Reversing the Brain Drain: A Practical Approach to the Capture and Retention of Tacit Knowledge within the Firm

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Abstract

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In this paper, the following themes are discussed:

1. Causes and effects of critical knowledge loss within the firm.
2. Current thinking in the realm of corporate knowledge management.
3. Theoretical basis for current methods in technical education.
4. An alternate pedagogy for facilitating enhanced meaningful learning in technical environments applicable to the task of improving the firm's ability to effectively capture and retain its critical tacit knowledge resources.

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Introduction

Strategies for management and retention of critical institutional knowledge are vital to the survival of the firm in markets that are becoming increasingly competitive at the national and international level. High on the list of threats to the firm’s ability to maintain positive control of its institutional knowledge is retirements and employee turnover. While high rates of turnover are a problem under any circumstance, employee turnover does not present as much of an immediate threat to the firm as would be the case for a sudden and dramatic mass retirement of employees in possession of critical institutional knowledge key to the firm’s economic competitiveness. Baby boomers, who comprise “more than 25 percent of the U.S. population” (Krishnan, 2006, p. 36) and a disproportionate number of key positions associated with vital organizational knowledge, are fast approaching retirement. In some industries, nearly half the key technical and managerial talent within the organization can be classified as potential, near-term retirees. Nowhere is this situation more critical than in the many agencies of the U.S. federal government. Years of attrition, reduction-in-forces (RIFs), and hiring freezes has produced a rapidly aging workforce of skilled employees who may not have been able to adequately train their eventual replacements. Many non-government organizations have made similar mistakes, and have yielded similar results. In order to survive the impending exodus of critical skills, talent, and knowledge, firms must “begin thinking ‘outside-of-the-box’” (Krishnan, 2006, p. 36) by adopting knowledge management strategies that are more efficient at capturing and redistributing this critical knowledge within the firm. According to Hoffman, Coffey, Ford, and Novak (2006), many firms are not even aware of the fact that knowledge vested in their employees is an important corporate asset.

Contemporary issues in corporate knowledge management

Part of the problem with managing the exodus of vital corporate knowledge stems from the fact that many firms have not fully identified all of their critical knowledge assets. According to Holsapple and Joshi (2002), the firm’s knowledge assets “are complex and multifaceted, ranging from tacit components to knowledge that is explicitly represented” (Holsapple & Joshi, 2002, p. 47). Under the contemporary knowledge management paradigm, explicit knowledge is defined as knowledge that exists in a tangible form such as print, audio/visual recording, computerized database, etc. In contrast, tacit knowledge is defined as that knowledge that exists as the intangible experiences or mental notes of a given person. Both tacit and explicit knowledge can exist as a form of descriptive, procedural, or reasoning knowledge (Holsapple & Joshi, 2002). Accordingly, Holsapple and Joshi state further that “this portfolio of skills and how they are deployed in manipulating available knowledge resources go a long way toward determining the nature of an organization’s innovations and outputs, and hence its competitiveness in a dynamic environment” (Holsapple & Joshi, 2002, p. 47). Alavi and Leidner (2001) add to this discussion, of the criticality of the firm’s portfolio of skills to the firm’s competitiveness, the notion that “knowledge-based resources are usually difficult to imitate and socially complex” (Alavi & Leidner, 2001, p. 108). In short, a successful firm with a competitive advantage (no matter how slight) must work tirelessly to ensure that the knowledge that led to the advent of the advantage not leave the company lest the company loose the advantage. Businesses that are astute enough to recognize this fact, tend to view employee know how as an asset that “may produce long-term sustainable competitive advantage” (Alavi & Leidner, 2001, p. 108). Yet, this view masks the real underlying truth of employee knowledge, and is itself partly responsible for the failure of many contemporary knowledge management initiatives. Alavi and Leidner suggest that it is not the knowledge itself that provides the competitive advantage, but rather the “firm’s ability to effectively apply the existing knowledge to create new knowledge and to take action that forms the basis for achieving competitive advantage from knowledge-assets” (Alavi & Leidner, 2001, p. 108). This higher order capability is what firms loose when key, long-term employees retire, and is representative of the skills that are largely irreplaceable when lost.

The traditional problem with knowledge management initiatives is that they wrongly focus too heavily on the technical aspects of knowledge retention (i.e., generate a report, store a report, make reports available for others to utilize, etc.). Not enough attention is paid to the art and science of the knowledge itself, as defined by the resident expert—the knowledge owner. Many experienced workers have vast stores of knowledge that do not translate well to report form. Even worse, many of these workers either lack the skill or lack the patience to actually write a report detailed enough to allow a lesser skilled employee to develop a competent understanding of the tacit knowledge at issue. The traditional method for sharing tacit knowledge in years past has always been through an apprenticeship of some sort. However, the disadvantage of apprenticing is that the apprentice usually must serve in this capacity for years in order to master the requisite tacit knowledge of the teacher. In the modern economy, there is generally not enough time or money allowed for students to serve as apprentices of the experienced workers, necessitating a more efficient means of transferring tacit knowledge from the proverbial "master" to his student.

Contemporary issues in technical education

With the looming specter of future mass retirements of critical employees existing as an indelible feature of today's reality, developing adequate coping strategies is becoming ever more important for at-risk firms with each passing day. In technical fields, however, the development of coping strategies is complicated by the fact that not everyone can be trained to perform the tasks currently being performed by the retiring experts (regardless of the level of prior education that new employees bring to the table prior to on-the-job training). Part of the problem originates in the assumption that all knowledge is both definable and absolute. To be considered definable, the knower has to be able to make the knowledge explicit. Sounds easy enough, right? Well, defining knowledge acquired through direct experience, perception, and individual cognition is extremely difficult to convey using words (hence the advent of the phrase, "a picture is worth a thousand words").

Contemporary technical education relies heavily upon cognitivist theory for its pedagogic foundation. According to cognitivist theory, all knowledge is absolute and definable, which allows this knowledge to be transferable between two parties engaged in some form of communication. The definability property of cognitivist knowledge imparts the ability of two communicating parties to establish a common word or set of words to describe some thing, and that terms in use will always invoke understanding of the thing "by definition." Absolutism implies that the definition of the something will not change regardless of whether or not there is variability in the language used to describe it. For example, a stone is a stone, regardless of whether or not someone refers to it as gravel, rock, or a pebble. While there may be additional contextual information conveyed by the use of the many colloquial names for a stone (such as its relative size, purpose, or composition), it is highly unlikely that a rational person would be confused by hearing a rock or pebble referred to as a stone. The foregoing example implies that cognitivist theory has the additional requirement that a fully descriptive and complete lexicon associated with the defined cognitivist knowledge exist, and that this lexicon be common to both parties prior to their attempt to convey knowledge. Without such a lexicon, communication between the two parties with respect to the subject knowledge would be largely impossible. Consider the situation in which a person is asked to describe how he feels upon seeing a blooming flower. The concepts of self, flower, and feeling are absolute and definable, and thus, are easily accommodated by the lexicon of everyday speech. In contrast, the language associated with the descriptive nature of one's feelings as they relate to that individual's response to such a singular and personal event is neither absolute (one person's reaction will not necessarily be the same as another's), nor definable (person A's definition of feeling may be different from person B's definition of the same feeling). Thus, pedagogy based on cognitivist theory would fail to provide an avenue for sharing tacit knowledge based (in this example) on the descriptive nature of one's feelings.

This limitation on the efficacy of cognitivist theory has significant implications for the development and successful implementation of knowledge management initiatives. Existing knowledge management initiatives rely heavily on the ability of the knower and the learner being able to communicate effectively using the lexicon of the knowledge domain. However, it is often the case that learners will use the lexicon associated with the knowledge domain properly, yet lack significant understanding of the knowledge domain to be able to perform tasks necessary to demonstrate a mastery of the subject knowledge. According to Case and Marshall (2004), this is an example of the surface approach to learning. The surface approach describes a learning strategy characterized by learners whose sole purpose is to perform memorization of knowledge for later recall. The learner makes no attempt to relate new knowledge to prior knowledge. This approach stands in contrast to the conceptual deep approach (Case & Marshall, 2004) in which the learner's strategy consists mainly of developing a conceptual understanding of the new knowledge such that this new knowledge can be related to prior knowledge in order to generate more new knowledge. Figure 1 illustrates the learning strategy continuum as it relates to the surface and conceptual deep approaches to learning.

INTENTION / STRATEGY	**Learn for Test Preparation**	**Learn to Comprehend**
Memorize	Surface Approach	
Solve Problems	Procedural Surface Approach	Procedural Deep Approach
Conceptualize		Conceptual Deep Approach

Figure 1. Student learning strategies (adapted from Case & Marshall, 2004, p. 613)

Case and Marshall seem to suggest that a strong relationship exists between the chosen learning strategy exhibited by learners and the chosen pedagogic approach used by the teacher, and that the learner's choice of strategy will manifest as a response to learning style required by the teacher. According to Case and Marshall (2004), different academic disciplines will require different learning strategies.

In engineering disciplines, for example, educators typically presume that the subject knowledge of their knowledge domain is tangible and absolute. This presumption extends naturally from the fact that they were at one point taught this belief by their own instructors, who were in turn taught this by their instructors (and so on and so on). Even if an individual instructor were to raise a question about the tangibility and absoluteness of the domain knowledge, others could easily counter by making the argument that textbooks could not exist if the domain knowledge were not tangible and, by inference, absolute and definable. Thus, a common lexicon exists such that people educated in this domain of knowledge can communicate with a common understanding of the symbolic representation of the knowledge in accordance with cognitivist theory (knowledge, once defined, can be shared). Thus, there is no reason for an educator to assume that meaningful learning (procedural deep or conceptual deep learning strategy) will not occur with contemporary pedagogic methods for knowledge sharing. However, there are some serious flaws with this reasoning. First, the shared lexicon is taught in a manner that encourages rote memorization. Students are presented with words, symbols, components, tools, etc., and are required to memorize their purpose, proper use, and other such relevant information (Marshall's surface approach). Secondly, the educator presumes that through this process, the learner will develop the requisite knowledge and skill necessary to adequately perform secondary tasks such as analyzing or solving contextual problems, as well as designing solutions to the problem using the components and tools with which they have become familiar. This presumption is, however, fallacious. Current pedagogic methods fail because of an over-reliance on cognitivist theory, as well as a presumption that students will choose the most appropriate learning strategy for acquiring the requisite knowledge at issue.

As addressed previously, contemporary pedagogic approaches to technical education do not adequately address the facilitation of meaningful learning (procedural deep or conceptual deep learning strategy), due to the failure of its cognitivist approach to ensure that a shared lexicon is both defined and extent prior to the initiation of knowledge sharing. Meaningful learning is described by Novak (1998) as a learning process in which an individual relates his existing knowledge to knowledge that has recently been acquired. What makes learning meaningful is the fact that the learning individual is not simply relying on rote memorization to acquire knowledge. Instead, the learner is making an effort to contextualize the new information, and to attempt to draw relationships between this new information and any existing related knowledge that he may posses (see Figure 1). For learning to be meaningful, the following requirements must be met (Novak 1998). First, all involved knowledge (newly acquired, as well as extent knowledge) must be relevant. This should come as no surprise, since irrelevant knowledge tends to be avoided by learners anyway. Next, the individual must make a conscious and deliberate effort to relate the new knowledge to existing knowledge, which meets the relevance criteria. Without meaningful learning, it would be difficult for an individual to make explicit knowledge (e.g., textbooks, journals, lecture material) useful, since such an act would first require that the individual be capable of relating the explicit knowledge to their own tacit knowledge (i.e., personal experience, etc.) in order to synthesize new knowledge.

In order to better understand why this is the case, it is necessary to gain an understanding of a competing explanatory learning theory: constructivism. Constructivism is an explanatory learning theory that contrasts with cognitivism. According to constructivist theory: (a) all knowledge is by definition intangible and abstract, (b) knowledge exists merely as a fabrication of the individual knower's mind, (c) knowledge is unique to the individual who possesses it, and (d) that the fabrication of knowledge results from the learning process through which the individual originally acquired the knowledge (Novak, 1998). The most significant difference between constructivist and cognitivist ideology is constructivist theory's inferential notion that knowledge, once learned, cannot be transferred directly from one individual to another.

Concept maps as a teaching instrument

The concept map, developed in the early 1970s by Joseph D. Novak (Novak 1998), is a visual method for representing knowledge and for making sense of knowledge. The concept map was first used by Novak in studies of elementary school-aged children to identify their base level of knowledge and understanding of various concepts, and to determine the effectiveness of various teaching methods on their understanding of new knowledge concepts (Novak, 1998). However, the usefulness of a concept map as a sense-making tool for capturing and conveying knowledge extends well beyond this early application. Figure 2, for example, depicts a concept map that was used by the author to teach basic foundational electrical engineering material to students at the U.S. Naval Academy during the fall semester of 2006. In this example, the knowledge contained in the requisite chapters of the course text was reduced to a single visual diagram that emphasized conceptual relationships between individual knowledge objects, as opposed to a strict conveyance of textual facts, numbers, and formulae. The method of teaching consisted of displaying the concept map for the day’s unit, and then walking the students through the relationships between individual knowledge objects, while being sure to define individual units of knowledge in the context of other units of knowledge with which it relates.

Figure 2. An actual concept map utilized by the author to teach introductory electrical engineering material to midshipmen at the U.S. Naval Academy during the fall of 2006

This independent teaching initiative consisted of an attempt to demonstrate that the first third of an engineering course could be effectively taught exclusively using concept maps. To encourage meaningful learning, students were required to read the next day's chapter assignment, and then produce a concept map for the given chapter that was collected as a homework assignment on the day that the chapter was to be covered in class. The author would then display his own concept map for the same chapter assignment, and then explain the relevant concepts as normal, while allowing the students to compare their own version of chapter knowledge to that of the author. In this manner, students were forced to modify their learning strategies to produce a conceptually deep understanding of the course material by:

1. Identifying relevant concepts in the chapter.
2. Consciously decomposing the relevant concept into their basic knowledge modules and knowledge components.
3. Drawing connections between the relevant concepts of the chapter.
4. Defining the relevant concepts in terms of their basic knowledge components.

Initially, students tended to be awestruck by the level of detail contained in the author's concept maps, and reacted with bewilderment and skepticism to its introduction in class. Typical comments referenced the fact that this method was radically different teaching methods currently taught in other courses. However, after being walked through the concept map in class, students began to recognize that the differences between the author's concept map and their own extended beyond level of detail. In time, as the students became more comfortable with process of creating and analyzing concept maps, the quality and detail of their individual concept maps improved substantially. Several students expressed that they not only found this approach to be meritorious, but that it substantially improved their understanding of a subject that had a reputation for being extremely difficult to learn (this course is taught to non-engineering majors exclusively). A student, who often expressed the fact that she regularly performed poorly in math and science classes, stated that she found the visual nature of the concept map to be extremely enlightening. Another student with a similar problematic relationship with math and science classes, lamented the fact that he felt that the class seemed too easy, and that he was afraid that he was somehow missing something in class because it was not as hard as he was expecting it to be. The author reiterated to these and other students the logic of using concept maps to enhance meaningful learning by helping them learn complex concepts through the establishment of relationships between comparatively primitive concepts. One surprise came when a student asked if it would be acceptable to read ahead in the textbook, and to begin putting together concept maps for these chapters in advance of being given such an assignment.

Conducted independently and without prior knowledge of the Case/Marshall study, the author's teaching initiative produced results consistent with the observations made by Case and Marshall. First, the author's pedagogic approach to teaching engineering material emphasized conceptualization over memorization, which, in time, forced students to adapt by adopting either a procedural deep or conceptual deep learning strategy. Secondly, it demonstrates that students will change their learning strategies over time as they assess the perceived value of its effectiveness, and in order to "comply with perceived procedural course requirements" (Case & Marshall, 2004, p. 613). Since the basic purpose of the concept map is to represent knowledge concepts in visual form, it provides a natural starting point for defining information that would otherwise remain undefined. The power of the concept map lies in its ability to allow learners to visually perceive relationships between disparate knowledge objects.

Knowledge management: A grounded theory approach

According to Mellion and Tovin (2002), grounded theory is considered by some researchers to be “the most comprehensive qualitative research methodology available” (Mellion & Tovin, 2002, p. 109). A grounded theory approach intends to answer the following three questions: “(1) What is the data a study of, (2) what category does this line or incident (group of lines) indicate, and (3) what is actually happening in the data?” (Duchscher & Morgan, 2004, p. 608). According to Glaser (one of the two co-founders of this research methodology), these three questions are “the only questions necessary to facilitate the advancement of the emerging theory” (Duchscher & Morgan, 2004, p. 608).

According to Charmaz (2002), all variants of grounded theory include the following six analytical steps:

1. Simultaneous data collection and analysis.
2. Pursuit of emergent themes through early data analysis.
3. Discovery of basic social processes within the data.
4. Inductive construction of abstract categories that explain and synthesize these processes.
5. Sampling to refine the categories through comparative processes.
6. Integration of categories into a theoretical framework that specifies causes, conditions, and consequences of the processes studied.

These six analytical steps constitute the two basic phases of any grounded theory study: data collection, and coding & analysis (Duchscher & Morgan, 2004). The data collection phase is where open coding (initial coding) takes place. During the data collection phase, the researcher approaches the data and the study with a "blank slate" approach. The intent of this approach is to reduce the likelihood that any prejudices or other preconceived notions will be allowed to influence the outcome of theory development. During the coding and analysis phase, the researcher reduces the data from a vast set of bulk collections down to a manageable array of individual codes. This data reduction is a very important part of the methodology, because a failure to properly code the data may lead to improper analysis of the coded data. The resultant theory emerges as the result of exposure of the coded data to the constant comparative analysis that results from the researcher constantly asking the aforementioned three questions, while reviewing the data and determining which new data must be collected and coded.

Knowledge Management Initiative

The knowledge management initiative advocated by the author consists of using concept maps to (a) capture individual knowledge objects (i.e., reports, documentation, customer testimonials, worker interviews, photographs, etc.), and to (b) illustrate the relationships between these knowledge objects. The grounded theory methodology is used to develop a comprehensive explanatory theory that is grounded in the knowledge objects collected during research of the object of study. When utilized in this manner, grounded theory methodology will exhibit characteristics of an ethnographic, phenomenological, and/or case study research approach.

Knowledge Management Process

In pursuit of answers to the three basic questions of grounded theory, the knowledge manager would begin the inquiry with a "blank-slate" phase 1 data collection.

Since experienced employees and employees nearing retirement generally have the most critical knowledge in need of recovery, considerable attention should be paid to gaining access to these individuals. In many corporate knowledge management programs, employees with critical knowledge are asked to produce written documentation intended to capture their knowledge. Unfortunately for these firms, most employees are loath to produce documentation of any kind. In many cases, employees will give such a project an extremely low level of priority and attention, or will attempt to blow it off all together. In some cases, an employee is capable of producing valuable services for the company or producing written knowledge objects, but not both. One possible solution to this conundrum is to conduct open-ended interviews of these and other employees during phase 1. The audio or video interviews would be grouped and coded during phase 2, and then placed in their proper context on the concept map, along with other phase 1 data.

After some brief introductory training on the concept map theory and practice, employees would be allowed to review and analyze the resulting concept map. The employees would be free to make any additions and changes to the contents of the concept map, provided changes are within the spirit of the scope of the three basic questions. The knowledge manager would be responsible for performing constant comparative analysis of the concept map data. Once the data has achieved a sufficient level of completeness, the resulting theory that emerges at this stage would take the form of a detailed explanatory summary of the knowledge area under study. This detailed summary would not only provide an excellent explanation of the firm’s knowledge on the given subject, but also a good starting point for new employees who must be trained in the knowledge domain associated with this knowledge repository. The concept map itself would then provide a good resource for allowing new employees to identify specific details provided by the authoring subject matter expert in the form of the original report, documentation, customer testimonials, worker interviews, photographs, etc.

Conclusion

In this paper, knowledge management initiatives that pertain to a firm's efforts to effectively capture and retain tacit intellectual capital vested in its knowledge workers is discussed. Under the contemporary knowledge management paradigm, explicit knowledge is defined as knowledge that exists in a tangible form such as print, audio/visual recording, computerized database, etc. In contrast, tacit knowledge is defined as that knowledge that exists as intangible experiences or mental notes of a given person. This paper presents both a technique (concept map) and a method (grounded theory) for the implementation of a knowledge management initiative that will improve the process of capturing both tacit and explicit knowledge.

The concept map (as a knowledge capture and sharing tool) has proven itself to be very effective at facilitating meaningful learning in the author's classroom. Based on this "real-world" experience, the author firmly believes that the concept map can be extrapolated to perform a similar knowledge sharing function in the corporate environment. In that environment, its use should greatly improve the firm's ability to effectively capture, retain, and distribute critical tacit knowledge resources within the firm.

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