Knowledge-Capturing Technologies and the Culture of Change

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Abstract

As the global economy becomes increasingly knowledge-based, and as employees' relationship with work becomes more transient, it is imperative that organizations be able to "capture" the knowledge of their expert employees. Technology is growing increasingly sophisticated in extracting implicit knowledge from employees and synthesizing it in a meaningful manner that can then be disseminated. This paper will explore how this technology is implemented as well as its larger implications for the organization and for communication in general.

The paper begins by providing a working definition of implicit knowledge and emphasizing its importance within an organization. Legal and ethical implications will also be examined, as well as the importance of measurement when introducing knowledge-capturing technologies.

The primary focus of the paper will be on the relationship between an organization's culture and the adoption of such programs. It will argue that having and communicating a participative, collaborative culture is vital to the successful implementation of knowledge-capturing technologies. It will describe the characteristics of the culture needed to support these efforts and offer suggestions for achieving the needed cultural change.

Knowledge-Capturing Technologies and the Culture of Change

Organizations in the twenty-first century, especially in the United States, are changing and evolving more rapidly than ever. The economy is becoming increasingly knowledge-based and, for organizations to stay competitive, they must find ways to capture and leverage the valuable knowledge of their employees. Much research suggests that successful companies are those with open communication where information is available to a wide audience. As technology increases in sophistication and becomes more prevalent in daily operations, knowledge-capturing technologies offer a viable means for organizations to obtain valuable information from employees in a format that can then be communicated to others.

Explicit and Implicit Knowledge

In considering what kinds of knowledge organizations need to capture and disseminate, a distinction is typically made between explicit and implicit knowledge. Explicit knowledge is typically the easier of the two to capture and is often codified in formats such as standard operating procedures and databases. It is often thought of as knowing "what to do" and is usually easily explained and shared (Brockman and Anthony, 2002). Implicit knowledge, however, is less tangible and thus more difficult to obtain, manage and present in a meaningful form. Brockman and Anthony (2002) define implicit knowledge as

> Work-related practical knowledge learned informally through experience on the job. It is an intellectual and cognitive process that is neither expressed nor declared openly but rather implied or simply understood. It is intimately related to action such that it reflects knowing *how* as contrasted with knowing *what* (p. 436).

This means an organization must find some means for determining who the experts are and then how to make their knowledge available to a wider audience, a concept that falls under the broader umbrella of knowledge management. Knowledge management also encompasses linking individuals with other people and resources to assist them as well as systems designed to walk the individual through solving a problem (Cairncross, 2002).

Rapid developments in technology are changing how people access and share information within organizations. Concerns with developing and maintaining knowledge and reliance on technology to facilitate organizational processes are both increasing; it is therefore natural that knowledge management has been a topic of interest among organizations (Ahmed, Kwan, and Zairi, 1999; Christie and Sandelands, 2000). What is often not considered by organizations, however, is the need for the right cultural conditions to make knowledge management effective. Often, upper management will tout the benefits of knowledge management and claim that the organization supports it, while the culture of the organization still supports individual contributions over the collective, and competition over collaboration. These factors almost ensure the failure of knowledge management initiatives. Mellander (2001) compares this situation with parents seeking to instill proper table manners in their children: “They said they wanted their children to have good manners, and they even described good manners to their children, but they did not provide the conditions that would foster behavioral changes” (p. 168).

With these considerations in mind, what is needed is an understanding of knowledge management and its potential benefits to an organization within a broader

context of its organizational culture. As decision-makers contemplate knowledge management initiatives, it is important that both the particulars and the broader implications of this technology are understood.

Overview of Knowledge Management Technology

There are several different types of technology applications dealing with various aspects of knowledge management. This paper will focus on those dealing with capturing knowledge, specifically implicit knowledge. Perhaps the most valuable type of information being gathered by knowledge management systems is the process by which an expert executes a given task or approaches a particular problem. This is often difficult to articulate but is the key to the success of experts (Frappaolo and Wilson, n.d.).

Identifying the Experts

The first step in capturing implicit knowledge is identifying who within the organization has this knowledge. This can be approached in a number of ways: one approach asks this question of several members of the organization and designates the names most commonly generated as experts (Seidman and McCauley, 2002). In organizations where products of employee knowledge, such as research papers, are searchable by other employees, another approach can be used. This consists of tracking which articles and authors are being chosen most frequently, and then placing those articles higher on the list generated by a search as well as identifying the authors as experts (Verity, Inc., 2001).

Capturing Expert Knowledge

Knowledge software applications generally approach capturing expert knowledge using one of two approaches, as summarized in Table 1. A first approach poses questions directly to the expert, such as Cerebyte's approach to determining an expert's "secret sauce" (Seidman and McCauley, 2002). A second approach analyzes documentation and output generated by the expert and compiles an expert profile, such as AskMe Corporation's "Auto Profiling Engine" (AskMe Corporation, 2003). Some organizations use a combination of the two approaches.

Table 1: **Approaches to Knowledge Capture**

Approach	Description/Goal	Examples	Considerations
Ask the expert	• Pose questions directly to the experts • Reveal thought process/mental models • Compile expert profiles	• Cerebyte's "Secret Sauce"	• Experts often have difficulty articulating knowledge
Content analysis	• Content submitted to system, algorithms used to approximate human cognition • Integrate knowledge capture into daily tasks and summarize knowledge	• AskMe Corporation's "AutoProfiling Engine" • Lotus's Discovery Server	• Expensive, complicated technology • Potential to oversimplify knowledge

In the first approach, questions asked of the expert seek to reveal the thought processes and mental models the experts use when approaching a problem. This information is then entered into some database format, which can then be searched by stakeholders seeking that knowledge (Seidman and McCauley, 2002). This can be managed in one of two ways: either by having a knowledge engineer pose the questions to the experts, and then creating the framework for storing and disseminating the

knowledge; or by bypassing the knowledge engineer and having the experts themselves create the framework to relay their own knowledge (Wagner, 2000).

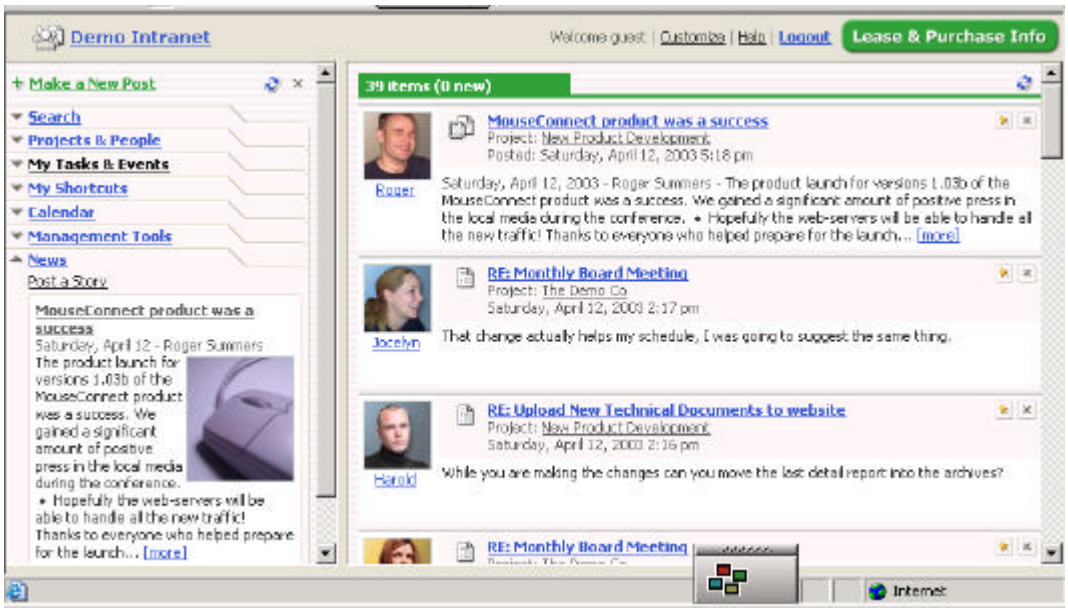
In the second approach, the technology required is more sophisticated. Employees submit content to the system, which is then sometimes subject to an approval stage. This information is then analyzed by the computer system using such techniques as pattern recognition and neural networks, which employ complicated algorithms to approximate the human cognitive processes. This approach can also make the process of knowledge capture less apparent by integrating it into another task, such as customer relations management, where the employee's actions on the computer are entered into the software and analyzed for knowledge management purposes (Dorfman, n.d.). Lotus's Discovery Server is an example of such a system. Rather than having employees enter their knowledge as a separate task, it tracks all of the work and correspondence employees do in a given day and creates summaries of their knowledge and tasks. It also creates personal profiles that can be edited and searched (Morejon, 2003).

Presenting Expert Knowledge

Knowledge management systems must not only capture and store information, they must also process that information in such a way that meaning can be culled from it (Wagner, 2000). Once the experts are identified and their knowledge captured and analyzed, it must then be presented in a format that is both useful and meaningful to others in the organization. The most common formats for storing and presenting information are intranets and database management systems. Intranets are generally more flexible and can be less expensive, ranging in price from free to millions of dollars (Ward, n.d.).

Intranets are generally better equipped to manage implicit and unstructured content, whereas database management systems rely on highly structured frameworks to be effective (Flynn, 2003; Cairncross, 2002; Telleen, 1997). And, through the use of the XML formatting language (short for Extended Markup Language), which permits the creation of customized means for transmitting and presenting data, organizations are able to create intranets that respond to their unique industry and organizational needs (see Figure 1).

Figure 1. **Sample Intranet**[1]

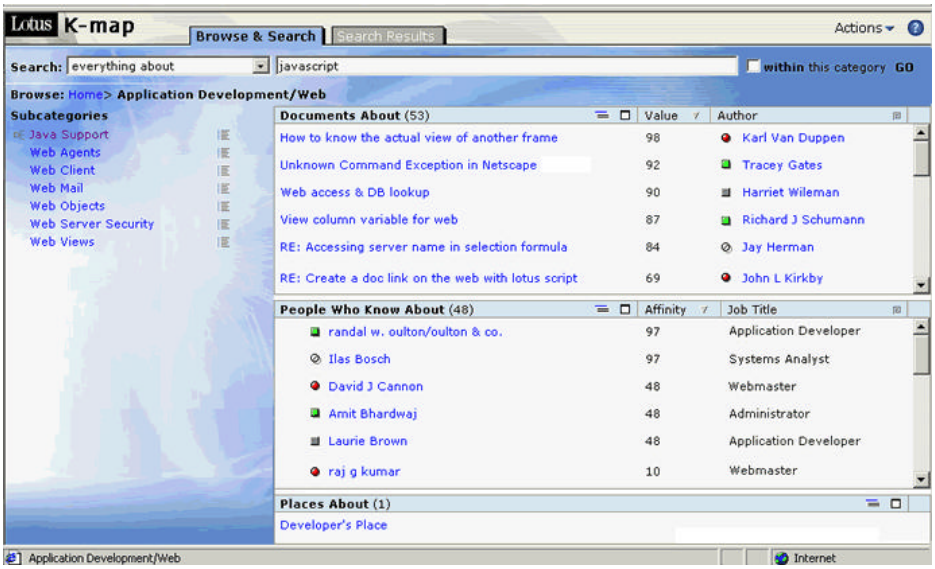


[1] From "Demo Intranet" by SilverOrange. Retrieved March 9, 2004 from http://demo.silverorange.com/.

Database management systems, by contrast, offer more structure, but also tend to be pricier. Lotus Discovery Server (see Figure 2) harvests and synthesizes employee knowledge unobtrusively, but costs nearly $100,000 (Morejon, 2003). ComponentOne, LLC offers a package that harvests and disseminates data in a variety of forms (see

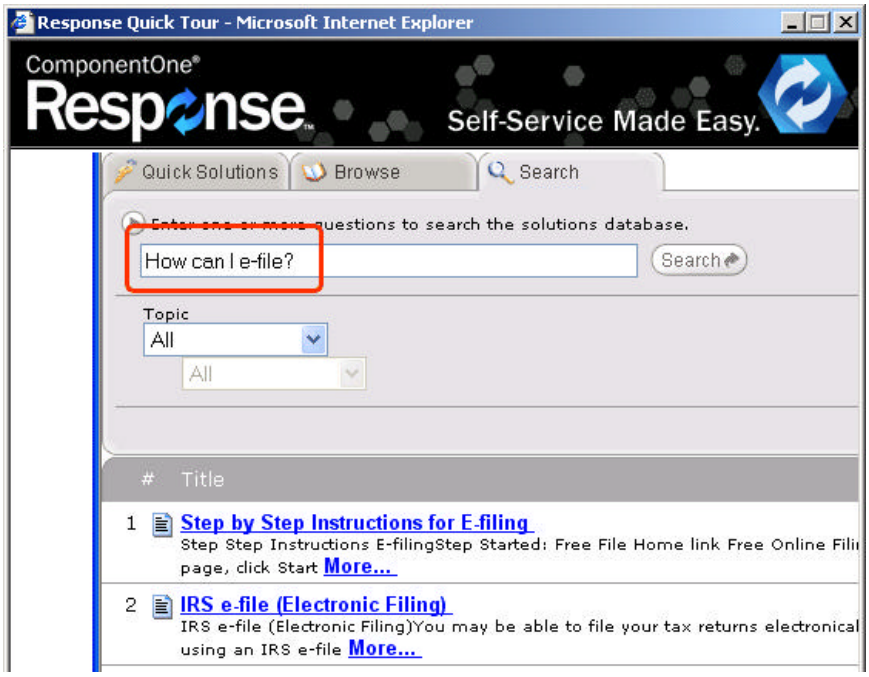
Figure 3) for between $3,000 and $7,000 (ComponentOne, LLC, 2001). These systems can offer a variety of views and combinations of data; however, some information must necessarily be lost as the software package reduces text to something searchable and combinable.

Figure 2. **Lotus Discovery Server**[2]



[2] From "Lotus Discovery Server Product Tour The K-map User Interface" by IBM Lotus Software. Retrieved March 9, 2004 from http://www.lotus.com/products/discserver.nsf/.

Figure 3. **ComponentOne, LLC's Response Center[3]**



[3] From "Response Center QuickTour" by ComponentOne, LLC. Retrieved March 9, 2004 from http://www.componentone.com/userpage/products/responsecenter/quicktour/tour5.htm.

Potential Benefits

There are a number of critical factors for an organization to consider when implementing a technology to capture and disseminate knowledge. One is the fluidity of implicit knowledge. Most of an organization's knowledge is implicit, and can account for up to 75% of the whole (Frappaolo and Wilson, n.d.). Considering the mobility of today's workforce, it is vital for organizations to retain this information.

Investments in human development, such as knowledge management systems, often do not produce immediate financial returns, and as such are typically the first areas

to be cut in times of financial instability. However, the costs of losing qualified employees and their knowledge can be far greater than the costs of keeping the system in place. Training new employees can be quite expensive, and without effective systems for storing the rich, implicit knowledge of employees, much of this knowledge cannot be re-acquired without years of experience (Hitt, Hoskisson, Harrison, and Summers, 1994). Knowledge-capturing systems can help alleviate these problems.

Implicit knowledge by nature tends to be abstract, and the greater the abstraction, the more difficult it is for other organizations to imitate this knowledge, thus creating a competitive advantage. Also, by documenting the information and knowledge that already exists, the need for individuals to rediscover answers is reduced; "the next questions asked are based upon new ignorance, not the revisiting of old ignorance" (Christie and Sandelands, 2000, p. 85). Managing this information effectively and making it accessible to the relevant stakeholders, Ahmed, Kim, and Zairi (1999) argue, will result in a culture that supports collaboration among employees, customers and suppliers, and produces an effective strategic advantage.

Aside from the obvious benefits of knowledge-sharing (one employee's expertise becomes available to everyone), information tends to richen and increase through collaboration. Knowledge management systems could be instrumental in facilitating this collaboration, if a supportive culture is in place. As expressed by complexity theory, the more people that information interacts with, the more possibilities and impact it has (Eisenberg and Goodall, 2003). As Wheatley (1992) suggests, by allowing information to interact with only a few individuals, we "collapse its wave function," reducing the

millions of potentialities it might have were it to come into contact with other individuals and other information concepts and technologies.

An effective knowledge management system can facilitate collaboration among individuals within an organization. Systems such as AskMe Corporation's "Auto Profiling Engine," for example, profile experts so users can seek out expertise in a given area (AskMe Corporation, 2003). This interaction among experts and non-experts can lead to the creation of valuable new knowledge. As Hardy, Phillips, and Lawrence (2003) suggest, "new knowledge grows out of the sort of ongoing social interaction that occurs in ongoing collaborations" (p. 326). Thus by implementing a technological structure to support this collaboration, not only is valuable existing knowledge retained and made available across much greater geographical and hierarchical distances, but new knowledge can be created as well, strengthening and increasing competitive advantage in a knowledge-based economy.

Using some form of knowledge-capturing technology can be instrumental in maintaining an organization's collective knowledge. Without it, there would be no reasonable means for storing or accessing this data, and the means for collaboration would be severely limited.

While the specific technology may vary among organizations--some benefit from highly structured database management systems while others work best with a flexible intranet--organizations today cannot afford to ignore this important trend. It is crucial that organizations find a way to incorporate these technologies with what is known about human interaction, and discover the balance between the two that maximizes individual employee knowledge and the sharing of that knowledge.

Potential Cultural Problems

We have seen that the increasingly transient nature of employee/organization relationships (Eisenberg and Goodall, 2003) puts pressure on organizations to retain the knowledge of its experts. However, it is not so simple as the implementation of a database or intranet. As Deckmyn (1999) states, "technology alone is not solving the problem." The change that must precede implementation of any knowledge management software is cultural: sharing information rather than withholding it needs to be valued and rewarded (Gates, 1999).

As organizations continue to increase their use of technology in nearly all aspects of their operations, individuals come to rely and even depend upon it. But simply because a technology is available does not mean it should be used, and "more access does not mean better access" (Preston and Allmand, 2001, p. 390).

Some also argue that tacit knowledge cannot be captured by technology or is at least extremely difficult to capture, due to its integral relationship with its context (Flanagin, 2002; Rigby, Day, Forrester and Burnett, 2000). Indeed, there are times when knowledge management systems may not be appropriate and not all knowledge should be captured. As Kathy Barbieri (personal communication, November 3, 2003) stated when discussing online courseware, if the technology doesn't improve the function, it is not worth it.

Knowledge management technologies also run the risk of simplifying the concept of knowledge by focusing on the individual as the knowledge source (Flanagin, 2002). As Hardy et al. (2003) and Patriotta (2003) demonstrated, a richer view of knowledge

involves networks of people, and collaboration and group narratives often provide a better understanding of the "intricacies of knowing" (Patriotta, 2003, p. 371).

Patriotta (2003) observed die workers in Fiat's Mirafiori Pressing Plant to further understand this narrative approach to knowledge. Employees at the Mirafiori Pressing Plant are grouped into semi-autonomous work teams that are responsible for some discrete part of the manufacturing process, such as the die process. Patriotta analyzed how the die team dealt with unforeseen errors. He found that employees in this work team used a "detective story" model, in which they construct a sequential group narrative of what must have happened according to "how we do things." This narrative allows the group to make sense of what happened and why it happened, and becomes a complex location of knowledge that was created and is maintained by the group. Without the group process of understanding what happened, a mechanical or human failure would be documented as a single incident without meaningful context and would not have the same potential for providing knowledge in the future. By creating this narrative, the knowledge is retained in the minds of many individuals with more complexity and intricacy than could be found in a knowledge management system. And because it is located in the minds of the group, it is also drawn upon and integrated into daily tasks more frequently and more naturally than any form of technology would allow.

While collaboration among individuals can result in both knowledge-sharing and knowledge creation, it can also serve to diminish the competitive advantage of the individual, who may, for this reason, not wish to part with knowledge (Hardy et al., 2003). It is therefore important to have an organizational reward structure in place so that

collaborative efforts are valued more than individual competition, both in word and in action.

Ironically, organizations that lack cultural support for knowledge management initiatives may also overestimate their impact. They assume that simply implementing a system to capture implicit knowledge somehow transforms an organization into a knowledge-based firm, with no other effort needed (Wagner, 2000). In practice, knowledge management needs to be part of a larger commitment by the organization. It is dangerous to assume that implementing any new technology will result in widespread organizational change; rather, it is more likely to result in rejection of the technology.

Consider the example of an Information Technology department at a paper mill in rural Maine, which implemented a "Request Database." The idea behind this tool was that employees would enter all user requests they received, along with the solution. This information would then be available should another staff member encounter a similar problem. The outcome, however, was not as intended. The culture within the department was such that individual accomplishments were rewarded and no recognition was given for contributions to this database. Employees saw the database as an extraneous step in the process of helping users and most simply did not contribute. The technology was there and could potentially have been powerful, but without the support structure within the organization, it was useless (Russell Lawn, personal communication, November 24, 2003).

While knowledge management is gaining prominence in organizational literature, the effectiveness of knowledge management still remains to be proven. As success within organizations is typically measured quantitatively, it is difficult to demonstrate the

effectiveness of knowledge management, as it does not lend itself well to that type of measurement. Frequently, organizations implement systems and have no means to demonstrate if they are effective or not, which may result in their discontinuation (Ahmed et al., 1999).

Intellectual property should also be considered when implementing a knowledge management system. Who owns the information put into this digital format? When it was in the mind of an individual it was unquestionably the property of that individual, but once it resides in a company-owned database or intranet, the issue of ownership is less clear. While information shared on the Internet is still considered the property of the creator, information on an organizational system tends to be the property of the organization (Michael Pinnisi, personal communication, November 17, 2003).

Another factor to be considered is quality control. Who decides what information is worthy of capture and, by extension, are there issues of censorship involved (Diane Gayeski, personal communication, November 25, 2003)? How an organization designates the experts whose knowledge will be captured is critical to the system's success. Allowing individuals within the organizations to choose the experts fosters a collaborative spirit, and may help the system become more successful and more widely accepted. The International Management Centres Association in the United Kingdom uses a process by which individuals "publish" their findings regarding actual problems within the organization; these papers are then submitted to a peer-reviewed process similar to that of an academic journal, and individuals receive written feedback from a panel of people from within the organization. Individuals are also encouraged to seek publishing opportunities outside the organization (Christie and Sandelands, 2000).

However, whenever a person's knowledge is captured, much of it will inevitably be lost. Because information is always intricately related to its context, one bit of data may produce a multitude of reactions in different people (Hildebrand, 1999). So while the attempt to preserve vital organizational knowledge is important, faith cannot be placed entirely on technological applications. "The goal of implicit knowledge management is to transfer knowledge so that it can…enhance intelligence, not emulate or replace thinking" (Frappaolo and Wilson, n.d.).

The State of Research on Knowledge Capture

In reviewing the current knowledge management literature, several gaps are apparent. Many of the documented success stories come from vendors, who tend not to publicize their failed attempts. However, much of the scholarly literature also neglects to discuss situations in which knowledge management initiatives failed. Many reports are cautionary tales about placing too much faith in this or any technology, but there are few concrete reasons or examples to support these admonitions. This points to the need for more concrete research in those areas where knowledge management fails. At this point there are hypotheses, but they remain to be tested.

Much of the knowledge management literature also neglects the broader issues of organizational context and culture interacting with the technology. For example, Hitt et al. (1994) suggest that "top managers…blend strategic management with internal organizational change" (p. 44), the implication here being that change should be implemented by top managers. Most change literature, especially cultural change

literature, stresses that while leadership is important, change that is implemented top-down is rarely effective (Schein, 1990).

Related to the lack of cultural discussion, it is generally assumed by the knowledge-management literature that all experts will be willing and even eager to share their knowledge, but this is not always the case. Even in organizations with a culture valuing collaboration, individuals are often wary of sharing their knowledge, especially within the broader cultural context of the United States where individualism is valued over collectivism. More research could be done in how to further encourage reticent stakeholders to share their valuable knowledge.

Another noticeable gap is the lack of discussion of potential problems concerning intellectual property. While it is reasonable to expect this to be lacking in the literature from vendors, who may not want to focus on any negative aspects of the technology, it seems a topic worth exploring by scholarly researchers. As knowledge-capturing technologies become more prevalent within organizations, it seems likely that issues regarding intellectual property will become more prominent, especially among employees who leave an organization and may not want to leave their knowledge behind.

Conclusions and Recommendations

While technologies that seek to capture and disseminate knowledge within organizations still present many implementation issues, it is clear that in today's knowledge-based economy, they will become increasingly sophisticated, relevant and vital.

One critical issue is the type of knowledge-capturing system to choose: one that poses questions directly to the experts; one that seeks to distill this knowledge indirectly;

or some combination of the two. Each organization must make this decision based on its own unique circumstances, including the type of knowledge being captured and how easily this information may be obtained by asking those with the knowledge. The experts' personalities and communications skills should be considered, especially whether these individuals will be capable of describing what they know, since often "experts are experts in what they do, not necessarily in explaining" (Wagner, 2000). More mundane concerns need to be taken into account as well, such as feasibility of costs and technology infrastructure.

With regard to the issues of quality control and censorship, organizations may wish to implement a review system where employees are chosen from within the field that is generating the knowledge. An oft-cited example is Xerox's service technicians' "Tiger Team," a panel of recognized experts who review tips submitted by other employees. Technicians who are credited with submitting the most tips can be selected to the Tiger Team. This is considered a highly prestigious group, and its members are chosen by their peers (Cross and Baird, 2000).

Organizations also need to consider their policies regarding intellectual property. While the law is relatively clear in stating that information on company-owned systems is the property of the company, it is up to individual organizations to determine their ethical stance on this issue. This position needs to be made clear to employees so they understand what they are surrendering when they allow their knowledge to be captured, and this makes it even more imperative to instill a culture in which collaborative effort is valued over individual competitive advantage.

Perhaps the major consideration when contemplating the implementation of a knowledge management system is the organizational culture: “Changes in technology or structure, unless accompanied by cultural changes, do not reflect the evolution of a new organizational form” (Svyantek and DeShon, 1993). While the technological aspect is vital to the system’s success, without the proper culture in place to support it, it will be useless. Cross and Baird (2000) argue that knowledge management systems can, at best, support social networks where most knowledge is captured and shared. Knowledge-management technologies should be used to supplement a culture that already focuses on collaboration:

> In many ways knowledge remains situated and community based…The goal of the technological support of [Knowledge Management] should be to share organizational knowledge without rendering it useless through reductionism, ignoring the evolving nature of where knowledge resides, or adopting too crude a view of knowledge itself (Flanagin, 2002, p. 248).

The general trend in organizations has been to move towards what Senge (1990) has classified as a “learning organization,” one that seeks to be more fluid and allows for growth and change in order to stay competitive. These learning organizations strive to value collaboration and open flows of communication, nearly the polar opposite of typical bureaucratic, “Industrial Era” organizations. Knowledge management initiatives align well with the learning organization concept, which is generally considered to be participative. As Lakomski (2001) suggests, these participative organizations have access to a broader range of resources and are thus able to find more innovative solutions to problems. Knowledge management systems can be a tool to bridge that wide range of resources.

Implementation of Knowledge Management Systems

To ensure that individuals actually use a newly implemented knowledge management system, the organization must demonstrate that it values the sharing of knowledge over individual competitive advantage, as the two are often seen as mutually exclusive (Hardy et al., 2003). Organizations need to establish a culture where continuous learning is valued and supported. Without this cultural framework, individuals seeking to take part in the new system will be rewarded in words but punished in actions, causing them to distrust the new system and, potentially, other new initiatives (Schein, 1993).

The organization's management should not only claim they value knowledge sharing and collaboration, but should also demonstrate their commitment through reward systems (Mellander, 2001; Putz, 1991) for sharing knowledge. This can be accomplished, for example, through recognition of employee contributions (Christie and Sandelands, 2000). It is equally important for organizations to reduce the reward for individual achievement by, for example, such weighing the individual's collaborative efforts more heavily than their individual achievements when considering promotions (Hitt et al., 1994).

Organizations would benefit from looking at this collaborative culture through the lens of chaos and complexity theory. In order to sustain this collaborative culture, some degree of control must be relinquished. Managers in organizations sometimes seek to delegate authority to encourage participation, while simultaneously seeking to have more control over behavior (Hitt et al., 1994). Controlling behavior does not lead to participation and is likely to undermine any efforts at knowledge-capturing and -sharing.

Chaos theory suggests using the "strange attractor" concept to control organizations. A strange attractor is defined as the boundaries of a chaotic system: while its behavior cannot be predicted in the short term, over long periods of time the behavior falls into predictable patterns. Within organizations, the mission, vision and values are typically viewed as the strange attractor (Bechtold, 1997; Svyantek and DeShon, 1993). By communicating a value system that is based on the sharing of knowledge and collaboration among individuals, chaos theory suggests that, over the long term, individuals within the organization will act in accordance with this value system. If this is effectively communicated and supported, a knowledge management system will have the cultural foundation needed to succeed.

Ultimately, an organization with a structure and culture based on the principles of chaos theory will operate under the assumption that people are capable and trustworthy and have the interests of the organization at heart (Bechtold, 1997). These same assumptions must underlie a knowledge management system, because such a system implies that employees have knowledge worth capturing and sharing.

Initiating Cultural Change

While knowledge management and participative, collaborative organizations appear at the forefront of organizational literature, many organizations that desire to use this approach are far from their goals. Implementing a successful knowledge management system requires a culture of collaboration, and this often necessitates a major change in organizational culture, a goal that is difficult for any organization to achieve.

Some argue that culture cannot be changed intentionally, that organizations are far too complex. Most literature suggests, however, that while no one is well served by oversimplifying the change process, deliberate cultural change within organizations is indeed possible (Asch and Salaman, 2002).

Schein (1990) suggests that cultures can change when a leader recognizes that the culture has somehow become dysfunctional. It is then the leader's responsibility to facilitate the necessary cultural changes. Others caution that the leaders are just as embedded in the culture as other employees and that it may be difficult for them to "step back" and realize the culture has become dysfunctional (Lakomski, 2001). While change can be initiated effectively through "grassroots" campaigns (Mellander, 2001), the role of leadership in initiating culture change is critical. However, especially when moving towards a more participative culture, it is vital that all members of the organizational system be involved in the process (Lakomski, 2001; Dolan and Garcia, 2002; Cross and Baird, 2000; Svyantek and DeShon, 1993).

Schein (1993) argues that cultural change can only succeed in a permissive environment that allows individuals to attempt to acquire new skills and habits and fail—even fail repeatedly. If employees are punished for failure, they will often revert to the "old way" that has worked for them previously. Schein also suggests that another means for initiating culture change is disconfirmation, which he describes as:

- Providing data that the current methods are no longer working;
- Creating guilt or anxiety around using the old method: Stakeholders will fail to meet some goal or their job will be in jeopardy if they do not adopt the new method;

- Creating psychological safety: Demonstrate a means for employees to accomplish this change without a complete loss of identity.

While cultural change will never be this formulaic, Schein's framework can be useful throughout the process.

Using chaos and complexity theory as a basis for understanding organizational structure and culture can be helpful when approaching large-scale cultural change. Chaos theory suggests that small changes can have large consequences, and that there is much ambiguity in the outcome. It is this ambiguity, however, that allows for creativity. Stakeholders within the organization must be informed of this ambiguity; they must understand that it is normal and that feelings of discomfort are to be expected. They should also be provided with a means to express their concerns and ideas (Bechtold, 1997; Dolan and Garcia, 2002; Lakomski, 2001; Svyanktek and DeShon, 1993).

Change is "slow and piecemeal because it is so context-sensitive" (Lakomski, 2001, p. 79), so the process will more closely resemble evolution than an immediate adoption. However, it is possible to design cultural change and to move an organization towards a participative, collaborative culture that is vital to the support of knowledge management technologies.

Measuring Success

Once a culture of support and collaboration is in place and the knowledge-capturing technology implemented, it is imperative that organizations have some means of measuring the results. It is difficult to manage something that cannot be measured, and measurement systems allow organizations to determine what needs to be improved

and to ensure that the system fits within the organization's broader objectives. Moreover, without measurement of the effectiveness of the knowledge management system, it will inevitably be discontinued in times of budgetary or personnel shortages.

Measurement is not necessarily limited to quantitative indicators of success, such as return on investment, but can include a combination of hard and soft measures. Measurements could include how often the technology is accessed and how performance has improved or changed in areas utilizing the system (Ahmed et al., 1999). The quality of the knowledge within the system could be evaluated by outside experts. In general, it is important to measure how the system adds value in ways meaningful to the organization.

In summary, organizations should choose a type of knowledge-capturing technology that fits their unique needs and constraints. This type of technology will often require a drastic change in culture towards a more participative, collaborative organization that can be understood through chaos and complexity theory. There are means to achieve this change, provided organizations are patient, trusting and tolerant of ambiguity. Following implementation, organizations need to have some measurement tool in place to ensure that the system is achieving its goals and fitting within the organization's larger mission, vision and values.

Organizations vary greatly, but most companies accept the inevitable trend towards a knowledge-based economy. This trend has broad implications, including the need for an organizational culture that values collaboration and communication over individual achievement as well as a fluid, more "chaotic" structure allowing for increased creativity. Considering these trends along with the increased prevalence and

sophistication of technology in organizations, knowledge-capturing technologies offer a viable means to extract, store and communicate the valuable knowledge of individuals and groups.

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