information concerning the research subject. She must form an understanding and become familiar with the subject, as well as associate new information to what is already acknowledged. Feelings of doubt and uncertainty may return and increase if unsuitable information is encountered. In this stage, some users might be prone to abandon the search completely.

The next stage, *formulation,* is considered a turning point in the information-seeking behavior. Forming a focus from the gathered information is essential in this stage. Ideas and personalized perspectives are constructed. Feelings of uncertainty diminish, while clarity and confidence begin to increase. The*collection* stage is where communication between the user and information system take place in the most useful and effective way. Since the topic has been chosen, the gathering of the relative information is carried out. The user's sense of direction is unambiguous, therefore facilitating an inclusive search of all gathered information. Feelings of uncertainty diminish, while interest and involvement deepen.

The final stage, *presentation*, comes to view when the research task in complete. The user focuses on using the findings, as in presenting the material. Strategies are often organizational—outlining and preparing the information is applied as the user puts his or her learning to use. Feelings of satisfaction (or disappointment) are conveyed (Kuhlthau, 1991).

At the end of their research, are the users truly satisfied? John Dewey (1910), author of *How We Think,* reminds us that there is "distraction and dispersion, what we observe and what we think, what we desire, and what we get, are at odds with each other" (p. 108). According to IDC, a premier global market intelligence firm, by 2011 the digital universe will be 10 times the size it was in 2006 (Gantz, 2008). It has gotten to the point where useful information has in some cases become a distraction (Brandel, 2008). Jackson (2008b) continues to argue that there is so much useless information that people get tired of searching through it and end up looking elsewhere. They often take hold of the first results that they find from limited search engines, which can often disperse poor quality information. Hert (1994) states that many users still use the standard information retrieval method, where they try to seek the best match between *mental boxes* (questions) and *structured information boxes* (answers).

Studies reveal that information-seekers have a limited range in searching. They often "opt for convenience over quality and give up easily" (Jackson, 2008a, p. 164). They usually never find what they started to look for. With the challenge of sense making, information-seekers are choosing the passive way. Jackson (2008a) continued to state that the *context* of our sense making is just as imperative as the

"form of the text and the force of our will" (Jackson, 2008a, p. 174). Making sense out of the random cannot be done, no matter how one tries. Farhoomand (2002) concluded that the "goal of information seeking should be answers to personally meaningful questions through filtering, delegation of information screening, and elimination of redundant information" (Farhoomand, 2002, p. 5). Mutch (1997) believed that information-seekers need to become more information literate. By doing this, they will reduce the mishandling of information and problems of information overload. A focus primarily on the question(s) one is seeking to ask, rather than on the identification and retrieval of data, will make an information-seeker truly literate in this age of information demands.

Multitasking: A Predecessor?

Cognition and effectiveness in multitasking are still fairly recent areas of study. For many years, corporations have advocated the importance of multitasking. However, what happens when you are too multitasked (Brandel, 2008)? Osif (2007) states that companies lose an average of 2.1 hours per day of employee productivity because of constant multitasking employees undergo. The effect adds up to $588 billion in lost productivity [United States businesses]. An important statistic shows that an average employee can only work for eleven whole minutes before being disrupted. Hallowell (2006) defines *multitasking* as a "mythical activity in which people believe they can perform two or more tasks simultaneously as effectively as one" (Hallowell, 2006, p. 18).

Jackson (2008b) believes that employees are constantly being interrupted, which gives way to a lack of focus. This can lead to stress, feelings of frustration, and angry outbursts. There is a worker productivity challenge for employers—their employees are swift multitaskers and habitual jugglers of interruptions. Osif (2007) defines *juggling* as a learned skill; as a "continuous pattern where each time an object is caught, it is thrown back up again" (p. 199). Workplace tasks have become, to some extent, a juggling exercise. Law, Logie, Pearson and Law (2006) stated that there is indeed a decrease in work performance when more than one duty in involved. When mixed in with an overloaded situation, the main concern is usually given to the more engaging duty, not the most relative one. Osif (2007) added that in multitasking, there are higher rates of error and a deficiency of critical thinking.

On the other hand, Wasson (2004) believed that multitasking has benefits in workplace productivity. He concluded that it can enhance employee productivity—but only when it "takes up 'slack' in an employee's attention resources that are not being utilized by [something other than their first priority]" (Wasson, 2004, p. 10). Wasson (2004) further stated that multitasking would not decrease productivity as long as employees make their mandatory task first priority and only put their excess attention resources into other tasks. Under these two conditions, Wasson (2004) believed that multitasking can enhance the productivity of the organization as a whole and can serve as a valuable tool to manage challenging workloads successfully.

When information overload occurs, a reduction in an individual's decision quality is likely to occur. Research concerning business productivity has found that information overload decreases decision quality, increases the time required to make decisions, and increases confusion regarding the decision. Firstly, it can take time away from working on ongoing tasks, which can potentially make an individual feel pressed for time. This situation can ultimately result in information overload. Secondly, interruptions can place greater demands on cognitive processing, which can result in an increase in information load and task-processing demands. It is imperative to note that interruptions are a regular aspect of the work environment of most organizations (Speier, Valacich & Vessey 1999).

Juggling has also been noted as the new field of "interruption science" (Jackson, 2008b, *Effects of Fragmentation* section). Jackson (2008b) described a perfect example where an employee might work on a budget for eleven minutes, but jump between e-mails and associated web research every three minutes. Nearly over 50 percent of the time, employees will interrupt themselves by jumping to other tasks. This type of cognitive dexterity might be useful, but it often takes employees nearly 25 minutes to get back on track. Because of multitasking and the constant flow of digital information, workers are continually interrupted by switching thoughts. Nicholas Carr, author of The *Big Switch: Rewiring the World, From Edison to Google*, felt the same way. "My mind isn't going … but it's changing. I'm not thinking the way I used to think. Now my concentration often starts to drift … I get fidgety, lose the thread, begin looking for something else to do" (Carr, 2008, p. 2). We are spreading ourselves wide and thin as we connect with the immense network of information retrieved by the simple touch of a button. Is technology really changing our brains?

Evolution of the Mind

Mark, Gonzalez, and Harris (2005), professors of informatics at the University of California, conducted an experiment on "work fragmentation." The authors observed how employees performed their work under certain "office" distractions. After studying two high-technological firms for more than 1,000 hours [2005], they found that most employees performed their job well. However, the more distractions the employees found themselves working with, the faster they worked. Oddly, when employees had no distractions or interruptions, stress and frustration were significantly higher. Unusual? Yes. Explainable? Certainly. Mark concluded that if employees are recurrently interrupted, they are switching thoughts and cannot "think deeply" about anything (Jackson 2008b, p. 45).

Many studies have revealed frequently described symptoms of information overload as cognitive strain and stress, a general lack of perspectives, lower job satisfaction, and an inability to use information to make decisions. These symptoms are characterized as the so-called "paralysis by analysis" (Eppler & Mengis, 2004, p. 331). For centuries, it has been claimed that information overload is a natural and predestined condition of the human species (Bawden, 2008). We have all heard the youth generation as being the true "digital natives". If a younger age group (18-21 years old) and an older age group (30-35 years old)

simultaneously perform the same technological task, the younger-age group will perform slightly better. Now, what if both groups were performing the same task and got interrupted by a text-message or phone call? The outcome reverses. The younger-age group just lost their advantage by the other group performing better. Why, you might ask? Older-age employees "are slightly more cognitively cautious … having more developed brain systems for switching between tasks" (Jackson, 2008b, *Effects of Fragmentation* section). Parts of the prefrontal cortex do not fully mature until a person's mid-20's. "Brain work" (Tidline, 1999, *Information Society* section), rather than physical work, is considered vital to most descriptions of the information society. Interlandi (2008) stated that how we gather, process, and share information would ultimately change as our brains evolve through time. This shift in evolution allows our brain to converge more towards technological skills, while basic social skills are slowly drifting away. The brain's ability to revolutionize (adapt/adjust) in response to diverse stimuli has to do with its plasticity. People who dedicate their time to an endless stream of digital information will have more neurons devoted to filtering that specific information.

Is the Internet truly rewiring our brains? Gary Small, a UCLA neuroscientist, conducted a study on adults and monitored their brain activity while performing Internet searching. He also observed how they each read a page of text. For those who used the Internet habitually (tech-savvy), signaling in brain regions accountable for complex reasoning and decision-making were twice as much than those whose Internet exposure was limited. Small concludes that the *digital natives* (those who grew up with digital technologies such as email and the Internet [Prensky, 2001]) have excellent cognitive abilities. These abilities enable a person to make "snap decisions and juggle multiple sources of sensory input" (Interlandi, 2008, p. 4). On the other hand, *digital immigrants* (those who did not grow up with technology, but adapted to it later in life) have had their brains trained for the technological innovations (Prensky, 2001). They focus on tasks one at a time, bit by bit.

Miller (1978) recorded some interesting observations about the form and effect of information overload on an individual. As input increases, output ultimately decreases. Also, some information overload symptoms may relate to those associated with schizophrenic behavior—withdrawal and escape coping methods. However, people react in different ways as they adapt to the overload of information. ADT, Attention Deficit Trait, is "a sustained negative neurological effect of information overload" (Houghton-Jan, 2008 p.2). Psychiatrist E. M. Hallowell identified this neurological effect as a response to the hyperkinetic society we all live in today. As more and more people deal with more input than they possibly can, the brain's frontal lobes lose their complexity. This causes people to have difficulty staying organized, managing time, and most importantly, setting priorities. Feelings of chronic guilt and panic are also present (Hallowell, 2006). In workplace productivity, these negative costs can result in employees' overlooking anything past the first few options, connecting and understanding details with difficulty, making mistakes, and managing time poorly.

Klapp (1986) insinuated that key responses to information overload are *boredom* and *anxiety*. He defined *information overload* as a degradation of

information, occurring when information is "noise like, irrelevant, and interferes with desired signals" (Klapp, 1986, p. 2). When information is unnecessary, predictable, and does not tell enough of interest, overload can also occur. He further discussed the idea of *satiation*. Satiation can occur from too much stimuli, habituation, and desensitization (the loss of sensitivity to strong stimuli). In all, repeated retrieval of useless information is one of the main causes of information overload.

Tim Sanders, project founder of HeartMath® and author of the *New York Times* bestseller *Love is the Killer App*, traveled the world giving presentations on *the always-on economy* and the effects it has on people. He developed a name for a new syndrome that people were struggling with—New Economy Depression Syndrome (NEDS). "NEDS is a self-reinforcing depression brought on by information overload and frequent interruption leading to an erosion of close personal relationships" (Sanders, 2003, p. 4). NEDS can produce symptoms such as burnout, sadness, irritability, anxiety, and difficulty in making decisions. Employees are constantly skimming pages of information on a daily basis, while being interrupted by their Blackberries, instant messaging, e-mail, etc. Sanders adds that many employees will simply e-mail another employee in the next cubicle instead of walking a few feet to converse with him or her. Many are relying too heavily on e-mail rather than conversing directly with someone. Workers are actually hiding behind their e-mail (Moss-Coane, 2007). Sanders has estimated that over eight million Americans qualify as victims of NEDS. This can cause a staggering decrease in business productivity.

The Journal of the American Medical Association estimated a 44 billion dollar loss of business productivity each year due to work-related depression (NEDS). To confirm his theory on NEDS, Sanders created a survey that associated "the relationship between PC and Internet usage, information overload, and depression" (Sanders, 2003, p. 3). He found that there was a connection between depression and the number of hours using the Internet: the more hours spent on the Internet, the higher the symptoms of depression. Those who experienced information overload had increased symptoms of depression and felt less connected with friends and family. Sanders (2003) wrote, "We're expected to shift our thinking every few seconds," (p. 12). Feelings of frustration and inadequacy are a direct result, as well as having trouble completing tasks (Kanigel, 2004). Overall, the survey produced results linking the Internet as a main source of information overload in work-related depression. Terry Real, founder of the Relational Recovery Institute, concludes that "technology is seduction, it's fast and easy—a psychological junk food. The more we turn to it the less satisfied we feel" (Sanders, 2003, p. 4).

We may be reading more than we did 20 to 30 years ago thanks to the Internet and its ubiquity of information. However, it is a different kind of reading, and behind that lies a different kind of thinking. Maryanne Wolf (2007), developmental psychologist at Tufts University and author of *Proust and the Squid: The Story and Science of the Reading Brain*, claimed that we are not only *what* we read. "We are *how* we read" (Wolf, 2007, p. 58). Wolf fears the style of reading endorsed by the Internet. She claims that it promotes efficiency and immediacy, which can reduce the user's ability for deep reading. When reading text online,

users tend to become "mere decoders of information" (Wolf, 2007, p. 58). A mental connection forms when deep reading is taking place. Carr (2008) claims that reading on the Internet can cause distraction as users are often found bouncing from one source to another, hardly ever reading more than one page before switching to another website. For many individuals, the Internet may replace the actual printing press, but it creates something altogether different. The kind of deep reading that "a sequence of printed pages promotes is valuable not just for the knowledge we acquire from the author's words but for the intellectual vibrations those words set off within our own minds" (Carr, 2008, p.63).

Focus: Employee Overload

The information overload phenomenon has been receiving escalating attention in recent years, particularly in business literature (Kock, 2000). In 1850, 4 percent of American employees handled information for a living. Today, jobs concerning information processing now accounts for more than half of the U.S. gross national product (Shenk, 1997). A recent report by Datamonitor, a website offering investment news, states that many organizations are losing up to 10 percent of their staff costs on wasted effort. This is due to typical employees spending up to a quarter of their day searching for the relevant information to complete a particular task (Organizations Waste, 2006).

On average, American workers spend forty-five hours a week at work (Moss-Coane, 2007). According to a study conducted by Microsoft, sixteen of those hours are spent inefficiently. Other companies, such as America Online and Salary.com, state that out of a full work week (five days), employees actually only work three days. The other two days are wasted. The Center for Work Life Policy states that the average professional workweek has lengthened from 45 hours to 70+ hours. Employees are tackling piles of paper to read, in addition to an escalating amount of other work—ranging from e-mails to scroll through, faxes arriving, and telephones ringing. This awareness of being overloaded with information is very difficult to avoid. Vickery and Vickery (2004) described employees' responses to the [above] given situations as "omission" (failing to attend to or absorb information) and "error" (assimilating it incorrectly). Omission can be necessarily selective—meaning that employees can omit what is difficult to assimilate, even though it may be important to their current tasks (Edmunds, 2000).

Braun-LaTour, Puccinelli and Mast (2007) suggested that the difference in how individuals, in this case employees, process incongruent information in overloaded situations depends on the mood-state that they are in at that particular time. Employees that are in a negative mood-state will process information in a less direct, if not slower, way. Processing incongruent information is much more difficult when someone is in that type of a mood. Eppler and Mengis (2004) concurred with this keen observation. A person's attitude, qualification, and experience are important factors in the causes of employee information overload. Earlier studies have stated that a person's ability to process information is rather limited. They have proven that individual limiting factors such as level of

experience, personal skills, and motivation directly affect the information processing capacity of an individual.

Belkin (2007) asked a simple question: are employees wasting time by working harder? Bob Kustka, founder of the consulting firm Fusion Factor, *s*tated that, "the longer an employee works, the less effective he or she will be." He further explained how productivity is unequivocally correlated to time. However, that connection is less direct in today's workplaces. Places of business are now managing the clocks—how many hours employees are putting in, not the work they are producing. They are looking at something the employee produces, using that as productivity. This can also be frustrating on the account of the *downsizing* factor. Over the last 20 years, companies have severely downsized their staffs. "Fewer workers are doing more" (Moss-Coane, 2007). In corporations, downsizing leads to fewer staff members dealing with rapidly increasing amounts of information. Charles Handy describes this rule as the ½-by-2-by-3 rule—meaning there are **half** as many people on the payroll, paid **twice** as well, producing **three** times as much productivity (Edmunds, 2000). Employees often feel that they have to constantly be up-to-date by receiving more and more information. Communication is becoming one of the biggest issues in organizations. Employees are not clear on what is expected from them. Managers need to be specific in regards to what is expected from employees. Kustka informed his listeners that most managers do not know how to manage employees, rarely giving them the constructive feedback they crave. This is a direct result on most managers avoiding conflict and confrontation. Kustka concludes "good bosses are developmental managers" (Moss-Coane, 2007, middle section of radio podcast).

Does information overload drastically affect workplace productivity and product quality? Kock claimed that although it has been believed to be a negative phenomenon, information overload might be the "force behind the building of specialized knowledge and skills" (Kock, 2000, p. 258). Kock (2000) asserted that information overload is merely an intervening variable. There are two factors involved: individual and task. Individual factors include an employee's knowledge base and decision style. Task factors include task complexity, number of information exchange interactions, and amount of information processed. The outcome of information overload is task productivity and/or task outcome quality. Kock (2000) concluded that there is no clear relationship between information overload and the efficiency or quality of tasks. Task performance is unrelated to the overload of information because for some employees, information overload rapidly leads to improved performance. Kock (2000) claimed information overload does not decrease performance, but in fact, increases it. The pressure to perform tasks within a certain time frame is directly related to information overload, rather than the amount of information that needs to be generated. Individual factors (as mentioned above) influence information overload more than task factors do. For example, an individual factor such as decision-making style and expertise will affect task completion time, rather than a task factor. Task factors are more reliant on process structure, which is more or less constant for different employees. Above all, Kock (2000) believed that information overload should only be looked at as an

intervening variable. Task factors are more reliant on an employee's job title and its responsibilities than on individual qualities.

Focus: Managerial Overload

Information technology can improve productivity in workplaces, improve the quality of their lives, and most importantly, improve managers' decision-making abilities. The emergence of information media has produced an extreme overload of information, which has taken over the lives of millions of knowledge workers worldwide. In 1966, Peter Drucker, considered to be the father of modern management, stated that "every *knowledge worker* in a modern organization is an 'executive' if, by virtue of his position or knowledge, he is responsible for a contribution that materially affects the capacity of the organization to perform and to obtain results" (Drucker, 2001, p. 194).

We have discussed information overload and its effects on general employees, but what about its effects on managers? Business information providers have expressed concern in the subject because it is in their best interests to ensure that the information load on managers "is not so great as to preclude use of their services" (Allen, 2003, p. 33). Firstly, information overload can be characterized in two situations. In the first situation, knowledge workers are given more information than they can handle. In the second situation, information overload can occur when the "information processing demand on an individual's time for performing interactions and internal calculations exceeds the supply or capacity of time available for such processing" (Farhoomand, 2002, p. 1). An empirical study, concerning managers and the overload of information they encounter, was conducted in transportation, manufacturing, financial services, and government agencies situated in the United States, United Kingdom, Australia, and Hong Kong. The main outcome of the study involved an excess *volume* of information that bombarded managers at work, followed by *time constraints* (the lack of time to understand the information), *noise* (trouble managing the information), and *multiple channels* (multiple sources of information) (Farhoomand, 2002). Nelson (1994) stated that *volume* can be defined as a greater number of data, more materials, more items, and more detail. Users are provided with information, both useful and useless. Users must learn quickly how to sort out and choose the useful information. When the background *noise* of a channel drowns out most of the constructive content for information-seekers, as is now occurring on the Internet, the effectiveness of the channel is destabilized (Berghel, 1997). Katzer et al. (1992) claimed that managers receive more information from more sources though more channels than almost anyone else in an organization. The dilemma is clear: managers receive too much information, but do not get enough of the right information.

Uline (1996) states that before the Information Age, new technological innovations often replaced older ones. In today's information society, new technologies do not replace older counterparts, but simply *add* to them. This particular situation implements an excess of multiple channels to the information source. In effect, information flow becomes instantaneous and multidirectional. Users may be captivated by their computers just because of the mere factor of their

"availability." Information is readily available to retrieve, but users may be unable to understand it. The convenience of searching and retrieving information, along with time constraints, causes users to rely heavily on sources that are immediately available and accessible. However, these may not provide the best references. This can often give a false sense of accomplishment.

In business organizations, information can be categorized by three characteristics: internal, external, and company information. The flow of information can occur in three different ways: from the environment into the organization (external), from the organization into the environment (company information), and surrounding the company (internal). Farhoomand (2002) clarified that over half of employees state that they have encountered information overload regularly, with 40 percent of it coming from external sources (print correspondence, e-mail, business-related news, the Internet, etc.) and 60 percent internal sources (interpersonal/department/office e-mail, memos, and reports). Informal information, such as gossip, also contributes to the overload of information managers have to deal with. One respondent wrote that information overload causes "delays, mistakes, and nonperformance" (Farhoomand, 2002, p. 129), eventually diminishing the quality of work. Others stated the feelings of frustration, confusion, restlessness, and anxiety. Above all, the worst is the discouraging effect on the commitment of the job.

Discussion and Conclusion

It is very unlikely that one perfect answer can be found to lessen or eliminate the problem of information overload (Edmunds & Morris, 2000). There are a number of factors related to information overload in various literatures concerning business productivity: increased communication, globalization, deregulation, downsizing, and technology. Given that management productivity is considered "knowledge work" (Allen & Wilson, 2003, p. 35), we can assume that managers will be in high need for cognition and will tend to acquire information. As employees progress through an organization, they will continue to prove their competency by taking on more work than they should be and working excessive hours to accomplish all their given tasks (Allen & Wilson, 2003).

During the writing of this paper, the numbers of task-switches were too high to count. The idea of multitasking is ubiquitous. Each of us considers ways to multitask during the day—and during the reading of this paper. There are just too many deadlines and competing expectations that encircle our lives (Osif, 2007).

Organizations will need to find ways to deal with information overload, particularly the reliability of certain sources that find their way to employees. As more young people come into the workplace, they are used to having these types of unreliable sources in their personal lives (Brandel, 2008).

The main cause of information overload is the stress generated by modern management practices. In effect, these practices can place jobs under threat and/or increase workloads, which can create defensive behavior. This can lead to information behavior that *produces* overload, not only on the individual, but on others as well (Tidline, 1999).

Solutions to information overload can include improved or revised input from the human intermediary. Prioritizing operations carried out in electronic environments should also be considered. When information overload affects employee productivity, studies suggesting solutions are carried out in business settings. These types of solutions include decision-making theories and profit motives (Tidline, 1999). Etzel (1995) suggests that in order to cope with information overload, personal information management strategies need to be developed. Deciding which medium to use, while carefully considering the tools that appear to be most relevant, should be practiced in any information-seeking individual. Taking an integrated approach rather than a dependence on tools is not a resolution by itself.

On the other hand, Wilson (1976) minimized the importance of information overload. He claimed that it does not need to be clarified. He believed the concept of information overload is purely a "phantom" (Wilson, 1976, p. 59) and argues that it does not exist for a majority of people in most situations. According to Wilson, people tend to ignore what they do not need, or what may be irrelevant to their needs. If threatened by a possible overload of information, people tend to cope by practicing avoidance or seeking information that will support their customary decision-making choices and practices.

IT specialists sometimes place emphasis on fast access to volumes of information, rather than offering access to quality information that can be considered useful. Many organizations are now employing information specialists who specialize in information handling. Others incorporate an information worker into a department, rather than placing him or her in a separate one (Edmunds et al., 2000).

The debate over technology, especially the Internet, was discussed in reference to information overload throughout this paper. However, the Internet's influence does not end at the edges of the computer screen. As information-seekers, what are our expectations? Have our minds become attuned to the "crazy quilt of Internet media" (Carr, 2008, p. 4)? Or do traditional media have to adapt to our new expectations? Old media have little option but to take part in the new media systems.

In many cases, it seems that technology may be the best answer—all that essential information sent to your computer without the need for any intervention on the part of information professionals. However, take a step backward. This brings us back to the common need for greater information literacy amongst those employed by business corporations, along with the importance of information content. The role of information professionals will be vital in determining the content of information (Hyams, 1997). Bugeja once said, "This is not the Age of Information. This is the "Age of Distraction" (Bugeja, 2008, p. 68). We all know that knowledge is power. But in the end, information [overload] may be a small price to pay for preserving it.

References

Allen, D., & Wilson, T. D. (2003). Information overload: Context and causes. *New Review of Information Behaviour Research, 4*(1), 31-34.

American Library Association. (1989). *Presidential Committee on Information Literacy: Final Report.* Retrieved November 25, 2008, from http://www.ala.org/ala/mgrps/divs/acrl/publications/whitepapers/presidential.cfm.

Bawden, D., Holtham, C., & Courtney, N. (2008). Perspectives on information overload. *Aslib Proceedings: New Information Perspectives, 51*(8), 249-255.

Belkin, L. (2007). Time wasted? Perhaps it's well spent. *New York Times,* Retrieved from http://www.nytimes.com/2007/05/31/fashion/31work.html

Berghel, H. (1997). Cyberspace 2000: Dealing with information overload. *Communications of the ACM, 40*(2), 19-24.

Blair, A. (2003). Reading strategies for coping with information overload. *Journal of the History of Ideas, 64*(1), 11-28.

Brandel, M. (2008). Information overload: Is it time to go on a data diet? *Computerworld, 42*(34), 18-23.

Braun-LaTour, K. A., Puccinelli, N. M., & Mast, F. W. (2007). Mood, information congruency, and overload. *Journal of Business Research, 60*(11), 1109-1116.

Bugeja, M. (2008). The age of distraction: The professor or the processor? *Futurist, 42*(1), 68-66.

Carr, N. (2008). Is Google making us stupid? *Atlantic Monthly, 302*(1), 56-63.

Dewey, J. (1910). *How we think*. Boston: D. C. Heath & Company.

DiPasquale, J. (2008, November 26). Online discussion forum in Rutgers MLIS Human Information Behavior Course: *Week 13 – Social Informatics* [Msg: "Immediacy"].

Drucker, P. F. (2001). *The Essential Drucker: Selections from the Management Works of Peter F. Drucker.* (1st Ed.). New York: Harper Business.

Edmunds, A., & Morris, A. (2000). The problem of information overload in business organizations: A review of the literature. *International Journal of Information Management, 20*(1), 17-28.

Eppler, M., & Mengis, J. (2004). The concept of information overload: A review of literature from organization science, accounting, marketing, MIS, and related disciplines. *The Information Society, 20*(5), 325-344.

Etzel, B. (1995). New strategy and techniques to cope with information overload. *IEE Colloquium Digest, 95*(223), 2/1-2/10.

Farhoomand, A. F., & Drury, D. H. (2002). Managerial information overload. *Communications of the ACM, 45*(10), 127-131.

Gantz, J. F. (2008). *The Diverse and Exploding Digital Universe* (2008 IDC EMC). Retrieved from http://www.emc.com/collateral/analyst-reports/diverse-exploding-digital-universe.pdf

Hallowell, E. M. (2006). *CrazyBusy: Overstretched, overbooked, and about to snap! Strategies for coping in a world gone ADD* (1st Ed.). New York: Ballantine Books.

Hert, C. A. (1994). A learning organization perspective on training: critical success factors for Internet implementation. *Internet Research, 4*(2), 36.

Houghton-Jan, S. (2008). Being wired or being tired: 10 ways to cope with information overload. *Ariadne,* Retrieved from http://www.ariadne.ac.uk/issue56/houghton-jan/

Hyams, E. (1997). New technological horizons and opportunities for LIS. *The Electronic Library, 15*(6), 455-462.

Interlandi, J. (2008). Reading this will change your brain. Retrieved November 14, 2008 from http://www.newsweek.com/id/163924

Jackson, M. (2008a). *Distracted: The Erosion of Attention and the Coming Dark Age*. New York: Prometheus Books.

Jackson, M. (2008b). Quelling distraction. *HR Magazine, 53*(8), 42-46.

Janssen, R., & de Poot, H. (2006). Information overload: Why some people seem to suffer more than others. *Proceedings of the 4th Nordic Conference on Human-Computer Interaction: Changing Roles*, Norway*, 189* (ACM International Conference Proceeding Series), 397-400.

Kanigel, R. (2004). Too much information! *Organic Style,* Retrieved October 19, 2008 from http://online.sfsu.edu/~kanigel/clipstoomuchinformation.html.

Katzer, J., & Fletcher, P. (1992). The Information Environment of Managers. *Annual Review of Information Science and Technology, 27*, 227-263.

Kennedy, S. D. (2001). Finding a cure for information anxiety. *Information Today, 18*(5), 40.

Klapp, O. E. (1986). *Overload and Boredom: Essays on the quality of life in the information society*. New York: Greenwood Press.

Kock, N. (2000). Information overload and worker performance: A process-centered view. *Knowledge and Process Management, 7*(4), 256-264.

Kuhlthau, C. C. (1991). Inside the search process: Information seeking from the user's perspective. *Journal of the American Society for Information Science, 42*(5), 361-371.

Law, A. S., Logie, R. H., Pearson, D. G., & Law, A. S. (2006). The impact of secondary tasks on multitasking in a virtual environment. *Acta Psychologica, 122*(1), 27-44.

Liang, T. P. (2006). Personalized content recommendation and user satisfaction: Theoretical synthesis and empirical findings. *Journal of Management Information Systems, 23*(3), 45-70.

Mark, G., Gonzalez, V. M., & Harris, J. (2005). No task left behind?: Examining the nature of fragmented work. *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems,* Oregon. *Conference on Human Factors in Computing Systems*, 321-330.

Miller, J. G. (1978). *Living Systems*. New York: McGraw-Hill.

Moss-Coane, M. (Producer). (2007, November 1). Why some workers are more productive than others. (Episode featuring Bob Kustka). WHYY's Radio Times with Marty Moss-Coane. Podcast retrieved from http://www.trumix.com/podshows/2036852.

Mutch, A. (1997). Information literacy: An exploration. *International Journal of Information Management, 17*(5), 377-386.
Needle, D. (2008). Information overload costs U.S. $900B. *InternetNews,* Retrieved December 28, 2008 from http://www.internetnews.com/stats/article.php/3793546.
Nelson, M. R. (1994). We have the information you want, but getting it will cost you: Held hostage by information overload. *Crossroads, 1*(1), 11-15. Retrieved October 30, 20008 from http://portal.acm.org/citation.cfm?id=197183
Organizations waste 10% of salary bill searching for information. (2006). *MarketWatch: Global Round-Up, 5*(12), 183-184.
Osif, B. A. (2007). Multitasking [bibliographical essay]. *Library Administration & Management, 21*(4), 109-204.
Prensky, M. 2001. Digital Natives, Digital Immigrants. *On the Horizon* 9(5). Retrieved November 1, 2008 from: http://www.marcprensky.com/writing/Prensky%20-%20Digital%20Natives,%20Digital%20Immigrants%20-%20Part1.pdf
Salim, J., & Ming D.C. (2004). Information skills: Perspectives and alternatives in search strategies. *Malaysian Journal of Library & Information Science, 9*(2), 79-94.
Sanders, T. (2003). *Millions gripped by NEDS.* Retrieved November 12, 2008 from http://sanderssays.typepad.com/NEDSPressRelease.doc
Shenk, D. (1997). *Data smog: Surviving the Information Glut* (1st Ed.). California: Harper Edge.
Speier, C., Valacich, J. S., & Vessey, I. (1999). The influence of task interruption on individual decision-making: An information overload perspective. *Decision Sciences, 30*(2), 337-360.
Spira, J. (2007). From knowledge to distraction. *KM World, 16*(3), 1-32.
Tidline, T. J. (1999). The mythology of information overload. *Library Trends, 47*(3), 485-506.
Liang, T.P., Lai, H.J., & Ku, Y.C. (2007). Personalized content recommendation and user satisfaction: Theoretical synthesis and empirical findings. *Journal of Management Information Systems, 23*(3), 45-70.
Tjaden, T. (2007). *Combating information overload.* Retrieved October 30, 2008, from http://www.slaw.ca/2007/06/26/combating-information-overload/
Uline, C. (1996). Knowledge in the information age. *Edu. Tech, 36*(5), 29-32.
Vickery, B. C., & Vickery, A. (2004). *Information science in theory and practice* (3rd Ed.). München: K.G. Saur.
Wasson, C. (2004). Multitasking during virtual meetings. *Human Resource Planning, 27*(4), 47-60.
Wilson, C. E. (1976). Information discrimination: A human habit. *Canadian Journal of Information Science, 1*(1), 59-63.
Wolf, M. (2007). *Proust and the Squid: The Story and Science of the Reading Brain* (1st Ed.). New York: Harper.

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