General Perspectives on Knowledge Management: Fostering a Research Agenda

VARUN GROVER AND THOMAS H. DAVENPORT

For biographical information on VARUN GROVER and THOMAS H. DAVENPORT see the Guest Editors' Introduction.

ABSTRACT. We trace in pragmatic terms some of what we know about knowledge, information technology, knowledge management practice and research, and provide two complementary frameworks that highlight potential opportunities for building a research agenda in this area. The papers in this special issue are then discussed.

KEY WORDS AND PHRASES: information technology, knowledge, knowledge management, knowledge market, knowledge process

IT WAS ONLY A FEW YEARS AGO that knowledge management was relegated to the domain of organizations whose primary business was to sell knowledge-based products. Now, it is rapidly becoming an integral business function for many organizations as they realize that competitiveness hinges on effective management of intellectual resources. In a relatively quiet and rapid way, the concept has penetrated into many different functions and processes of business. This is perhaps the best possible set of outcomes for knowledge management. Rather than becoming a stand-alone business fad, the management of knowledge is best accomplished by becoming embedded in other aspects of business. Ironically, the best future for knowledge management would be for it to become so pervasive and common that it seems invisible.

Knowledge and the Role of Information Technology

AS WE TRACE THE EVOLUTION OF COMPUTING TECHNOLOGIES in business, we can observe their changing level of organizational impact. The first level of impact was clearly at the point work got done and transactions (e.g., orders, deposits, reservations) took place. The inflexible, centralized mainframe of the 1960s allowed for little more than massive number crunching, commonly known as electronic *data* processing. Organizations became data heavy at the bottom and data management systems were used to keep the data in check. Also, the management *information* system of the 1970s was used to aggregate these data into useful information reports, often

Journal of Management Information Systems / Summer 2001, Vol. 18, No. 1, pp. 5–21

0742-1222 / 2001 $9.50 + 0.00

prescheduled, for the control level of the organization—people who were making sure that organizational resources like personnel, money, and physical goods were being deployed efficiently. So the notoriety of information system (IS) groups within organizations grew as they struggled to figure out what information managers really wanted and massive reports were pummeled down the accountant's or inventory manager's throat. The advent of the PC in the 1980s brought an organic component into a generally mechanistic systems environment. Managers could use decentralized computing power to cater to their own unstructured data and information needs. These decision support systems, complemented with easy to use fourth generation languages, distributed informational control to the individual managers. The mid to late 1980s brought a more proactive approach to information and systems under the umbrella term of strategic information systems. Key issues focused on organizational effectiveness, interorganizational deployment, and competitive advantage. However, the focus of all these systems was still information. How do we provide better information to customers? How do we mine our data to gain strategic information? How do we reduce our inventory by getting faster and better information? A major catalyst was of course the emergence of the Internet and related technologies that provided a potent mechanism for efficiently allowing access to a rich repertoire of information using multimedia channels. However, in a time where responsiveness to market opportunities (and threats) is critical, technologies are facilitating data and information abundance, and corporate attention is a scarce resource, what portions of these repositories are really useful? How do we manage *really* useful information in our firm? Out of such discussions emerged the concept of knowledge as a particularly high-value form of information.

Today, any discussion of knowledge quickly leads to the issue of how knowledge is defined. A pragmatic definition defines the topic as the most valuable form of content in a continuum starting at data, encompassing information, and ending at knowledge. Typically, data is classified, summarized, transferred or corrected in order to add value, and become information within a certain context. This conversion is relatively mechanical and has long been facilitated by storage, processing, and communication technologies. These technologies add place, time, and form utility to the data. In doing so, the information serves to "inform" or reduce uncertainty within the problem domain. Therefore, information is united with the context, that is, it only has utility within the context.

Knowledge has the highest value, the most human contribution, the greatest relevance to decisions and actions, and the greatest dependence on a specific situation or context. It is also the most difficult of content types to manage, because it originates and is applied in the minds of human beings. People who are knowledgeable not only have information, but have the ability to integrate and frame the information within the context of their experience, expertise, and judgment. In doing so, they can create new information that expands the state of possibilities, and in turn allows for further interaction with experience, expertise, and judgment. Therefore, in an organizational context, all new knowledge stems from people. Some knowledge is incorporated in organizational artifacts like processes, structures, and technology. However, institu-

tionalized knowledge often inhibits competition in a dynamic context, unless adaptability of people and processes (higher order learning) is built into the institutional mechanisms themselves.

In sum, the mechanical generation of databases, Web sites, and systems that process data are good and have the potential to take us to a higher plane in the organization, help us understand our processes better, and help us deal with organizational pathologies and problems. The data-to-information transition often involves a low level mechanical process that is well within the domain of contemporary information technologies, though humans are helpful in this transition as well. This information could exist in different forms throughout the organization and could even form the basis of competitive advantage or information products. For example, provision of information to customers about their order or shipment status is something that companies like Baxter and Fedex have been doing for years. But unlike knowledge, mechanically supplied information can not be the source of sustained competitive advantage, particularly when the architectures on which it is based are becoming more open and omnipresent.

Regardless of definition, however, knowledge managers often take a highly inclusive approach to the content with which they deal. In practice, what companies actually manage under the banner of knowledge management is a mix of knowledge, information, and unrefined data—in short, whatever anyone finds that is useful and easy to store in an electronic repository. In the case of data and information, however, there are often attempts to add more value and create knowledge. This transformation might involve the addition of insight, experience, context, interpretation, or the myriad of other activities in which human brains specialize.

Useful Concepts in Knowledge Management

THE PRACTICE OF KNOWLEDGE MANAGEMENT has benefited from several key concepts, some of which were not created within the knowledge management movement, but have been imported into it.

Tacit vs. Explicit Knowledge. This idea can be traced back to the philosopher Michael Polanyi, but has been applied to business and knowledge management by the Japanese management scholar Ikujiro Nonaka [21]. It suggests that there are two types of knowledge: tacit, which is embedded in the human brain and cannot be expressed easily, and explicit knowledge, which can be easily codified. Both types of knowledge are important, but Western firms have focused largely on managing explicit knowledge.

Knowledge Processes. The knowledge processes lie somewhere between information and the firm's source of revenue, its products and services. This process can be generically represented as three subprocesses: knowledge generation, knowledge codification, and knowledge transfer/realization. Knowledge generation includes all processes involved in the acquisition and development of knowledge. Knowledge codification involves the conversion of knowledge into accessible and applicable

formats. Knowledge transfer includes the movement of knowledge from its point of generation or codified form to the point of use.

One of the reasons that knowledge is such a difficult concept is because this process is recursive, expanding, and often discontinuous. Many cycles of generation, codification, and transfer are concurrently occurring in businesses. These cycles feed on each other. Knowledge interacts with information to increase the state space of possibilities and provide new information, which can then facilitate generation of new knowledge. The knowledge process acts on information to create new information that allows for greater possibilities to fulfill old or possibly new organizational needs. This process is often discontinuous, where new (previously unknown) needs and their fulfillment mechanism could be created. The invention of the laser, arguably one of the most versatile technologies of the twentieth century was initially not even patented by Bell Labs on the grounds that such an innovation had no possible relevance to the telecommunications industry. No one had considered the possibility of fiber optics!

Codification vs. Personalization. This distinction is related to the tacit vs. explicit concept. It involves an organization's primary approach to knowledge transfer [14]. Companies using codification approaches rely primarily on repositories of explicit knowledge. Personalization approaches imply that the primary mode of knowledge transfer is direct interaction among people. Both are necessary in most organizations, but an increased focus on one approach or the other at any given time within a specific organization may be appropriate.

Knowledge Markets. This concept recognizes the interest that individuals have in holding onto the knowledge they possess. In order to part with it, they need to receive something in exchange [7]. Any organization is a knowledge market in which knowledge is exchanged for other things of value—money, respect, promotions, or other knowledge.

Communities of Practice. This idea, which developed in the "organizational learning" movement, posits that knowledge flows best through networks of people who may not be in the same part of the organization, but have the same work interests [4]. Some firms have attempted to formalize these communities, even though theorists argue that they should emerge in a self-organizing fashion without any relationship to formal organizational structures.

Intangible Assets. Many observers have recently pointed out that formal accounting systems do not measure the valuable knowledge, intellectual capital, and other "intangible" assets of a corporation [27] This is undeniably true. The market values of knowledge-intensive organizations are often several times their "book" or accounting value. Some analysts have even argued that accounting systems should change to incorporate intangible assets and that knowledge capital should be reflected on the balance sheet. However, the esoteric and subjective nature of knowledge makes it impossible to assign a fixed and permanent value to knowledge.

These concepts are useful and allow us to create a common vocabulary for research and practice. However, the use of separate terminology and concepts should not preclude us from recognizing the embedment of knowledge management into other aspects of business.

Knowledge Management Practices

MOST KNOWLEDGE MANAGEMENT PROJECTS IN ORGANIZATIONS fall into a relatively few categories or types, each of which has a key objective. Although it is possible, and even desirable, to combine multiple objectives in a single project, this was not normally observed in a study of 31 knowledge management projects in 1997 [8]. Since that time, it is possible that projects have matured and have taken on more ambitious collections of objectives.

In Western organizations, by far the most common objective involves implementing some sort of knowledge repository. The objective of this type of project is to capture knowledge for later and broader access by others within the same organization. Common repository technologies include Lotus Notes, Web-based intranets, and Microsoft's Exchange, supplemented by search engines, document management tools, and other tools that allow editing and access.

The repositories typically contain a specific type of knowledge for a particular business function or process, such as:

- "Best practices" knowledge within a quality or business process management function.
- Knowledge for sales purposes involving products, markets, and customers.
- Lessons learned in projects or product development efforts.
- Knowledge around implementation of information systems.
- Competitive intelligence for strategy and planning functions.
- "Learning histories" or records of experience with a new corporate direction or approach.

Although most knowledge repositories serve a single function, it is increasingly common for companies to construct an internal "portal" so that employees can access multiple different repositories and sources from one screen. It is also possible and increasingly popular for repositories to contain not (or not only) knowledge itself, but also pointers to experts within the organization on key knowledge topics. Called "Knowledge Yellow Pages," these systems facilitate contact and knowledge transfer between knowledgeable people and those who seek their knowledge. It is also feasible to combine stored knowledge with lists of the individuals who contributed the knowledge and could provide more detail or background on it.

Firms increasingly view attempts to transform raw data into usable knowledge as part of their knowledge management initiatives. These approaches typically involve isolating data in a separate "warehouse" for easier access and the use of statistical analysis or data mining and visualization tools. Since their goal is to create data-derived knowledge, however, they are increasingly addressed as a part of knowledge management. Some vendors have already begun to introduce e-commerce tools. They serve to customize the menu of available knowledge to individual customers, allowing sampling of knowledge before buying and carrying out sales transactions for knowledge purchases.

When companies want to use knowledge in real-time, mission-critical applications, they have to structure the knowledge base for rapid, precise access. A Web search yielding hundreds of documents won't suffice when a customer is waiting on the phone for an answer. Representing and structuring knowledge is a requirement that has long been addressed by "artificial intelligence" researchers. Now their technologies are being applied in the context of knowledge management. Rule-based systems, and more commonly, case-based systems are used to capture and provide access to customer service problem resolution, legal knowledge, new product development knowledge, and many other types. Although it can be difficult and labor-intensive to author a structured knowledge base, the effort can pay off in terms of faster responses to customers, lower cost per knowledge transaction, and lessened requirements for experienced, expert personnel.

For the most part, knowledge management efforts have focused on developing new applications of information technology to support the capture, storage, retrieval, and distribution of explicit knowledge. Most organizations have not taken a conscious process-oriented approach to knowledge management. However, structurally a number of initiatives are underway to create entities outside corporate library and R&D groups to manage knowledge.

The most visible of these is the chief knowledge officer (CKO) or equivalent role [9]. The role is an important one for both operational and symbolic reasons. Operationally, CKOs perform a variety of key roles, including serving as the chief designer of the knowledge architecture, the top of the reporting relationship for knowledge professionals, the head technologist for knowledge technologies, and the primary procurement officer for external knowledge content. Symbolically, the presence of a CKO serves as an important indicator that a firm views knowledge and its management as critical to its success. If the CKO is a member of the senior executive team, it becomes obvious to employees that knowledge is a critical business resource on the level of labor and capital.

Less visible but equally important are the cadre of managers who understand knowledge and its uses in various aspects of the business, the motivational and attitudinal factors necessary to get people to create, share, and use knowledge effectively, and the ways to use technology to enhance knowledge activities. On a daily basis, knowledge managers perform a broad collection of tasks, including:

- Facilitation of knowledge-sharing networks and communities of practice.
- Creation, editing, and pruning of "knowledge objects" in a repository.
- Building and maintaining technology-based knowledge applications.
- Incorporating knowledge-oriented job descriptions, motivational approaches, and evaluation and reward systems into the human resource management processes of the organization.
- Redesigning knowledge work processes and incorporating knowledge tasks and activities into them.

In sum, the practice of knowledge management has thus far emphasized technology-based initiatives. However, building of professional capabilities such as knowl-

edge management specialists, formal procedures, and separate knowledge management skills are becoming increasingly prevalent. The challenge is to bring these capabilities and processes into the day-to-day milieu of every knowledge worker.

Research on Knowledge Management

THE STUDY OF KNOWLEDGE IN ITSELF IS NOT A NEW TOPIC. It extends back to the ancient philosophers. Its scientific study, however, can be traced back to the 1950s, when tremendous progress occurred in the cognitive sciences. Knowledge was considered to be representations of the world that consist of objects and events, and the challenge of a cognitive system, computational or biological, was to represent this model as accurately as possible. To the cognitivist, knowledge was explicit, capable of being coded and stored, and easy to transfer. Significant research in artificial intelligence stems from this vantage point, with many of the resulting systems being currently used in business.

The more contemporary but complementary view, epitomized by Nonaka and Takeuchi [22], places importance on the tacit and personal nature of knowledge as a key source of innovation. Key elements stemming from this thinking are the conversion processes, ignored by cognitivists, which leads to explicit knowledge or ultimately into a new product or service. These conversions are more likely to involve social activities than knowledge technologies.

Although there has been much research in the social and psychological sciences pertaining to knowledge use and transfer, business emphasis on the topic has been more recent. Perhaps the greatest focus has been in the management and organizational area, where two major streams of work can be identified. The first involves theorization of why firms have performance differences. Debate on the "theory of the firm" originates from two viewpoints, one based in transaction cost economics (TCE), and the other in resource based theory (RBT). While TCE posits that firms exist in lieu of markets due to their reduced potential for opportunism [29], RBT asserts that long-run superior performance is associated with the possession of scarce, valuable, and inimitable firm-specific resources [2]. The debate stems from the tenet that knowledge as a focal resource creates unique advantages for governing economic activities through a logic that is very different from a market [6, 12, 19]. A knowledge-based view argues that the success of firms is not only based on the economics of the contracts it implements (property rights, incentives), but also on its heterogeneous stocks and flows of knowledge. Further work from this perspective has examined different models of organizational design [e.g., 15] and development of organizational capabilities [11]. The latter view conceptualizes the firm as an institution for integrating knowledge and examines how the mechanisms for integration establish flexible response capabilities in hypercompetitive markets [10, 11].

The second, and more empirically based stream, focuses on knowledge flows between organizational units and between organizations. Some work is targeted at multinational corporation (MNC) and the factors that affect knowledge flow to and from

subsidiaries [13, 17]. More prominent however is the study of interfirm collaboration and factors that affect knowledge sharing [1, 16, 18, 25, 30].

In the IS domain, prior research on knowledge has mainly followed a cognitive perspective. Considerable emphasis has been placed on knowledge-based systems, particularly tools and techniques for knowledge representation [e.g., 3, 20, 28] and knowledge transfer [e.g., 23]. Other studies with some relevance to knowledge management are those that examine factors affecting media choice in rich information exchange [5, 26] and ethnographic accounts of knowledge work [24].

A Process Framework

Clearly, research in the domain of knowledge management seems fragmented. A number of management concepts, such as transaction costs, resource-based theory, higher order learning, absorptive capacity, dynamic capabilities, media richness, and so on, have enriched our vocabulary and centered attention on how to create and utilize knowledge in order to create new products and processes. However, the treatment of knowledge, for the most part, has been implicit. It is our view that the gap between research and practice remains significant. Although recognition of knowledge has increased, so has the need to treat it systematically. The growing literature on knowledge management should continue to draw from rich theoretical perspectives, but also deal with the "how" questions of management. For instance, if we know that a company's prior knowledge base is critical to exploit new knowledge, we need to know how it can be done.

To this end, we propose a simple, yet pragmatic framework for the study of knowledge management. The framework focuses on the knowledge process and the context in which this process is embedded (see Figure 1). These processes could be deliberate or emergent. Deliberate knowledge processes are the result of conscious organizational knowledge management initiatives. Emergent knowledge processes are tied into the work processes themselves. The role of knowledge in these may not be visible to participants. Both exist simultaneously in firms, and arguably a well-conceived knowledge management program will seek their convergence. The processes themselves can be divided into generation, codification, and transfer phases as described earlier. Knowledge realization/outcome refers to the process involved in creating value for the recipient of knowledge and ultimately for the firm. It also highlights the importance of conducting research on the evaluation of knowledge assets and outcomes.

The rows of Figure 1 identify key elements of the embedded context. All knowledge processes exist in duality with the context, that is, they can be influenced by and influence the context. The framework can be studied for knowledge processes occurring between individuals, groups, and organizations. Of course prescriptive implications will emerge only from analysis of the effectiveness processes in each cell.

The framework illustrates key domains for pragmatic research on knowledge management. It frames relevant questions on interventions that could facilitate knowledge processes. Of particular note to IS researchers is technology, which has been the catalyst for the recent resurgence of interest in knowledge management. By focusing

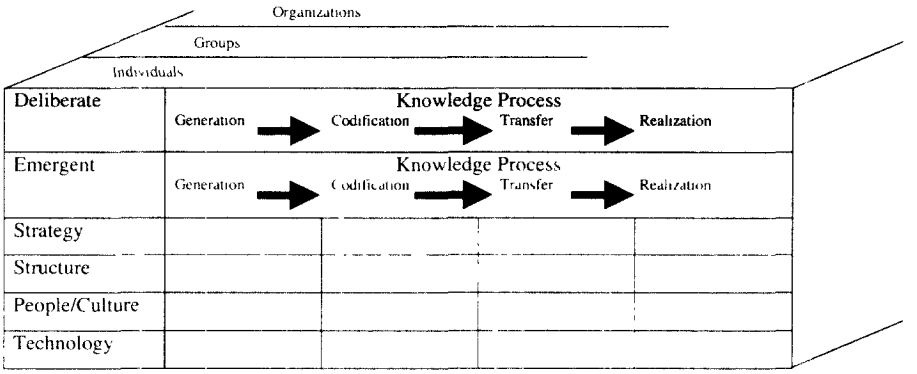

Figure 1. A Pragmatic Framework for KM Research

on multiple cells (e.g., technology and people), the interaction effects on knowledge processes can be observed.

Much of the existing research in management has focused on knowledge transfer between and within organizations and structural manifestations of knowledge. Some IS research has emphasized the impact of information technology (IT) on codification. Very little research has emphasized knowledge generation and realization processes or the role of strategy and its relationship with knowledge processes. Fertile opportunities exist, for instance, to study the role of IT (networks) in the transfer of explicit and implicit knowledge, the impact of tightly aligned corporate knowledge strategy and IS strategy on facilitating the knowledge process, cultural and technology-based impediments to the knowledge process, task and structural factors that enable knowledge transfer, effectiveness of various codification methods under different task/structural conditions, and individual motivations for emergent and deliberate knowledge processes.

From a practitioner's perspective, much of the work undertaken on knowledge management by firms has been accomplished without substantial change in how the organization does business. But firms that have reached the initial plateau of knowledge management now realize that long-term, complete success at using knowledge for business advantage requires change in many core aspects of the business. In the first phase, the emphasis was on the knowledge management project. Projects are a good way to get started with knowledge management, but they are by definition peripheral to the rest of the business. Projects "bottle up" knowledge and treat it as something separate. What firms must do in the second phase of knowledge management is to integrate it with familiar aspects of the business: strategy, process, culture, and behavior. Therefore, topics on which practitioners need direct help are in the integration of knowledge management with business strategy (how can the more effective use of knowledge support or enhance business strategy?), work processes (how can a deliberate knowledge management process be "baked" into key knowledge work processes?), culture (how does one create a culture that values the creation, sharing, and use of knowledge?), and behavior (how do individuals and firms reconcile the need to

balance learning and doing and realize knowledge-based benefits?). These questions, well represented in the framework, provide an ambitious agenda for practice-oriented knowledge management research.

A Market Framework

AN ALTERNATE BUT COMPLEMENTARY WAY TO STUDY KNOWLEDGE is from a transactional perspective, where knowledge exchanges occur in a marketplace [7]. In defining any market, we must be clear as to who are the buyers and sellers, and what pricing system exists to determine what the consumer pays for a product or service. Knowledge markets, as noted above, exist within every organization. These markets include not only knowledge that has been codified or synthesized (realized) into a company's processes, structure, technology, or strategy, but also include all dynamic exchanges of knowledge between buyers and suppliers. Organizations can be viewed to have two categories of buyers of knowledge, local buyers and global buyers. The local buyers are people who are searching for knowledge assets to address an issue that they need to resolve. They require more than information. Expertise, experience, insight, and judgment are needed to bring to bear on the issue. They could pay for knowledge in hard currency via, say, a consultant from outside the firm, or buy the knowledge from internal suppliers. The global knowledge buyer is the firm, which has a vested interest in realizing knowledge assets into valuable products and services. The global knowledge buyer, represented by organizational stakeholders whose benefits are tied to organizational level outcomes, has a strong interest in transferring local knowledge to global knowledge. Doing so reduces dependency on knowledge sellers—in case they choose to leave the firm. Knowledge sellers are people who have knowledge (usually tacit) to sell. The quality of this knowledge might be high or low depending on the credibility of the source.

It is important to note that pure markets do not exist, and to fully understand organizational markets, political and social realities must be taken into account. However, it is useful to define *efficiency of markets* based on whether buyers can extract surplus revenues from suppliers due to competition.

Attributes of an efficient market would include such factors as:

- Information symmetry, where buyers and sellers have access to the same information on products so suppliers do not benefit from private information.
- Product standardization, where buyers have an understanding of the basis of comparison of multiple offerings and can make an informed choice of price/value trade-offs.
- Homogeneity of customers, where the market is not segmented so that all customers value the products in an equivalent manner.
- Large numbers of suppliers, where buyers have a real choice and suppliers cannot generate monopolistic rents.
- Common currency, where the currency of exchange is well understood and forms the benchmark for pricing.

Highly efficient knowledge markets therefore have little information asymmetry, high levels of standardization, homogeneous customers, large numbers of suppliers, and a well-understood currency. Such markets work in favor of the buyer. Table 1 examines why it is difficult for knowledge markets within firms to be efficient for local buyers. An inherent source of inefficiency in this market is the difficulty in assessing the value of knowledge. As knowledge assets evolve through generation, codification, and realization, their uncertainty is reduced and their source of value is easier to see. Therefore, while knowledge in the generation stage (or a knowledge creator) might have tremendous potential for value, its uncertainty reduces the present value of future returns from the asset. Knowledge in the codification stage (if explicit) is visible to customers and somewhat easier to assess. The value of knowledge in the transfer and realization stages might be the most tangible since its value is based on visible products and services that it can create.

Although high levels of knowledge market efficiency may never be achieved, the market concept offers a useful way for organizations to think about knowledge. In theory, high market efficiency would result in greater liquidity of knowledge flows and benefits that accrue to the buyer. Efficient markets can be effective for the global buyer (the firm) if it can "buy" knowledge at a fair price and realize it for organizational goals. Therefore, *knowledge management can be framed as the problem of creating an effective and efficient knowledge marketplace* in the organization. Such markets work to improve the stock of both the local and global buyer while providing appropriate compensation for the sellers.

From a research perspective, this framework raises questions that focus on pragmatic issues of "how" and "what" make knowledge markets work better. These could include issues on the role of IT in reducing information asymmetry on knowledge, factors affecting the currency or value of knowledge sharing, conditions that influence beliefs on organizational versus individual knowledge ownership, relationships between knowledge market efficiency and workforce morale, and the types of physical and virtual market mechanisms and their impact. We believe that both the process and market frameworks provide a fairly complete, yet complementary representation of knowledge management research questions.

Articles in This Issue

THE ARTICLES IN THIS SPECIAL ISSUE REPRESENT a variety of conceptual and methodological approaches that epitomize the complexity of the phenomenon being examined. They can be mapped onto the process and market frameworks. Figure 2 provides a general depiction of the mapping for the process framework.

The first three articles are mainly concerned with knowledge codification and transfer among individuals. These papers mostly examine individual (emergent) processes, but discuss implications for deliberate interventions. Becerra-Fernandez and Sabherwal focus on explicit and implicit knowledge transfer and argue that the nature of the task (structural) context influences the effectiveness of the transfer process. Based on

Table 1. Efficiency of Knowledge Markets

Efficient Market Characteristics	Knowledge Markets
Information symmetry	Knowledge by its very nature is unique. Therefore, the seller of knowledge has the most information on the front-end of the knowledge process, that is, what was generated and how it is codified. The buyer might have information on how the knowledge can be realized within the context of the issue being addressed. This is a natural information asymmetry. This problem is further compounded by the fact that buyers often cannot identify good sources of knowledge and rely on close (local) networks of people they know Even more inefficiency could exist due to the fact that certain knowledge sources might choose to keep information about their knowledge private due to cultural or political reasons. This leads to very inefficient buying and selling where buyers have to incur tremendous costs to reduce information asymmetry
Product standardization	Again, the unique nature of knowledge makes it very difficult to compare knowledge sources. If consultant A is prescribing methodology 1 to solve problem X, and consultant B is prescribing methodology 2, how should a company make a choice, given that problem X is unique to the context of the company and methodology 1 and 2 have never been tested within that context. Additional difficulty exists due to the recursive nature of knowledge and its discontinuous interaction. It is very difficult to predict how new knowledge will interact with the information on the issue under consideration. This interaction could yield a completely different solution set that could be of much greater value than any being originally considered. It may be almost impossible to assess the value of this knowledge a priori. Therefore, knowledge uniqueness could allow sellers to generate monopolies.
Homogeneity of customers	On the demand side we can see a similar problem regarding the contexts on which knowledge needs to be brought to bear. These contexts or issues are not simple to define. They cannot be addressed by provision of information (e.g., what is the relationship between our advertising expenditures and sales), but require complex knowledge processes that need to be conducted by people or people networks with specific knowledge competencies Therefore, customers are inherently segmented into markets of unitary size, leading to differences in expectations and prices for the same knowledge assets.

Large number of suppliers	A substantial amount of knowledge tends to be tacit or in the minds of employees. If this tacit knowledge is kept invisible to the broad market or is visible only to a local market, the suppliers are essentially unavailable to a potential buyer. This buyer may then obtain the knowledge from suboptimal sources (i.e., convenience sources or external consultants) and pay a premium for what he considers monopolistic knowledge. There may, however, be a large number of suppliers who, if visible to the buyer, would bring the price of the knowledge down. Again, the interaction of knowledge with information makes it very difficult in many cases to accurately predict the appropriate supplier and the quality of knowledge obtained. Therefore, the buyer may not be able to assess the relevant supplier pool—rendering greater uncertainty and inefficiency.
Common currency	Although sellers outside the firm, and occasionally within the firm, might charge hard currency (based on hourly rates or a retainer) for professional expertise, many knowledge transactions do not use common currency. Some arrangements are made based on a quid pro quo arrangement or an expectation of subsequent reciprocity. Other knowledge sellers could part with their knowledge for the price of ego gratification or simply out of friendship. Further, the currency could change, based upon time or context, making it very difficult to compare knowledge assets.

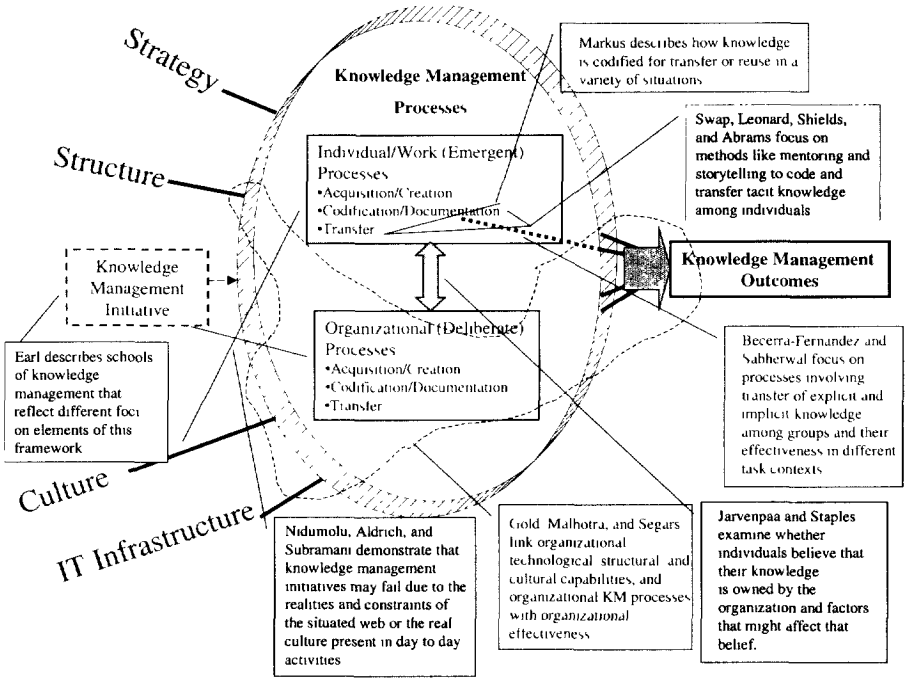

Figure 2. Mapping of the Papers in This Special Issue

empirical data gathered from eight subunits of a knowledge-intensive organization, the Kennedy Space Center, they provide evidence for their contingency framework. The results suggest that in developing (deliberate) knowledge management processes, task domain and orientation should be considered. The next article by Markus synthesizes literature from various sources to develop an initial theory of knowledge reusability (documentation and transfer). Four types of knowledge reuse situations are identified, based on the knowledge distance between knowledge producers and reusers. The study provides interventions for managers, such as the use of human and technical intermediaries that might lead to more successful reuse in organizations. The third article by Swap, Leonard, Shields, and Abrams focuses on mentoring and storytelling as techniques for effectively transferring tacit knowledge in work settings. Drawing on research in cognitive psychology and extensive field studies, the authors frame an essay on principles for effective knowledge transfer through these mechanisms. They also argue that sophisticated managers can recognize and nurture these types of informal learning processes.

The fourth article, by Nidumolu, Aldrich, and Subramani, provides an interpretive examination of knowledge. Using a rich investigation of a single company, the authors demonstrate the underlying tension between the deliberate initiative and the emergent practices of the participants. The authors use metaphors and symbols to describe why the cultural climate at the company inhibited the knowledge initiative

from being successful. The study alerts managers to recognize the reality of the situated knowledge web before undertaking knowledge management initiatives.

The next article, by Jarvenpaa and Staples, examines the interesting issue of organizational ownership rights to individual information and knowledge. By using vignettes and a questionnaire, individuals in two organizations were asked to assess their propensity to share within and outside the organization a variety of contextual variables. These were hypothesized to be associated with individual beliefs about organizational ownership. The results provide preliminary guidelines on the environment that needs to be cultivated where individuals attach high levels of organizational ownership to their information and knowledge.

The sixth article, by Gold, Malhotra, and Segars, provides an organizational perspective of knowledge management. The authors define a number of additive components of (deliberate) knowledge process capability and knowledge infrastructure capability. They then survey over 300 senior executives. Using rich multi-item scales, they hypothesize and test a structural model of organizational effectiveness. The results suggest that managers should focus on multiple dimensions of knowledge management, rather than optimize on any one.

Finally, Earl draws on case studies and interviews to inductively develop taxonomy of seven "schools" of knowledge management. These schools are differentiated by their focus, aim, success factor, role of IT, and central philosophy. The study provides a useful way to make sense of the many corporate initiatives undertaken in recent years. The author provides guidelines for firms that wish to use the taxonomy to begin formulation of a knowledge management strategy.

The seven articles can also be examined in light of the market framework Becerra-Fernandez and Sabherwal demonstrate that flow of knowledge has greater friction if the appropriate task conditions are not matched. Markus emphasizes the importance of bridging knowledge distance (asymmetry) between supplier and buyer in order to have successful outcomes. Swap et al. focus on how managers can use the hidden currency of soft mechanisms to effectively sell tacit knowledge. Nidumolu et al. demonstrate how cultural impediments can inhibit both market efficiency and effectiveness. Jarvenpaa and Staples study factors influencing the (perceived) convergence between market effectiveness for the organization and efficiency for the buyer. Finally, Gold et al. describe capability sets that encourage efficient and effective knowledge markets, while Earl describes dimensions that frame the context in which knowledge markets occur.

Conclusion

KNOWLEDGE AND ITS MANAGEMENT involve effort on many fronts to be successful. Whether framed in terms of a process and its context or in terms of market efficiency and effectiveness, knowledge management offers fertile avenues for research. This Special Issue provides one small step in this regard. It is important to note however that the research agenda should be closely tied to practical issues in knowledge management. A healthy tension between knowledge and action is the key to organizational success.

REFERENCES

1. Appleyard, M.M. How does knowledge flow? Interfirm patterns in the semiconductor industry. *Strategic Management Journal, 17* (1996), 137–154.

2. Barney, J.B. Firm resources and sustained competitive advantage *Journal of Management, 17* (1991), 99–120.

3. Bohme, B., and Wieland, R Knowledge representation in expert systems for process control. *Decision Support Systems, 6,* 4 (1990), 307–314

4. Brown, J S . and Duguid, P. Organizational learning and communities of practice: toward a unified view of working, learning, and innovation *Organization Science, 2,* 1 (1991), 40–57

5 Carlson, J.R , and Zmud, R.W Channel expansion theory and the experiential nature of media richness perceptions. *Academy of Management Journal, 42,* 2 (1999), 153–170.

6. Conner, K R., and Prahalad, C.K. A resource-based theory of the firm: knowledge versus opportunism *Organization Science, 7,* 5 (1996), 477–501.

7. Davenport, T.H., and Prusak, L. *Working Knowledge: How Organizations Manage What They Know.* Boston: Harvard Business School Press, 1998

8. Davenport, T.H.; De Long, D.W., and Beers, M.C. Successful knowledge management projects. *Sloan Management Review, 39,* 2 (1998), 43–57.

9. Earl, M.J., and Scott, I A. Opinion· what is a chief knowledge officer? *Sloan Management Review, 40* (1999), 29–38

10. Galunic, D.C., and Rodan, S. Resource recombinations in the firm: knowledge structures and the potential for Schumpeterian innovation. *Strategic Management Journal, 19,* 12 (1998), 1193–1201.

11. Grant, R.M. Prospering in dynamically-competitive environments: organizational capability as knowledge integration. *Organization Science, 7,* 4 (1996), 375–387.

12. Grant, R.M.; Baden-Fuller, C., Ghoshal, S ; and Moran, P. A knowledge-based theory of inter-firm collaboration. Bad for practice: a critique of the transaction cost theory. *Academy of Management Best Papers Proceedings* (1995), 17–21.

13. Gupta, A.K., and Govindarajan, V Knowledge flows and the structure of control within multinational corporations. *Academy of Management Review, 16,* 4 (1991), 768–792.

14. Hansen, M.; Nohria, N.; and Tierney, T What's your strategy for managing knowledge?" *Harvard Business Review, 77,* 2 (1999), 106–116

15 Hedlund, G. A model of knowledge management and the N-form corporation. *Strategic Management Journal, 15,* Special Issue (1994), 73–90.

16. Inkpen, A.C , and Dinur, A Knowledge management processes and international joint ventures. *Organization Science, 9,* 4 (1998), 454–468.

17. Kogut, B., and Zander, U. Knowledge of the firm and the evolutionary theory of the multinational corporation *Journal of International Business Studies, 24,* 4 (1993), 625–645.

18 Larsson, R ; Bengtsson, L.; Henriksson, K., and Sparks, J. The interorganizational learning dilemma: collective knowledge development in strategic alliances. *Organization Science, 9,* 3 (1998), 285–305.

19. Liebeskind, J.P Knowledge, strategy, and the theory of the firm. *Strategic Management Journal, 17,* 1 (1996), 93–107

20 Murrell, S., and Plant, R.T A survey of tools for the validation and verification of knowledge-based systems: 1985–1995 *Decision Support Systems, 21,* 4 (1997), 307–323.

21. Nonaka, I. The knowledge-creating company *Harvard Business Review, 79,* 6 (1991), 96–104

22 Nonaka, I., and Takeuchi, H. *The Knowledge-Creating Company—How Japanese Companies Create the Dynamics of Innovation.* Oxford. Oxford University Press, 1995.

23. Olson, J R., and Reuter, H.H. Extracting expertise from experts: methods for knowledge acquisition. *Expert Systems, 4,* 3 (1987), 152–168.

24. Schultze, U. A confessional account of an ethnography about knowledge work. *MIS Quarterly, 24,* 1 (2000), 3–42.

25. Simonin, B.L Ambiguity and the process of knowledge transfer in strategic alliances. *Strategic Management Journal, 20,* 7 (1999), 595–623.

26. Straub, D., and Karahanna, E. Knowledge worker communications and recipient availability: toward a task closure explanation of media choice. *Organization Science, 9,* 2 (1998), 160–175.

27. Sveiby, K.E. *The New Organizational Wealth: Managing and Measuring Knowledge-Based Assets.* San Francisco: Berrett-Koehler, 1997.

28. Raghunathan, S.; Krishnan, R.; and May, J.H. MODFORM: a knowledge-based tool to support the modeling process. *Information Systems Research, 4,* 4 (1993), 331–358.

29. Williamson, O E. *The Economic Institutions of Capitalism: Firms, Markets, Relational Contracting* London: The Free Press, 1985.

30. Zander, U., and Kogut, B. Knowledge and the speed of the transfer and imitation of organizational capabilities, an empirical test. *Organization Science, 6,* 1 (1995), 76–92