

Knowledge Management Systems: Emerging Views and Practices from the Field

Maryam Alavi
Robert H. Smith School of Business
University of Maryland at College Park
College Park, Maryland 20742
malavi@rhsmith.umd.edu

Dorothy Leidner
INSEAD
Boulevard de Constance
77305 Fontainebleau cedex France
dorothy.leidner@insead.fr

Abstract

The knowledge-based theory of the firm suggests that knowledge is the organizational asset that enables sustainable competitive advantage in hypercompetitive environments. The emphasis on knowledge in today's organizations is based on the assumption that barriers to the transfer and replication of knowledge endow it with strategic importance. Many organizations are developing information systems designed specifically to facilitate the sharing and integration of knowledge. Such systems are referred to as Knowledge Management Systems (KMS). Because KMS are just beginning to appear in organizations, there exists little research and field data to guide the development and implementation of these systems or to guide expectations of the potential benefits of such systems. The current study provides an analysis of current practices and outcomes of KMS and the nature of KMS as they are evolving in fifty organizations. The findings suggest that interest in KMS across a variety of industries is very high, the technological foundations are varied, and the major concerns revolve around achieving the correct amount and type of accurate knowledge and garnering support for contributing to the KMS. Implications for practice and suggestions for future research are drawn from the study findings.

Keywords: Knowledge Management, Knowledge Management Systems, Organizational Learning, Organizational Use of IS

Categories: DD06, GA01, HA09

” In post-capitalism, power comes from transmitting information to make it productive, not from hiding it.”

1. INTRODUCTION

Information technologies designed to assist managerial and professional workers have evolved over several decades. They have progressed from systems that process and disseminate vast amounts of information to an organization's managers (MIS), to systems that provide specific decision makers with tools for ad hoc decision analysis (DSS), to systems designed to provide updated, often real-time, relevant information to senior and middle managers (EIS). These systems have each contributed to individual and organizational improvements in varying degrees and continue to be important components of organizations' information technology investment. An emerging line of systems targets professional and managerial activities by focusing on creating, gathering, organizing, and disseminating an organization's "knowledge" as opposed to "information" or "data." These systems are referred to as Knowledge Management Systems (KMS).

The concept of coding and transmitting knowledge in organizations is not new--training and employee development programs, organizational policies, routines, procedures, reports, and manuals have served this function for years. For example, the McDonald's operating manual captures almost every aspect of the restaurant management including: cooking, nutrition, hygiene, marketing, food production, and accounting. By capturing, codifying, and disseminating this knowledge, the company reduces the level of required know-how for its managers while improving the effectiveness and efficiency of its operations (Peters, 1994). What is new and exciting in the knowledge management area is the potential of using modern information technologies (e.g., the Internet, intranets, browsers, data warehouses, filters

and software agents) to systematize, facilitate, and expedite firm-wide knowledge management.

The existing body of work on KMS consists primarily of general and conceptual principles of KMS [Davenport, 1997b] and case descriptions of such systems in a handful of bellwether organizations [Alavi, 1997; Baird, Henderson and Watts, 1997; Bartlett, 1996; Henderson and Sussman, 1997; Sensiper, 1997; Watts, Thomas and Henderson, 1997]. Because KMS are just beginning to appear in organizations, there exists little research and insight to guide the successful development and implementation of such systems, or to frame expectations of the benefits and costs of such systems. Nor is it yet clear if KMS will experience widespread development and implementation across a variety of industries, or if KMS are destined to be highly touted systems that quickly find themselves in desuetude as a passing fad. The current exploratory field work aims to contribute an understanding of the perceptions of knowledge management and knowledge management systems, both from the perspective of individuals in organizations with KMS as well as organizations without KMS. More specifically, the study identifies the technologies being used to build KMS, knowledge domains being incorporated into KMS, the champions of KMS initiatives, the desired benefits and expected costs of KMS, as well as the major concerns regarding KMS.

The organization of the paper is as follows: in the second section, knowledge and KMS are defined. The third section describes the methodology and the fourth presents the study findings. The fifth and final section discusses the implications of the findings.

2. KNOWLEDGE, KNOWLEDGE MANAGEMENT, AND KMS

To define KMS, it is necessary to first define knowledge and knowledge management. Knowledge is a broad and abstract notion that has defined epistemological debates in western philosophy since the classical Greek era.¹ Since this article has an applied (versus a theoretical or philosophical) orientation, we have adapted the following working definition of knowledge, based on the work of Nonaka [1994] and Huber [1991]. Knowledge is a justified personal belief that increases an individual's capacity to take effective action. Action in this context refers to physical skills and competencies (e.g., playing tennis, or carpentry), cognitive/intellectual activity (e.g., problem solving), or both (e.g., surgery which involves both manual skills as well as cognitive elements in the

form of knowledge of human anatomy and medicine). The definitions of knowledge as found in information systems literature further make a distinction among knowledge, information and data. For example, Vance [1997] defines information as data interpreted into a meaningful framework whereas knowledge is information that has been authenticated and thought to be true. Maglitta [1996] suggests that data is raw numbers and facts, information is processed data, and knowledge is "information made actionable."

While each conceptualization makes inroads into understanding differences in the three terms, they fall short of providing a means to readily determine when information has become knowledge. The problem appears to be the presumption of a hierarchy from data to information to knowledge with each varying along some dimension, such as context, usefulness, or interpretability. What we consider key to effectively distinguishing between information and knowledge is not found in the content, structure, accuracy, or utility of the supposed information or knowledge. Rather, knowledge is information possessed in the mind of an individual: it is personalized or subjective information related to facts, procedures, concepts, interpretations, ideas, observations and judgments (which may or may not be unique, useful, accurate, or structurable). We are basically positing that knowledge is not a radically different concept than information, but rather that information becomes knowledge once it is processed in the mind of an individual ("tacit" knowledge in the words of Polanyi [1962] and Nonaka [1994]) which then becomes information (or what Nonaka refers to as "explicit knowledge") once it is articulated or communicated to others in the form of text, computer output, spoken or written words or other means. The recipient can then cognitively process and internalize the information so that it is converted back to tacit knowledge. This is consistent with Churchman's [1972] conceptualization of knowledge and his statement that "knowledge resides in the user and not in the collection [of information]."

Two major points emerge from this conceptualization: 1. Because knowledge is personalized, in order for one person's knowledge to be useful for another individual, it must be communicated in such a manner as to be interpretable and accessible to the other individual. 2. Hoards of information is of little value: only that information which is actively processed in the mind of an individual through a process of reflection, enlightenment, and learning can be useful. **Knowledge management** then refers to a systemic and organizationally specified process for acquiring, organizing and communicating both tacit and explicit knowledge of employees so that other employees may make use of it to be more effective and productive in their work.

The major challenge of managing knowledge is less its creation than its capture and integration [Grant,

¹ The epistemological debates have been expressed from a variety of perspectives and positions including the rationalist perspective (advanced by philosophers such as Descartes in the seventeenth century), the empiricist perspective (advanced by Locke and others in the eighteenth century), and the interactionist perspective (advanced by Kant and others in the nineteenth century). For a discussion of the history of knowledge and epistemology, see Polanyi (1958, 1962).

1996; Davenport, 1997a]. Indeed, knowledge is of limited organizational value if it is not shared. The ability to integrate and apply specialized knowledge of organizational members is fundamental to a firm's ability to create and sustain competitive advantage [Grant, 1996]. Traditionally, knowledge creation and transfer has occurred through various means such as face-to-face interactions (planned or ad hoc), mentoring, job rotation, and staff development. However, as markets and organizations become more global and move to virtual forms, these traditional means may prove to be too slow and less effective and in need of being supplemented by more efficient electronic means. On the other hand, as Brown and Duguid (1991) note, knowledge will not necessarily circulate freely firm-wide just because the technology to support such circulation is available.

Indeed, studies on such technologies as LotusNotes have not shown a change in information sharing and communication patterns; rather, organizational members who tended to communicate regularly and frequently without LotusNotes communicated regularly and frequently with LotusNotes whereas members who communicated less regularly and less frequently before the implementation of Notes continued to communicate less regularly and less frequently [Vandenbosch and Ginzberg, 1997]. Hence, in the absence of an explicit strategy to better create and integrate knowledge in the organization, computer systems which facilitate communication and information sharing have only a random effect at best. As a result, companies, particularly those which compete on the basis of services and expertise (e.g., management consulting and professional services firms), are beginning to implement information systems designed specifically to facilitate the codification, collection, integration, and dissemination of organizational knowledge [Alavi, 1997; Bartlett, 1996; Sensiper, 1997]. Such systems are referred to as Knowledge Management Systems.

The popular claims for the results of KMS are high and include the ability of organizations to be flexible and to respond more quickly to changing market conditions, and the ability to be more innovative as well as improve decision making and productivity [Sata, 1997; Harris, 1996]. To develop an understanding of the current practices and outcomes of knowledge management and the form and nature of KMS that are evolving in organizations, we undertook a descriptive study of perceptions and practices of KMS in fifty organizations from a variety of industries. We hope that the findings of this study will lead to insights that will guide early KMS initiatives in organizations and reduce failures and false starts. In addition, we anticipate that the results can help guide further research endeavors in the emerging area of KMS.

3. METHODOLOGY

We invited a non-random sample of 109 participants in an executive development program conducted at a northeast university in July of 1997 to participate in this study. The participants in the program represented a cadre of vanguard organizations from 12 countries that in the authors' view would represent companies with significant IT investments and thus would be likely candidates to have KMS under consideration/development or already in operation. These participants were attending a two-week residential executive development program on the management of information technology. The participants were chief information officers (CIOs), information systems (IS) managers, and general and functional area executives. The participants were asked to respond to the study questionnaire on an individual basis during the first three days of their program. The questionnaire contained 13 questions consisting of short answers and multiple choice. The respondents estimated that it took them about 30 minutes to complete the questionnaire. A total of 50 usable responses were received for a response rate of 45.8 percent. The questionnaire tapped into the respondents' concepts and perspectives on KMS, their perceptions of the current level of KMS activities in their firms, and their expectations of potential benefits and their concerns regarding these systems.

4. STUDY FINDINGS

The respondents represented a range of countries, organizational positions, and industries. Twelve different countries were represented: Australia (four respondents), Canada (two respondents), England (one respondent), Germany (one respondent), Israel (two respondents), Luxembourg (two respondents), the Netherlands (two respondents); Saudi Arabia, South Africa, Spain, and Switzerland (one respondent each). Thirty-two respondents were from the United States. A larger number of the US respondents (5) reported having an existing KMS in their organization than non-US respondents; however, a larger number of non-US respondents (15 organizations) reported that their organizations were currently developing KMS. Forty-two percent of the respondents were senior non-IS managers (21% each – senior non-IS managers and functional area managers). Nine percent of the respondents were CIOs, 32% of the respondents were Directors of IS, and the remaining 17% were IS managers. Several industries represented in the sample: manufacturing (17%), consulting (15%), financial services (24%), energy (17%) and government (6%). The remaining 21% consisted of consumer products, chemicals, retail and other services. All respondents, regardless of whether they currently had or were developing KMS in their organizations, responded to questions concerning their perceptions of knowledge management, the capabilities they believed necessary for effective knowledge management, and the

key concerns they had about knowledge management. These are summarized in Tables 1 through 3 and discussed below.

4.1 Perspectives on knowledge management

One of the objectives of the study was to ascertain what managers consider the concept of knowledge management to entail. Three perspectives emerged: an information-based perspective, a technology-based perspective, and a culture-based perspective (See Table 1.).

In terms of the information-based perspective, managers reported thinking knowledge management to be about characteristics of information, such as readily-accessible information, real-time information, and actionable information. Some spoke in terms of free text and concepts as being the information foundation of knowledge management. Also in terms of the information perspective, several managers mentioned their view that knowledge management was about reducing the overload of information by “filtering the gems from the rocks.” There was an apparent concern with the extraordinary amount of information that can now easily be gathered and disseminated via information technologies. The managers expressed a desire to obtain competitive advantage from information itself (as opposed to associating competitive advantage with any particular information technology). Lastly, some managers thought very specifically of knowledge management as being a “corporate yellow pages” or a “people-to-people information archive.” In other words, they viewed knowledge management as a means of keeping track not so much of knowledge itself, but of who held the knowledge and how to locate them.

Knowledge was not distinguished from information or data, rather the words were evidently used interchangeably. However, the managers were implicitly making a distinction between the terms. For example, one manager stated “one person’s knowledge” is “another’s data.” This is consistent with the view that knowledge resides in the individual and that there are no inherent “objective” attributes that distinguishes between the two constructs.

In terms of the technology-based perspective, the managers associated knowledge management with various other systems (including data warehousing, enterprise-wide systems, executive information systems, expert systems, and the intranet), as well as various tools (e.g., search engines, multi-media, and decision making tools). More generally, participants suggested that knowledge management was about information technology infrastructure, specifically, about the integration of cross-functional systems worldwide. There did not emerge a clear view of a new type of technology specifically dedicated to knowledge management. Indeed, this is consistent with the fact that knowledge

management systems can be accomplished with sundry different technologies, the most effective of which would likely depend upon an organization’s size and existing technical infrastructure.

Lastly, in terms of the culture-based perspective of knowledge management, managers associated knowledge management with learning, primarily from an organizational perspective, communication, and intellectual property cultivation. Some suggested that the information/technology component of knowledge management was only 20% of the concept whereas the cultural and managerial aspects accounted for the bulk of the issue. However, their responses were nebulous in terms of specific cultural implications, perhaps indicating a root concern absent concrete ideas on how to address it. The responses were examined based upon whether the responding individual was from an organization with a KMS or not. However, there did not appear to be any major differences in the perceptions of KMS for the two groups, with the exception that individuals from organizations without KMS tended to offer technology-based responses slightly more frequently than individuals from organizations with KMS.

4.2 Knowledge management capabilities needed

When asked what capabilities related to knowledge management that their organizations were in need of, the managers also tended to proffer three perspectives (See Table 2.). In terms of information, they suggested the need for access to customer information, client information, competitor information, and product/market information. These are all external information which have historically not been provided by most computer systems. Several internal knowledge domains were also desired, including activity-based costing, human resource information, and up-to-date financial status. The technology capabilities desired included wider bandwidth, a consistent suite of e-mail and web-based products, search engines, intelligent agents, navigational tools, global IT infrastructure, interoperability of existing data systems, and fast retrieval. Lastly, the managers reported a need for practical guidelines on how to build and implement knowledge management systems and how to facilitate organizational change to promote knowledge sharing.

4.3 Key Issues Concerning Knowledge Management

When asked about the key concerns they had about knowledge management, the managers expressed concern primarily over cultural, managerial, and informational issues (See Table 3.). In terms of the cultural issue, the managers were concerned about the implications for change management, the ability to convince people to volunteer their knowledge, and the ability to convince business units to share their knowledge

with other units (particularly when each business unit was responsible for showing a profit). The managerial concerns related to the business value of knowledge management and the need for metrics upon which to demonstrate the value. There was concern about determining who would be responsible for managing the knowledge and of bringing together the many players involved in developing KMS, including technical staff, corporate librarians, documentation staff, archivists, database administrators, and the professionals with the knowledge. Concern was also expressed over how to effectively implement KMS.

Generally speaking, the managers expressed concern that knowledge management might be perceived by senior managers as just another “fad” and that the concept suffered from immaturity. In particular managers from organizations that had not yet implemented KMS expressed a need to better understand the concept and to be convinced that knowledge management “worked” before pursuing KMS.

The concerns related to information were primarily associated with a desire to avoid overloading already taxed users with yet more information. The concern was as much about the new information that would be available as it was about eliminating “old/wrong data” or knowledge that was no longer valid. This supports Courtney et al’s [1997] assertion that “omitting the unimportant may be as important as concentrating on the important” in determining what knowledge to include in KMS. There was also a mention of concern about customer and client confidentiality now that much information about customers and clients would be gathered and widely available in the organization.

Lastly, several managers expressed some concerns over technological issues. These issues were related to technical infrastructure and the security of data on the Internet. More specifically, configuring an effective technical infrastructure and architectural requirements in the face of highly dynamic technology was reported.

4.4 Characteristics of KMS

For those respondents whose organizations had or were developing KMS, questions were asked concerning the initiator, the team members on the KMS project, the budget, the types of knowledge included, and the tools used. As is readily apparent in Figure 1, KMS are most commonly championed by senior general managers. This would be expected given that knowledge management as a concept is not directly tied to technology; rather emerging technologies provide a means of enabling more effective knowledge management. In terms of the KMS development teams, virtually all respondents providing information on the teams responsible for developing their organization’s KMS indicated that directors from the business units as

well as IS managers and staff comprised the team. Less consistency emerged on the individual responsible for the KMS. In some cases, respondents reported that the CIO was responsible for leading the KMS development team; in other cases, respondents indicated that a business unit director was responsible for the team.

Figure 2 shows the estimated average budgets associated with KMS development. The lowest reported budget for a KMS was \$25,000. The highest reported figure was \$50,000,000. The wide range of estimated budgets may be attributed to several factors including the size of the organization, the current level of infrastructure, and the scope of the knowledge management initiative. In some firms, knowledge management is a firm-wide initiative involving upgrading the technical infrastructure, deploying workstations to professional staff desktops, developing and implementing large intranets, and implementing large-scale communication and groupware tools. On the other hand, with the appropriate technology and information infrastructure in place, the average KMS development budget is substantially lower. For example, in a professional services firm that had already installed LotusNotes, the cost of a knowledge management system for the project engagement teams was limited to the cost of developing several Notes templates that the team then used to populate with customer and project-related knowledge. On the other hand, the estimated budget of KMS in another professional services firm was \$50 million. This figure included the cost of content development, training, and overhaul of the technical infrastructure of the entire firm (hardware, software, and network acquisition and development cost).

Table 4 shows the technologies being used in KMS development. The Intranet seems to be the primary means of displaying and distributing knowledge in organizations with 90% of the organizations using browser tools. The other two most common tools are electronic mail and search/retrieval tools.

Table 5 shows the importance of various types of information that may be included in knowledge management systems. Respondents answered on a 7 point scale with 7 representing the highest score. Respondents in organizations without KMS were also asked to rate the importance of the various domains of knowledge in their organizations even if they did not have technology designed to provide such knowledge. The most important knowledge domain for firms with and without KMS is knowledge on customer service. The second and third domains for firms with KMS were business partners and internal operations. For firms without KMS, the second and third highest domains were marketing/sales and business partners. For both groups, knowledge on suppliers was indicated as the least important domain of knowledge to be included in systems, perhaps reflecting the large percentage of service-oriented firms in our sample. Overall, external sources of information tended to be rated highly.

4.5 Perceived benefits of existing KMS

The respondents who reported that their organizations currently had or were currently developing KMS expressed that the KMS were designed to achieve process result improvements leading to organizational outcomes. The process improvements involved shortening the proposal time for client engagements, saving time, improving project management, increasing staff participation, enhancing communication, making the opinions of plant staff more visible, reducing problem-solving time, better serving the clients, and providing better measurement and accountability. These process improvements can be thought of as either relating to communication improvements or efficiency gains. The process improvements then, in the minds of the managers, led to cost reduction of specific activities, increased sales, personnel reduction, higher profitability, lower inventory levels, consistent proposal terms for worldwide clients, and enhanced and proactive marketing). Thus, the perceived organizational benefits of KMS can be thought of primarily as being of a financial, marketing, and general nature (see Table 6).

The data suggests that these practitioners did not value knowledge management for the sake of knowledge as an end in itself, but only when it was perceived to lead to desirable organizational benefits. This is consistent with King's view that knowledge should make a difference in some way " ... materially, aesthetically, or spiritually" (King 1993, p. 80).

5. DISCUSSION AND CONCLUSION

5.1 Discussion

Several observations can be drawn from the data:

(1) KMS is not just for consulting and professional services firms. Traditionally, management consulting and professional services firms have been considered knowledge-intensive firms and therefore interested in knowledge management and KMS. For example, almost all the Big Five accounting and consulting firms² have created internal KMS over the past few years. Our survey revealed, however, that interest in KMS goes far beyond professional services firms, and a broad range of organizations from a variety of industries are looking into this area, feeling that they can potentially benefit from KMS.

(2) Knowledge management systems are multi-faceted.

² The Big Five consulting and accounting firms consist of: Arthur Andersen and Andersen Consulting, Deloitte & Touche, Ernst & Young, KPMG Peat Marwick, and Price Waterhouse Coopers.

That is, effective knowledge management systems involve far more than just technology, encompassing broad cultural and organizational issues. In fact, effective resolution of cultural and organizational issues were identified as major concerns in the deployment of KMS. This is consistent with the IT management literature which advocates organizational and behavioral change management as critical success factors in their implementation of information systems [Alavi and Joachimsthaler, 1992] Firm-wide KMS usually require profound cultural renovations. This is because traditionally, organizations have rewarded their professionals and employees based on their individual performance and know-how. In many organizations, a major cultural shift would be required to change their employees' attitudes and behavior so that they willingly and consistently share their knowledge and insights. An effective way to motivate knowledge sharing is through the organizational reward and incentive mechanisms. Both McKinsey & Company and Coopers & Lybrand LLP (a management consulting and a professional services firm, respectively) use this mechanism to promote knowledge sharing among their consulting and professional staff. At McKinsey, for example, number and frequency of use of a consultant's publications (a measure of knowledge sharing) is an important input to the consultant's promotion decisions. Similarly, Price Waterhouse Coopers enhanced the appeal of knowledge sharing by revising the professionals performance reviews to reward them for knowledge sharing activities [Hildebrand, 1994].

(3) It is important to try to develop metrics to assess benefits of KMS. Although none of the organizations participating in our survey had conducted (or were planning to conduct) formal cost-benefit analysis for their KMS, the respondents felt that development of meaningful metrics for measuring the value, quality and quantity of knowledge is a key factor for long-term success and growth of KMS. To this end, knowledge management initiatives should be directly linked to explicit and important aspects of organizational performance (i.e., customer satisfaction, product/service innovations, time to market, cost savings, competitive positioning and market shares, etc.). In other words, organizations need to find leverage points where enhanced "knowledge" can add value, and then develop KMS to add value through delivery of the required knowledge.

(4) An integrated and integrative technology architecture is a key driver for KMS. No single and dominant technology tool or product for KMS emerged in our survey. KMS seem to require a variety of technological tools in three areas: database and database management, communication and messaging, and browsing and retrieval. The need for seamless integration of the various

tools in these three areas may lead to the dominance of the Internet and internet-based KMS architectures. For example, the knowledge domains identified as valuable by both organizations with and without operational KMS in this sample (e.g., customers and business partners) had an external focus. Thus, the Internet and internet-based technologies and service providers can play a key role in development of KMS by providing cost-effective access to the external knowledge domains. At KPMG Peat Marwick LLP, a participant organization in our survey, some of the files from external sources (e.g., the Gartner Group's weekly analyst report files and customer data files) are imported to the firm over the Internet using FTP.

Since access to internal organizational knowledge sources was also rated relatively high and desirable by our sample, we predict that organizational intranets will also play a dominant role in support of internal knowledge management activities due to cost-effective technical capabilities including: access to the legacy systems, platform independence, access to multimedia data formats, uniform and easy-to-use, point-and-click interface, and capability for easy multi-media publication for knowledge sharing.

(5) Knowledge in the context of KMS is perceived to constitute a new form of information not previously addressed in other systems such as MIS, DSS, and EIS. The respondents in the survey implied a distinction between information and knowledge, although they seem to have used the words interchangeably. This was implicit in their discussions of a potential for creating a condition of cognitive overload due to an over-supply of information, and the desirability of providing access to people with knowledge (e.g., corporate yellow pages), rather than the information itself. This is consistent with the view held by some of the participants who had linked knowledge management to organizational learning processes. If we broadly view learning as the process of internalizing and converting information to knowledge, these two perspectives seem to support the view that information is the raw material for knowledge, and that more information does not necessarily lead to enhanced knowledge creation and sharing. This insight is very important for the designers of KMS for the following reason: simply delivering or "pushing" information (or even pre-filtered information) to the users' desktop may not be an effective knowledge management strategy due to the scarcity of user attention required for processing this information and converting it to knowledge. That is, in addition to the provision of the necessary information (the raw material for knowledge creation), individuals should also be motivated to convert it to knowledge (i.e., learn and internalize the information). Hence, knowledge is created and shared on the basis of "pull" by individuals and not a centralized technology-enabled "push" of information to desktops [Manville and Foote, 1996].

5.2 Conclusion

The study has provided a description of emerging issues and practices of Knowledge Management Systems. While the respondents were not drawn from a random sample of organizations or industries and while the number of respondents was relatively small, their views do represent a range of industries, organizational levels, and nationalities. The study was not intended to build or test theory but does offer some insights into needed and relevant research in the area of KMS. One useful line of inquiry entails an exploration of KMS-culture fit. Much has been made of technology-structure alignment, but the success of KMS may be more related to organizational culture than to organizational structure as evinced by the concerns of our respondents on getting knowledge sharing accepted in their organizations. Another useful line of research would consider methods of making users active contributors to KMS. The very label of "user" is somewhat inappropriate in the context of KMS as users are both contributors and beneficiaries of the system. Involving users in design is not sufficient: they must be involved in the consistent maintenance and operation of KMS. A third potential line of research suggested by our study would uncover the decision making process for determining what knowledge to include in KMS. Since a major concern of our respondents was avoiding too much information, it is worth asking at what point knowledge may stifle rather than enhance performance. Finally, an important line of research will consider the issue of KMS benefits. Given the primarily external focus of information contained in KMS, it is likely that outcomes experienced should involve enhancing relationships with external entities (such as customers and business partners). Studies that include the views of an organization's external entities might shed light on the actual benefits of KMS. The research on these topics (determining the relevant knowledge domains and obtaining business payoffs from KMS) may benefit from a focus on the possible links between knowledge and a firm's strategy and an explicit re-examination of competitiveness from a knowledge resource perspective.

To make information resources productive, they should be converted to actionable knowledge. Such a process introduces challenges relating to knowledge creation, capture, sharing, and maintenance. Our study suggests that knowledge management benefits will only be realized by organizations that are not only technologically adept, but that make the long term investment to align the cultural, managerial and organizational elements for knowledge management.

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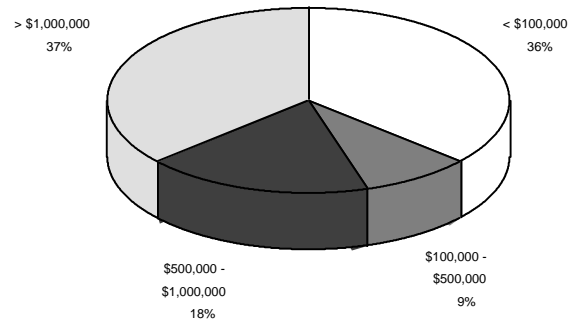


Figure 1: Initiators of KMS with or developing KMS

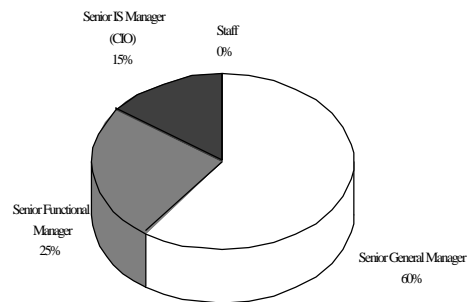


Figure 2: Estimated average budgets of KMS in organizations with KMS

Information-based	Technology-based	Culture-based
Actionable information	Data mining	Collective learning
Categorizing of data	Data warehouses	Continuous learning
Corporate yellow pages	Executive information systems	Intellectual property cultivation
Filtered information	Expert systems	Learning organization
Free text and concepts	Intelligent agents	
People information archive	Intranet	
Readily accessible information	Multimedia	
	Search engines	
	Smart systems	

Table 1: Perspectives on the meaning of knowledge management

Information-based	Technology-based	Culture-based
External:	Integrated databases	Teamwork
Client information	Interoperability of existing	Practical guidelines
Competitive information	systems	Knowledge sharing
Customer information	Larger bandwidth	
Market information	Global IT infrastructure	
Internal:	Intelligent agents	
Activity-based costing	Consistent suite of email and	
Financial information	web products	
Human resources information	Navigational tools	
Product/Services information	Fast retrieval	

Table 2: Needed knowledge management capabilities

Information	Building vast amounts of data into usable form Avoiding overloading users with unnecessary data Eliminating wrong/old data Ensuring customer confidentiality Keeping the information current
Management	Change management implications Getting individuals to volunteer knowledge Getting business units to share knowledge Demonstrating business value Bringing together the many people from various units Determining responsibility for managing the
Technology	Determining infrastructure requirements Keeping up with new technologies Security of data on Internet

Table 3: Key concerns related to knowledge management

Browser	90%
Electronic mail	84%
Search/retrieval tools	73%
Information repositories	52%
WWW server	42%
Agents/Filters	36%
External server services	31%
Videoconferencing	23%

Table 4: Percent of KMS with various technologies/tools
(Note: multiple items could be specified when applicable)

	Firms with or Building KMS	Firms with no KMS
Customer service	5.14	6.15
Business partners	4.83	5.00
Internal operations	4.62	4.95
Competition	4.57	4.90
Marketing/Sales	4.57	5.30
Suppliers	4.56	4.26
Human resources	3.94	4.72

Table 5: Importance of Knowledge domain (maximum of 7)

Process Outcomes	Organizational Outcomes
<p>Communication:</p> <ul style="list-style-type: none"> Enhanced communication Faster communication More visible opinions of staff Increased staff participation <p>Efficiency:</p> <ul style="list-style-type: none"> Reduced problem solving time Shortening proposal times Faster restuls Faster delivery to market Greater overall efficiency 	<p>Financial:</p> <ul style="list-style-type: none"> Increased sales Decreased cost Higher profitability <p>Marketing:</p> <ul style="list-style-type: none"> Better service Customer focus Targeted marketing Proactive marketing <p>General:</p> <ul style="list-style-type: none"> Consistent proposals to multinational clients Improved Project management Personnel reduction

Table 6: Perceived benefits of existing knowledge management systems