ENCOURAGING KNOWLEDGE DOCUMENTATION THROUGH TECHNOLOGY AND BEHAVIORAL-BASED INCENTIVES

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Abstract
This paper consists of an exploration of the technology-based and behavioral-based incentives that are effective in promoting knowledge documentation. It hypothesizes the types of incentives needed for employees to completely and effectively document their knowledge and critically examines the hypotheses through the analysis of a survey of functional business employees.

Introduction
According to some estimates, 70 percent of organizational knowledge resides in the minds of employees and is never formally documented (Carey, 2003; Ralph, 2003). Capturing this knowledge is vital to creating and sustaining a competitive advantage. However, employee turnover is natural and complicates this process. Employees are transferred or fired, often unwillingly, or they may simply retire, become ill or die. Others pursue better opportunities. For example, personnel in the Army, Navy, Air Force and Coast Guard often leave after one or two tours of duty for better positions in the private sector. Their knowledge must be captured, often to ensure the safety of those who follow. Although planning for employee turnover and the resulting loss of knowledge is not pleasant, ignoring the inevitable does not make such events less likely to occur. On average, 275,000 jobs were cut per month in 2002 in the U.S. (Carey, 2003). With respect to retirement, the Bureau of Labor Statistics estimates 19 percent of those holding executive, administrative, and managerial positions will retire within the next five years in the U.S. (Carey, 2003). The public sector is even worse off. By 2005, more than half of the 1.8 million U.S. federal government employees will be eligible for retirement, including 71 percent of those within the senior ranks (Carey, 2003). The median length of employment today is short, only 4.5 years by some estimates (Droege, 2003). Hence, the knowledge and experience of employees must be captured; otherwise, when they eventually do leave, much of their knowledge leaves with them, decreasing productivity and possibly crippling a company’s ability to compete. Hence, managing knowledge appropriately is critical.

Knowledge management (KM) is the process of adding value to the know-how and experience within and, in many cases, between organizations (Ruggles, 1998). KM facilitates documentation of knowledge, incorporating it into the organizational knowledge base so that it may be used efficiently to contribute to changes in work practices, processes, and products (Gore and Gore, 1999). Completing and effectively documenting knowledge lessens the likelihood that an organization will fail. Ford experienced firsthand the importance of documenting knowledge. When Ford attempted to understand why the Taurus was so successful, it was unable to determine the exact reasons since the original designers had all left the company, taking their unrecorded, uncaptured knowledge with them (Mulholland, Zdrahal, Domingue,
Hatala, and Bernardi, 2001). In Ford’s case, replacing the valuable knowledge of these designers was possible only with considerable effort and expense.

Obviously, management should carefully and selectively retain valued employees and motivate them to document their knowledge. This paper focuses on the latter; that is, how management can use technology and behavioral-based incentives to encourage employees to document knowledge. The technologist perspective identifies systems that encourage the storage and use of knowledge, whereas the humanistic approach focuses on organizational culture, reward systems, or coercions that foster complete and effective documentation of knowledge. Finally, hypotheses are tested concerning incentives for encouraging documentation of knowledge.

**Technology-Based Initiatives**

Documenting knowledge must occur daily and be regularly measured to become entrenched in the company’s culture. Employees need to document two types of knowledge—explicit and tacit. Explicit knowledge can be easily shared among people and codified, or stored, in a central location, making it accessible. Tacit knowledge is more difficult to codify. It is an individual’s know-how and the context added through experience and interaction. For example, the knowledge of how to best approach a particular customer (using flattery, a hard sell, or a no-nonsense approach) represents tacit knowledge (Alavi and Leidner, 2001).

Technology facilitates consistent knowledge documentation, storage, organization, and reuse (Milton, Shadbolt, Cottam, and Hammersley, 1999). Without it, knowledge would be inaccessible, crammed in filing cabinets, stuffed in desk drawers, and worst of all, not recorded at all, but residing only in the minds of employees. Undocumented knowledge will be lost or forgotten (Alavi and Leidner, 2001). Hence, to prevent loss of valuable knowledge and foster reuse, technology must easily enable knowledge possessors to completely and accurately document their knowledge.

Duffy (2000) describes five-layer KM architecture: user interface, knowledge metamodel, knowledge repository (source repositories), knowledge access tools, and knowledge management enablers (see Figure 1). The user interface “protects the user from technology complexities,” making it quite important (Duffy 2000, p. 63). Interfaces must be intuitive, responsive, and easy to use; otherwise, the company has wasted resources, increasing the risk that any documented knowledge will eventually be abandoned.

Two generic classes of KM applications are integrative and interactive (Zack, 1999). Integrative applications primarily capture explicit knowledge and focus on the sequential flow of knowledge into and out of the repository (Zack, 1999). Such applications support tacit knowledge creation and documentation by focusing on employee interaction. Interactive applications typically support integrative applications. Organizations must encourage the documentation of both tacit and explicit knowledge. Hence, both types of KM applications are needed.

The knowledge metamodel and knowledge map (k-map) are two important parts of a knowledge management system (KMS). The metamodel is comprised of metaknowledge—“knowledge about the knowledge” (Duffy, 2000), such as the creator, the purpose, underlying circumstances, and relationships with other knowledge. The k-map is a representation of all knowledge units within the repositories, providing visual feedback about hierarchical layers (Duffy, 2000). Repository design should support knowledge being stored in specific contexts and grouped with similar knowledge. Without context, knowledge is reduced to information or data. Think of knowledge in terms of units that can be labeled, indexed, stored, retrieved, and manipulated; the repository structure focuses on cross-referencing and linking those units with a common relationship (Zack, 1999). Knowledge access tools and enablers deal
mainly with the components that interact with the knowledge repository and user interface. These tools include, but are not limited to, security models, directory interfaces, network interfaces, physical location of the knowledge, protocols, and distribution tools and engines (Duffy, 2000).

Figure 1 Knowledge Management Architecture Layers

The KMS supports the KM life cycle, which Zack (1999) stated consisted of five-stages (see Figure 2): knowledge acquisition, refinement, storage/retrieval, distribution, and presentation. This process starts with the acquisition of knowledge, which is refined, labeled, sorted, categorized, abstracted, and stored in the repository. Later, knowledge can be retrieved by the KMS based on content and structure, then presented and distributed to users. Too much knowledge makes it difficult for users to distinctly separate knowledge based on context or find knowledge when searching. Frustrated users are more apt to give up and make no further attempts at using the KMS. Hence, intelligent retention rules must be applied (Duffy, 2000). As a result, knowledge must be periodically archived to free up space and ensure the relevance of knowledge returned during searches.
Behavioral-Based Initiatives

As anyone involved in a major system change knows, cultural and managerial issues drive success, at least as much as, if not more than, technology. “For knowledge management efforts to bear fruit, they must contain large doses of attention to organization culture, performance measurements and rewards, decision making processes, human resource policies, and communication styles” (Lubit, 2001, p. 173). Before examining behavioral-based incentives, organizational culture is first examined.

The degree to which an organization’s culture promotes learning depends on where the organization is on the learning continuum (Mellander, 2001). Culture makes or breaks a KMS—“no knowledge management initiative can exist or succeed in any environment without first providing the right conditions for learning” (Mellander, 2001, p. 165). Learning occurs at an individual, group, and organizational level and is more than just mastering a new task or process. True expertise at an individual level, “as contrasted with competence, takes at least 10 years to develop and there is little evidence that the process can be significantly accelerated” (Swap et al., 2001, p. 97). According to Swap et al., learning takes place best by doing, but mentoring and storytelling also serve as tools for learning and sharing of explicit and tacit knowledge. The culture must promote learning by continuously encouraging people to share and document their knowledge. A learning environment promotes and rewards employees for sharing their knowledge.

Learning as an integral part of working should occur naturally in the vast majority of organizations (Mulholland, Zdrahal, Domingue, Hatala, and Bernardi, 2001, p. 337). An organization may need to promote increased innovation or implement more discipline. Before behavioral modifications are made, management must understand what motivates employees and determine desired behavioral outcomes.
Finally, an organization must reward employees properly and fairly, taking into consideration what motivates them.

An important aspect of behavioral-based initiatives that encourages documentation is the personal aspect of employee-manager relations, specifically the types of rewards and coercive power available to managers (see Table 1). “...If knowledge is being extracted from individuals or groups for others to use, it is likely that incentives or rewards for knowledge creation and contribution are required” (Earl, 2001, p. 219). Reward systems vary in type, each producing different behaviors depending upon the circumstances and personalities of those involved. Four common types of rewards are financial rewards, recognition, compensation time, and promotions. Other types of rewards exist but will not be considered in this work. Rewarding employees for contributing their knowledge helps encourage others to do the same. “Managers need to develop a system that encourages people to write down what they know and to get those documents into the electronic repository. Real incentives—not small enticements—are required to get people to take those steps” (Reneker and Buntzen, 2000, p. 394).

### Table 1: Behavioral-Based Incentives

<table>
<thead>
<tr>
<th>Reward Power</th>
<th>Coercive Power</th>
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<tbody>
<tr>
<td>Monetary</td>
<td>Withholding Services</td>
</tr>
<tr>
<td>Recognition</td>
<td>Reprimanding</td>
</tr>
<tr>
<td>Compensation Time</td>
<td>Termination of Employment</td>
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<tr>
<td>Promotion</td>
<td>Demotion</td>
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<tr>
<td>Work Assignments</td>
<td>Application of Sanctions (from sarcasm to ostracism)</td>
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Rewards require measurements. However, knowledge is difficult to quantify. In fact, Fahey and Prusak (1998) even advise that “developing direct measures of knowledge” is counterproductive to KM (p. 273). Instead, they argue knowledge use should be measured in order to distinguish best practices from merely good practices. Xerox implemented a system to reward employees for their contribution of best practices to its KMS.

An engineer can submit to the intranet-based maintenance group a solution to a tricky problem encountered in photocopier maintenance. A panel of highly regarded peer assessors then has to evaluate the solution in terms of worthiness, novelty, and practicality. If it is approved, it is added to the knowledge base. The reward to the engineer is the fame or recognition of being the author of a solution others may then use by consulting the Web-based system remotely from the field” (Earl, 2001, p. 219).

Coercive power, the opposite of reward, can also be used. Employees who knowingly misrepresent or fail to document their knowledge could be punished. If employees fear retribution, they may attempt to dispel that fear by documenting their knowledge completely and fully. However, this fear may cause employees to spend an exorbitant amount of time documenting their knowledge, diverting resources away from satisfying customers. Furthermore, coercive approaches tend to elicit explicit knowledge rather than tacit knowledge. Coercing an accountant may result in documented “hard” data and spreadsheets, but soft knowledge likely will be ignored. “Clearly, managers must understand that codification or integration initiatives applied to tacit knowledge can yield less than desirable results” (Gold, Malhotra, and Segars, 2001, p. 209).

Why are incentives necessary if technology is available and easy to use? First, employees need something in exchange for their knowledge. Grover and Davenport (2001) introduced the idea of
knowledge markets where “knowledge is exchanged for other things of value--money, respect, promotions, or other knowledge” (p. 8). In addition, Jarvenpaa and Staples (2001) argue that employees take ownership of the products of their own minds. At the same time, management expects to benefit from the knowledge and intellectual creations of employees in their organization. Some employees must sign intellectual property agreements upon employment, even though in some cases an individual may legally own the intellectual property. Jarvenpaa and Staples (2001) report that United States law states that the person who created the knowledge or intellectual property is the true owner and that person’s name is to be associated with the knowledge; however, the organization that the employee works for has the right to use that knowledge freely and in ways that would benefit the organization, but not necessarily the originator of the knowledge (p. 155). “For example, if an employee creates an innovation that is patentable, the patent legally belongs to the individual though the organization has the right to use the patent” (Jarvenpaa and Staples, 2001, p. 155).

Even though “joint ownership” of intellectual property can occur legally, employees often feel organizations exploit their knowledge. Carter and Scarbrough (2001) note that some managerial practices may involve attempts to “exploit intellectual property rights” (p. 216). Once that happens, an employee may be less inclined to document knowledge. One solution is to abstract knowledge “from highly situated processes…such that its use is no longer so closely tied to its creation” (Carter and Scarbrough, 2001, p. 216). In most cases, both technology-based and behavioral-based initiatives are required. Take the case study presented by Gore and Gore (1999) where a business school at a large university attempted to codify its faculty knowledge to prevent against loss and to exert some control over curriculum. Faculty response was less than supportive. Faculty feared loss of control, or ownership, over their knowledge. To combat this problem, technology initiatives were implemented so that faculty had the ability to restrict viewing capabilities in the system (Gore and Gore, 1999). In addition, the organizational culture had to change, and incentives for documentation were offered. “Meetings were held with all staff to convince them of the need to ‘buy in’ to the new approach and all to allow their personal explicit knowledge base to become organizational knowledge” (Gore and Gore, 1999, p. S559). Therefore, as this case demonstrates, both technology-based and behavioral-based initiatives were needed.

Research Framework: Influencing Employees to Document

It is hypothesized that both technology-based and behavioral-based initiatives are needed in order to encourage effective and complete documentation of knowledge by employees. In the Gore and Gore (1999) case study, technology was available, but it did not provide adequate functionality to promote complete documentation. Once that functionality was added, faculty was more accepting of the system and more likely to document their knowledge. In addition, administrators used behavioral-based incentives to encourage knowledge documentation as well as change the organizational culture; otherwise, why would faculty document their knowledge?

In general, different incentives motivate different people differently. For example, an introvert may not respond well to the promise of public recognition, whereas an employee who is well off financially is unlikely to be predominantly motivated by monetary incentives. Managers must identify those types of rewards that are most appealing and motivating to employees and the technology needed to promote effective documentation within any particular department or segment of an organization. More specifically, it is hypothesized that:

H1: Both technological and behavioral incentives are equally important in encouraging all employees to document their knowledge.
The organization must also provide easy-to-use technology with the desired functionality. Therefore, it is further hypothesized that:

**H2:** The ease of use and functionality of the KMS positively and directly influences how often employees document their knowledge.

Coercive approaches tend to create an atmosphere of fear and instill in employees a sense they are being exploited. Employees prefer to be valued, increasing their desire to help the organization pursue its strategic mission. Hence, coercive approaches tend to fail. This statement is tested through the following hypothesis:

**H3:** Coercive approaches to encourage employees to document their knowledge are not as effective as rewards.

In addition, it is hypothesized that:

**H4:** Different types of employees are motivated by different incentives.

The conceptual research model, which contains the above stated hypotheses, is graphically represented in Figure 3.

**Survey Results and Hypotheses Tests**

Fifty-four professionals were surveyed at the annual APICS Rochester Top Management Night in Rochester, New York, in May of 2003. This section contains the results of the survey.
There was support for H1. Seven respondents noted that the availability and ease-of-use of technology initiatives as well as the behavioral-based incentive approaches were equally important to the encouragement of knowledge documentation. It was split nearly in half with regards to whether incentives outweighed technology or technology outweighed incentives. Eighteen respondents favored the use of behavioral-based reward systems, and 15 respondents favored the availability and ease-of-use of technology in the organization.

There was no significant relationship evident for H2. Five respondents who documented knowledge often did not even have access to a KMS at their place of work. Another five who documented knowledge often also answered that their KMS was easy to use. Two respondents out of the 13 who responded that they document their knowledge often also described their company’s KMS as providing enough functionality.

Support for H3 was mixed. From the perspective of subordinate employees, coercion is not favored. Only one respondent thought coercive approaches provided motivation. From the perspective of supervisors, five respondents thought coercive approaches were most important, even more than providing rewards or making technology available and easy to use, in encouraging the documentation of knowledge. Four of those five held supervisory positions within their organizations.

Support for H4 was noteworthy. Overall, 35% of the female respondents stated that monetary reward would best motivate them to document their knowledge, and 36% of our male respondents stated that recognition is the best motivator for documenting knowledge. While approximately 54% of respondents said they were very willing to document their knowledge, only 17% said that they responded very well to incentives that may not have been the most motivating for them (see Figure 4). This shows that an incentive specific to an employee’s interests is important in motivating employees to document knowledge.

Figure 4

Important Factors in Employee Knowledge Documentation

![Pie Chart](chart.png)
Discussion and Observations

An empirical analysis (see Figure 5) was conducted on 54 APICS Rochester members at a dinner meeting in Rochester, New York, in May, 2003. The results of the analysis were very interesting, and, in some cases, unexpected. This section will offer possible reasons for the unexpected results and also expand on the expected outcomes. Also contained within this section is an exploration of other, non-hypothesized survey results that directly relates to the technology-based or behavioral-based initiatives for the encouragement of knowledge documentation.

Figure 5  
**Gender vs. Incentives to Document Knowledge**

The first hypothesis conjectured dealt with technology versus behavioral incentives. Which is most important to the facilitation of knowledge documentation? It was hypothesized that both technology-based and behavioral-based initiatives were equally important. The survey upholds this hypothesis (see Figure 6). Seven respondents noted that the availability and ease-of-use of technology initiatives as well as the behavioral-based incentive approaches were equally important to the encouragement of knowledge documentation. It was split nearly in half with regards to whether incentives outweighed technology or technology outweighed incentives. Eighteen respondents favored the use of behavioral-based reward systems, and 15 respondents favored the availability and ease-of-use of technology in the organization. Organizations must provide both reward systems and easy-to-use and functional technology in order to foster the complete and effective documentation of knowledge by their employees.
Although the two incentives were proven to be equally important by current professionals, most knowledge management initiatives fell short of their goals (Desouza, 2003a), largely due to taking a technologist perspective rather than a humanistic or balanced perspective (Desouza, 2003b). Understanding how people are innately motivated to apply their personal expertise is the key to avoiding the trap of building technology marvels no one uses (Tiwana, 2003). Technology alone, despite its power, flexibility, and ability to transcend geographical and temporal barriers, rarely suffices to motivate employees to share knowledge.

Technology is merely one medium for knowledge transfer; it is not synonymous with knowledge transfer, and certainly not with knowledge acquisition. Acquisition is a loose but complex process that depends on messy human-related factors like motivation, commitment, hopes and rewards. Any attempt at knowledge transfer and acquisition that fails to account for human characteristics cannot succeed, states Hamilton Beazley, chairman of Strategic Leadership Group (Carey, 2003, p. 36).

Employees must be given the time, space, and opportunity to share knowledge.

According to the survey results, the ease of use and functionality of the KMS was not related to the frequency at which employees documented their knowledge. Five respondents who documented knowledge often did not even have access to a KMS at their place of work. Another five who documented knowledge often reported that their KMS was easy to use. Two respondents out of the 13 who documented their knowledge often described their company’s KMS as providing enough functionality. The results indicate that many employees do not have access to an easy to use KMS, as 29 out of the 47 respondents reported.

The survey did not positively support the third hypothesis, which surmised that coercive approaches tend to fail in organizations. However, the survey did not specifically address questions to supervisors. This hypothesis showed that employees do not want to be coerced, but some people (particularly those in supervisory roles) believe it is an important motivating factor in getting employees to document knowledge. From the perspective of subordinate employees, coercion is not favored. Only one respondent thought coercive approaches provided motivation. From the perspective of supervisors, five respondents...
thought coercive approaches were most important, even more than providing rewards or making technology available and easy to use, in encouraging the documentation of knowledge. Four of those five held supervisory positions within their organizations.

The final hypothesis conjectured that different incentives will motivate different people. This is certainly true, and the survey results show support of this hypothesis. While approximately 54% of respondents said they were very willing to document their knowledge, only 17% said that they responded very well to incentives that may not have been the most motivating for them (see Figure 4). This shows that an incentive specific to an employee’s interests is important in motivating employees to document knowledge.

Gender was considered against all of the types of incentives available for management use (see Figure 7). It was found that women are more likely to respond to monetary reward and compensation time than are men, and men were found to be more likely to respond to recognition and promotion incentives than are women. Overall, 35% of the female respondents stated that monetary reward would best motivate them to document their knowledge, and 36% of our male respondents stated that recognition is the best motivator for documenting knowledge. The other respondents were split up among the other categories, but a distinction between male preferences and female preferences did exist. This piece of information can help those who are about to implement a KMS.

Figure 7  Employee Responsiveness to Incentives for Documenting Knowledge

Second, age was considered against the same incentives (see Figure 8). Monetary reward was a motivator for all age groups but was the most popular reward in the 18-22 and 50-64 age groups. This may be because the 18-22 aged employees are coming immediately from college with debt or starting without money, and the 50-64 aged employees are focused on saving for retirement as it is drawing closer. Generally, the results show that the respondents over 40 years of age were motivated most by recognition and those under 40 were motivated most by money and promotion.
These numbers as well as the age and gender breakdowns show that management must structure its incentive programs so that each individual is motivated the most to document his/her knowledge. For example, a team supervisor or department head must recognize that in general, females are not motivated as much as males by recognition, but would prefer money instead. It is important to note that not all females want money and not all males want recognition. Each person is unique with a variety of different traits, such as personality type, gender, age, ethnicity, personal beliefs, and values. Therefore, any incentives must be completely customized to each individual in order to maximize the effectiveness of the incentives. Unfortunately, organizations do not seem to see the importance of customizing incentives. More than half (approximately 55%) of all respondents said that their organizations either offered the same incentives for everyone or did not offer incentives at all for the documentation of knowledge (see Figure 9).

In an ideal world, employees would document their knowledge through their own will. However, experts estimate “three-quarters of all knowledge crucial to a company's efforts is transmitted verbally; virtually none of this knowledge has been captured for use” (Angus, 2003, p. 34).
Notwithstanding these opportunities, human behavior, not technology, represents the most daunting caveat. Unlike information sharing, knowledge sharing has a competitive dimension: The more valuable a nugget of knowledge is to an individual, the less likely he or she is to share it (Tiwana, 2003, pp. 79-80).

In conducting the survey, a number of undocumented comments were made regarding the issue of knowledge documentation and why people do not like to document. It was said that most employees feel that their worth in the marketplace is measured by the amount of knowledge that they have. If employees have to give up all of their knowledge to the organizations they work for, they feel they are worth less to the organization and can be released from service at any point. At least in containing some of the knowledge, employees can justify good reasons for organizations to keep them. What organization, after all, would release an employee who has important and relevant knowledge of best practices or how to maintain specific information systems? This is yet another reason why behavioral-based incentive systems are needed to encourage the employee to document, or “give up,” his/her knowledge.

To summarize the empirical study, there is a need for both technology-based initiatives and behavioral-based initiatives and the need for management to identify personal differences and differentiate their incentives in order to motivate all employees to document their knowledge. Marshall (2000) states that a vehicle for knowledge capture is necessary, such as a KMS (p. 42). Once available, employees must be given financial incentives to use it, and it must be easy to use (Marshall, 2000, p. 42). The hypothesis on coercive approaches needs further study and analysis in order to better understand the effect coercion has on getting employees to document their knowledge. The most interesting statistic in the analysis is arguably how many organizations use knowledge management systems. According to the respondents, who came from 15 different industries, 70% said that their organizations did not use knowledge management systems. In order to increase or, in some cases, maintain competitive advantage, organizations must develop a knowledge management strategy. Many organizations, especially those that our respondents were from, did not have formal procedures in place for the documentation of knowledge.

Conclusion

Documenting knowledge is extremely important. It helps organizations to continue moving forward even though knowledgeable employees may leave. Two methods were presented, technology-based and behavioral-based approaches, both of which are equally important. Organizations must find the right mix of the two in order to motivate and facilitate documentation of employees’ knowledge.

This research is a starting point for organizations. Documentation of knowledge is important in developing a successful KMS. Future research is needed to help organizations determine how to encourage employees to use knowledge once documented.

REFERENCES


