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# Knowledge Management Strategies: Toward a Taxonomy

MICHAEL EARL

MICHAEL J. EARL is Professor of Information Management at London Business School, where he is also currently Coordinator of E-Business. He has authored several books and written articles in the fields of strategic information systems planning, the management of the IT function, knowledge management, and e-commerce in journals such as *MIS Quarterly*, *Journal of Management Information Systems*, *Harvard Business Review*, and *Sloan Management Review*.

**ABSTRACT:** This paper draws on primary and secondary data to propose a taxonomy of strategies, or "schools," for knowledge management. The primary purpose of this framework is to guide executives on choices to initiate knowledge management projects according to goals, organizational character, and technological, behavioral, or economic biases. It may also be useful to teachers in demonstrating the scope of knowledge management and to researchers in generating propositions for further study.

**KEY WORDS AND PHRASES:** business strategy, knowledge, knowledge management

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KNOWLEDGE MANAGEMENT, LIKE KNOWLEDGE ITSELF, is difficult to define. Concepts and practices evolved through the 1990s as managements in the postindustrial era not only realized that knowledge was perhaps the critical resource, rather than land, machines, or capital [6], but also that their organizations generally poorly managed it. If more attention were paid to creating, providing, sharing, using, and perhaps protecting knowledge, the promise was that organizational performance would improve. In this sense, knowledge management could be seen as consistent with resource-based theories of the firm [13], namely building and competing on a capability that could be quite difficult for others to imitate.

More practically, knowledge management was seen to be central to product and process innovation and improvement, to executive decision-making, and to organizational adaptation and renewal. Theoretical insights into how knowledge might be managed were available from several disciplines including economics [30], philosophy and epistemology [18], computer science [15], and sociology [23, 24]. Furthermore, management scholars and writers were making an impact in the 1990s through certain influential books including Nonaka and Takeuchi [22], Drucker [6], Leonard-Barton [19], Senge [29], Quinn [26], and more recently, Davenport and Prusak [2].

However, once organizations embraced the concept that knowledge could make a difference to performance and that somehow it should be managed better, they often have not known where to start. In short, initiating a knowledge management program was a nontrivial issue. One approach was to appoint a chief knowledge officer (CKO) [11], but then he faced the same dilemma—where or how to begin. This was one reason why consultants and writers developed several analytical frameworks of knowledge and knowledge management, but found that most CKOs had concluded these were not helpful in galvanizing knowledge management programs [10]. They were either too abstract or too limiting. In particular, they did not help a firm decide “what to do next Monday.” Example frameworks include those that distinguish knowledge from information and data or those that distinguish explicit from tacit knowledge. They might be of some educational value in “awareness” events, but they did not easily suggest what knowledge management interventions or investments an organization should make.

Therefore there is a need for models, frameworks, or methodologies that can help corporate executives both to understand the sorts of knowledge management initiatives or investments that are possible and to identify those that make sense in their context. Based on descriptive and inductive research and inquiry over the period 1996–1999, this paper proposes such a framework. It is an early classification or typology of “schools” of knowledge management.

### Method of Research and Inquiry

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THE SCHOOLS SUMMARIZED in Table 1 have been derived by assembling and classifying descriptive data from four sources:

1. Case study research in six companies.
2. Data collected from interviews with 20 chief knowledge officers about their roles and experiences and their Knowledge Management initiatives [10].
3. Workshop discussions of company knowledge management programs.<sup>1</sup>
4. Accounts of company knowledge management programs published in professional and academic journals.

Each school is proposed as an ideal type. No claims are made that any one school outperforms others. Each represents a particular orientation, a different sort of organizational intervention, and speculation is made later on how or why a particular school could be selected. However, the schools are not mutually exclusive. Indeed two or three of them sometimes have been observed in the same organization. Furthermore, there may be other schools that my research has not encountered. Certainly there are some other interventions of a dominant nature that one could imagine—but they have not been found yet.

The attributes of each school—namely focus, aim, unit, success factors and “philosophy”—do stand out and there are implications for the contribution that information technology can make. There may be others and some are suggested in the next

Table 1. Schools of Knowledge Management

SCHOOL ATTRIBUTE	← TECHNOCRATIC →		← ECONOMIC →		← BEHAVIORAL →		
	SYSTEMS	CARTOGRAPHIC	ENGINEERING	COMMERCIAL	ORGANIZATIONAL	SPATIAL	STRATEGIC
FOCUS	Technology	Maps	Processes	Income	Networks	Space	Mindset
AIM	Knowledge Bases	Knowledge Directories	Knowledge Flows	Knowledge Assets	Knowledge Pooling	Knowledge Exchange	Knowledge Capabilities
UNIT	Domain	Enterprise	Activity	Know-how	Communities	Place	Business
EXAMPLE	Xerox Shorko Films	Bain & Co AT&T	HP Frito-Lay	Dow Chemical IBM	BP Amoco Shell	Skandia British Airways	Skandia Unilever
CRITICAL SUCCESS FACTORS	Content Validation Incentives to Provide Content	Culture/Incentives to share Knowledge Networks to Connect People	Knowledge Learning and Information Unrestricted Distribution	Specialist Teams Institutionalized Process	Sociable Culture Knowledge Intermediaries	Design for Purpose Encouragement	Rhetoric Artifacts
PRINCIPAL CONTRIBUTION	Knowledge-based Systems	Profiles and Directories on Internets	Shared Databases	Intellectual Asset Register and Processing System	Groupware and Intranets	Access and Representational Tools	Eclectic
"PHILOSOPHY"	Codification	Connectivity	Capability	Commercialization	Collaboration	Contactivity	Consciousness

section for certain of the schools. One that is absent is any distinguishing definition of knowledge itself. This is because many knowledge management endeavors are concerned with both explicit and tacit knowledge and with both internal and external knowledge. Indeed, some also encompass what some may see as information systems. Many CKOs and CEOs (chief executive officers) interviewed for this research are not overly concerned about the distinctions between data, information and knowledge.

### Schools of Knowledge Management

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THE FIRST THREE SCHOOLS ARE LABELED "TECHNOCRATIC" because they are based on information or management technologies, which largely support and, to different degrees, condition employees (or knowledge workers) in their everyday tasks. The fourth school, labeled "economic," is rather more singular, being the most commercial in orientation, explicitly creating revenue streams from the exploitation of knowledge and intellectual capital. The other three schools can be seen as more behavioral, stimulating and orchestrating managers and managements to be proactive in the creation, sharing, and use of knowledge as a resource.

The systems school is perhaps the longest established, formal approach to knowledge management, being similar but not identical to concepts and practices of knowledge-based systems which have evolved over the last 25 years [15]. The fundamental idea is to capture specialist knowledge in knowledge bases (from conventional databases through CD-Roms to expert systems) which other specialist or "qualified" people can access. It is thus a way of capturing individual or group-held knowledge and making it the wider property of the organization and certain other stakeholders such as qualified customer personnel. One example is described by Earl [7] from Skandia International where a risks/claims/premiums database was built up over several years and made available to Skandia International reinsurance underwriters worldwide to guide their decisions on what risks to underwrite, in what proportions, and at what price. Examples such as this (codifying experience and expertise for others to access using their own judgment) often seem more effective than the expert systems idealized in the 1980s which were too inflexible and narrow [2].

However, like knowledge-based systems in general, such knowledge bases tend to be domain-specific, supporting and improving specific knowledge-intensive work tasks and particular sorts of decision-making. Classic applications are to be found in engineering design and maintenance. For example, Airbus Industries create CD-ROMs of airplane maintenance technical expertise—maintenance manuals—to distribute to technical staff in airports worldwide. The essence is that authorized technical specifications and repair and maintenance procedures are distributed in a controlled and updateable manner. It is the codification of technical know-how to those qualified to use it. The know-how comprises both objective engineering data and cumulative technical expertise.

A similar example can be found in Xerox, where a Web-based maintenance knowledge base has been built for and by field engineers who repair photocopiers. Besides

product and maintenance specifications, the system also comprises best practice solutions to problems experienced in the field—variously called “fix-its,” “work-arounds,” “patches,” and so on. 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. Although this knowledge base both serves and is maintained by a specialist community, it is not classified as an example of the organizational school (see later) that centers on knowledge communities, because it is the system or knowledge base, which is the day-to-day knowledge provider—not the knowledge-based interactions between members of the community.

The systems school can encompass what some may perceive as information systems as much as knowledge-based systems. One example described by Earl [7] is the database built by Shorko Films to capture all second-by-second transactional data from a distributed process control system. It was augmented by asking the process operators to input all their custom and practice rules used in tasks such as change-overs and machine adjustments. This knowledge base was used to analyze chemical behaviors, process practices, product parameters, and environmental conditions in order to optimize factory performance. Subsequently, operators analyzed the database and conducted simulations to make decisions on product mix scheduling, order acceptance, and pricing.

Earl classified the Shorko Initiative as a knowledge investment. It was a deliberate attempt to distill and codify experience. The business strategy changed from one based on low cost production to one based on differentiation based on product and process knowledge. Factory operators became knowledge workers with often more line responsibility than their managers. (Indeed, through intensive education and training they were “upskilled” so that they mixed ever higher levels of expertise with ever deeper experience.)

These examples suggest at least two critical success factors for the systems school. Knowledge can be derived not only from objective data (such as engineering specifications or scientific laws, and technical or professional expertise based on education and training), but also from experience gained through practice. However, since the underlying philosophy of building knowledge-based systems is codification of what becomes official knowledge, the content has to be validated. In the case of experience-derived knowledge, peer and superior review is likely to be the most appropriate form of validation, as in Xerox. Alternatively, statistical tests of validation and pattern-based reasoning may be required as at Shorko Films.

Second, 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. In Xerox, the visible reward is individual recognition. The incentive is more communal, namely helping each other to do a better and more time-efficient job, which benefits all field engineers. The driver behind this knowledge management initiative in Xerox was the recognition that call service engineers did not learn collectively from

experience and share knowledge. In Shorko Films, the operators willingly gave their lifelong craft-based knowledge to a system because the strategy driving the initiative was business survival. The plant was due to close unless a dramatic turnaround in performance was achieved.

In each of these examples, the underpinning philosophy is codification of domain-specific knowledge. And without information technology (IT), the systems school is nonfeasible. Computer systems which capture, store, organize, and display knowledge derived from expertise and experience are the engine.

The cartographic school, as the name implies, is concerned with mapping organizational knowledge. It aims to record and disclose who in the organization knows what by building knowledge directories. Often called "yellow pages," the principal idea is to make sure knowledgeable people in the organization are accessible to others for advice, consultation, or knowledge exchange. Knowledge directories are not so much repositories of knowledge as gateways to knowledge, and the knowledge is as likely to be tacit as explicit. Since tacit knowledge is not easily explicated or articulated [28], the key is to identify who might be a source of knowledge anywhere in the enterprise through conversation and contact rather than to access a knowledge base which not only may contain inadequate knowledge, but also have answers to rather too precise questions.

Hansen et al. [14] describe an example of this school, Bain and Company. In contrast to what the authors called a codification approach to knowledge, where knowledge is explicated, codified, and stored in a repository—as typical of the systems school—Bain adopted a personalization approach of leading knowledge seekers to possible knowledge providers. Bain's "people finder" database is used by consultants on novel assignments to locate other consultants who can be contacted by telephone, e-mail, videoconference, or face-to-face to probe for advice on or solutions to problems. Here the rationale is that person-to-person communication is likely to release high value, often tacit, knowledge in strategy consulting.

In contrast to the systems school, the role of rewards is more for incentivizing exchange of knowledge with others than for giving knowledge to a system. Clearly, people are also expected to provide accurate and comprehensive profiles of their competences and experience in the directories. In short, a culture of mutual support and knowledge-sharing in pursuit of a common purpose is likely to be a critical success factor in this school. So are communications networks to bring people together.

McKinsey & Co. also employ knowledge mapping and developed their first guide to experts in different practices within the firm in the early 1980s. American Express did something similar, locating which offices were sources of different types of knowledge. Hughes Space and Communications, who have built both knowledge bases and knowledge directories, and AT&T, with its on-line directory of expertise, are among those who have discovered that mapping "who knows what" is generally more efficient and effective than mapping what the organization knows in different domains [16]. Updating people profiles—often by the individuals themselves—is cheaper and more feasible than continuous editing, maintenance, and validation of content. Furthermore, providing a directory to the "knowers" in an organization (who not only

know "that" but also know "who," "what," "where," and "which") is likely to lead you to either the (largely explicit) knowledge sources in the organization or the (often tacit) knowledge possessors.

Knowledge directories represent more of a belief in personalized knowledge of individuals than the codified knowledge of knowledge bases and may demonstrate organizational preferences for human, not technology-mediated, communication and exchange. The knowledge philosophy of the mapping school thus can be seen as one of people connectivity. Consequently, the principal contribution of IT is to connect people via intranets and to help them locate knowledge sources and providers using directories accessed by the intranet. Extranets and the Internet may connect knowledge workers to external knowledge sources and providers.

The process school in some ways is a derivative or outgrowth of business process reengineering. There are at least two ideas driving this school. The first, exemplified by Hewlett-Packard (HP), is that performance of business processes can be enhanced by providing operating personnel with knowledge relevant to their tasks. The second is that management processes [27] are inherently more knowledge-intensive than business processes [5, 8]. In particular, they are less structured and routine. Consequently, provision of not only decision-relevant information, but contextual and best-practice knowledge should be beneficial.

HP has traditionally favored decentralized operations, believing in local autonomy. As a complement, HP also has focused on process in the search for efficiency on the one hand and learning and adaptation on the other: "at Hewlett Packard there is a process for everything" [12]. For example in HP's consultancy practice, the emphasis is on learning and improvement from knowledge reuse, recognizing that assignments and their component tasks or processes are often repeatable. Past assignment summaries or logs are available on the HP intranet to those working on similar assignments. Likewise, proposals can be compared with previously implemented proposals in order to transfer ideas and best practice.

On a broader front, HP's Web-based knowledge links provide information on competitors, research, products, and customer satisfaction to knowledge workers in product divisions. Davenport et al. [4] describe HP's "Electronic Sales Partner," which provides technical product information, sales presentations, sales and marketing tactics, customer account information, and anything else that might benefit field personnel in the sales process. The Products and Processes Organization in HP has mapped key knowledge areas within divisions in order to capture and make available known knowledge to support knowledge workers. It also has mapped knowledge links between divisions so that ideas may be shared among different groups of knowledge workers [31]. These interventions make sense if the aim is continuous process improvement.

The same principle can be seen in the way Texas Instruments reengineered management processes, such as capital budgeting [3]. If you learn from experience and give knowledge workers access to knowledge and information, performance and adaptation of both business and management processes are likely to improve.

Frito-Lay's well-known transformation of business and management processes using sales data captured in the field by handheld computers demonstrates this principle

[1]. The business process of fulfillment was improved by being based on accurate, detailed, and timely sales data. Then the management process of sales planning was redesigned to make sales analysis data available not only to headquarters marketing executives, but also to field sales managers and their teams. Indeed, new one-on-one meetings between different levels of management were instituted so that experience and ideas (or learning) could be combined with information on a weekly basis to devise new tactics and strategies. In other words, key personnel at the operating level were empowered in the sales process with information previously denied to them, but to ensure the expertise and experience of field managers—local knowledge—was explored and exploited, a new knowledge-sharing device of weekly meetings was required. Sales management was no longer top-down nor was it bottom-up—it was collaborative to ensure two-way knowledge flow.

Critical success factors in this school, implied by these examples, are that both knowledge (expertise, experience, and learning) and information (intelligence, feedback, and data analyses) are provided by systems and intranets to operatives, staff, or executives. Second, the supply and distribution of knowledge and information are not restricted. Whereas we might have said in the industrial age, "give the workers the tools to do the job," we now might say "give knowledge workers the knowledge and information to do the job." This is another way of saying that the philosophy of the process school is enhancing the firm's core capabilities with knowledge flows. However, as Davenport et al. [5] point out, it is probably best to implement this school on a process-by-process basis.

The essential contribution, therefore, that IT can make is the provision of shared databases across tasks, levels, entities, and geographies to all knowledge workers throughout a process.

The commercial school carries the higher level of classification of "economic" because it is overtly and explicitly concerned with both protecting and exploiting a firm's knowledge or intellectual assets to produce revenue streams (or rent). It is perhaps what Davenport et al. [4] describe as "managing knowledge as an asset," where, to use a paradigm case of Dow Chemical, knowledge or intellectual assets comprise patents, trademarks, copyrights, and know-how. "Intellectual property" could be another means of describing the object being managed. Of all the schools, it is the one most concerned with exploitation of knowledge and least concerned with exploration [34].

The Dow Chemical Company became interested in managing its knowledge assets in the early 1980s and soon set out "to maximise the business value of its intellectual assets" [31]. Like several others, Dow believes that the difference between its market value and book value is its intellectual assets or intellectual capital. Many of these assets are in the form of patents, numbering over 25,000 according to McConnachie [20]. As an indicator of Dow's capacity to generate intellectual assets, 1,227 patents were issued in 1996 and a further 1,795 filed.

Dow decided to turn the management of its patent portfolio into an active management process rather than just a passive record keeping one [31] or a reactive procedure. A patent department was incurring costs of \$30 million per annum and yet licensing income was only \$25 million. So to actively grow revenue from patents was



an "early winner" for the new Intellectual Asset Management Teams. It could produce visible financial results for the Dow businesses and it was an initiative, which was not based on some evangelical and mystical call to make a business out of knowledge. Licensing the protection of patents was not an alien or revolutionary concept. It just had not been accomplished as well as it might have been.

Keeping an invention's patents in force over its lifetime can cost up to \$250,000 in tax maintenance fees. So Dow analyzed which patents had no value to Dow and then abandoned, donated, licensed, or sold them. Over \$40 million savings in patent maintenance costs were achieved in 18 months. A new streamlined process for managing the agreements and patents portfolios of new know-how saved the company \$1 million per annum. Intellectual assets that underpinned the company's business were identified, protected (not only by patents but by copyright, trademarks, publications, and secrecy), and nurtured for further development and value realization. A five-year target was set to increase licensing income from \$25 million to \$125 million per annum.

A corporate Intellectual Asset Management group developed methods for identifying, assessing, valuing, and protecting patents and other knowledge property. In addition, Intellectual Asset Management Teams were located in business units to ensure that the active commercialization of know-how was grounded in business understanding, made market sense, and contributed to financial results.

One critical success factor in this school appears to be the development of a specialist team or function to aggressively manage knowledge property. Otherwise it is too easily forgotten. A second is the development or acquisition of techniques and procedures to manage intellectual assets as routinized process. Otherwise there is sub-optimization, or a danger that companies spend too much time trying to measure intellectual capital rather than actually developing and exploiting it.

IBM is another company illustrative of the commercial school. In 1999, IBM leveraged its patent portfolio in supply agreements with domestic and foreign companies to increase its sales of components by \$39 billion over five years. This was in addition to annual licensing income of more than \$1 billion in the previous three years [33]. Texas Instruments initiated a similar thrust in 1995 and earned nearly \$200 million, more than half its total profit, from licensing of patents and intellectual property [4].

The philosophy of this school is pure commercialization of intellectual or knowledge property. For most companies, the lesson of this school will not be about what it is, but how to do it efficiently and effectively. The potential contribution of IT is relatively mundane—the development and use of intellectual asset register and processing systems.

The organizational school describes the use of organizational structures, or networks, to share or pool knowledge. Often described as "knowledge communities," the archetypal organizational arrangement is a group of people with a common interest, problem, or experience. These communities are designed and maintained for a business purpose and they can be intra- or interorganizational. Although supported by technology, this school is classified as one of the three behavioral ones because the essential feature of communities is that they exchange and share knowledge interactively, often in nonroutine, personal, and unstructured ways, as an interdependent

network. Curiously, two companies from the same industry provide instructive and typical examples—BP Amoco and Shell.

An important feature of knowledge communities is that they bring together knowledge and knowers. Typically, communities are supported and informed by knowledge bases provided over networks. Lotus Notes™ groupware, capturing knowledge and experience distributed over intranets, is typical. However, the community is itself also a communications network—both technological and social—which connects personnel with questions to personnel with answers. To use the Hansen et al. [14] framework, communities combine both codification and personalization knowledge management strategies. In both of these aspects, a new role of knowledge intermediary can be a necessary condition for success.

In BP Amoco, the knowledge management program has been bolstered by CEO John Browne's drive to create a learning organization [25]. The initial vision was to capture what everybody knows and to connect people who know. This was first operationalized by focusing on teams (a useful synonym for communities) to capture good practices, on the job experiences, and agreed learnings in order to build team-owned knowledge assets. For example, one early initiative was to assemble a global knowledge community across BP to bring expertise to bear on maintenance of oil drilling platforms. Another was to construct a network of experts on reservoir modeling. These teams are essentially communities of practice, which are enhanced by construction of, and access to, accumulated knowledge. However, they typically cross normal business or operational organizational units, linking personnel across sites, divisions, countries, and functions.

The most common goal of knowledge communities in BP Amoco is productivity through knowledge reuse and accelerated learning. "Every time we drill another well, we do the next one better" captures this ambition. However, better and faster decision-making plus development of new products and services are other knowledge management objectives.

In a typical productivity-through-knowledge project in BP, "how we work now" is first documented. Knowledge or expertise on critical operational tasks is then collected, synthesized, and codified in a system. Whenever a new experience occurs or a project is completed, after action reviews are conducted to assess initial goals, explore what actually happened, and analyze the difference between outcome and intent. In this way, new learning is added, validated by those who went through the experience as well as by expert validators.

This is similar to the Xerox example described earlier. A corporate intranet is also the glue that connects the community together. However, there are four significant differences. First, existing knowledge is often captured on video from interviews. When expertise and experience are accessed, more personal and lively content is presented alongside more impersonal and formalized data. Second, the knowledge bases do not contain everything that everybody knows. They also keep track of who knows what. In this way an engineer on a North Sea drilling platform can access potential advice throughout the corporation and BP Amoco's partners. To enable this, desk-to-desk videoconferencing has been installed so that "we can solve problems

eyeball to eyeball." Finally to address unanticipated problems or needs, a "connect" system has been built to find knowers—15,000 employees who have profiled themselves on the system and signaled their willingness to be contacted in order to share knowledge or give advice.

In Shell, knowledge communities operate in a similar way [32]. Again they are virtual teams—connected by the Shell-wide web and spanning conventional organizational boundaries. The aim is to deploy knowledge to a variety of situations: operational problems, business development projects, company turnarounds, and technical capability-building. Four classes of knowledge are brought to bear: Shell's own research and best practice; personal expertise and experience; advice, suggestions, and ideas from across the Shell network; and externally-acquired content.

Shell's knowledge communities then build and have access to three different types of "forum." The most codified or structured are best practice forums, which are maintained and validated by communities of practice. The least codified are discussion forums, which are voluntary communities with a common interest in one topic—for example, seismic modeling or knowledge management. An intermediate type is the task forum, a community brought together to solve or advise on a particularly significant challenge—for example, turning round a business in difficulty. In this case, members of the community may be invited or seconded to work on the problem directly.

Each forum has a moderator—a person who identifies who should be a member of the community, refers people with questions to people with possible answers, evaluates and arranges validation of content, and maintains the forum. In other words, a knowledge community or network would seem to require a human hub or switch, whose function is as much to know who knows what as to know what is known. Other companies that have built such knowledge networks and discovered the need for such moderators or brokers include Ericsson and Sekurit Saint-Gobain [32].

Two critical success factors can be inferred from these examples. Communities are more likely to work where there is a tradition of sociability and networking. Oil companies such as BP and Shell have been famous for this, for example, the connectedness and resilience of expatriate communities or graduate entry classes. Second, communities are as much social networks as technology-enabled ones, and a human hub (or moderator) is as necessary as a network switch. This insight becomes important when it is recognized that the philosophy of the organizational school is increasing connectivity between knowledge workers.

The potential contribution of IT is very clear—the combination of intranets and groupware to connect members and pool their knowledge, both explicit and tacit.

The spatial school is more a design for emergence philosophy of knowledge management. In particular, it centers on the use of space—or spatial design—to facilitate knowledge exchange.

Typical examples are the metaphors so often quoted in contemporary management journalism—the water cooler as a meeting place, the open-style coffee bar or kitchen as a "knowledge café," the open-plan office as a "knowledge building." There are at least four reasons why they should not be dismissed. Most people in organizations are social beings who not only like contact, but prefer conversation to documents or IT

systems. Tacit knowledge is most likely to be discovered and exchanged through discussion. Both organizational and physical architectures have often kept people apart rather than connected them. And the pursuit of business efficiency often has eroded or removed opportunities to meet people you do not need to interact with formally, to reflect or exchange ideas, or to break out of a clinical office environment.

An alternative label for this school could be the *social school*, because the intent is to encourage socialization as a means of knowledge exchange. This school is perhaps as much concerned with the nurturing and utilization of social capital that develops from people interacting, formally or informally, repeatedly over time [21]. However, the label "spatial" is preferred because executives do seem to identify with the use of space to stimulate conversations and exchange.

One example of the use of space in pursuit of knowledge creation and exchange is Skandia's Future Centre on the Stockholm Archipelago [9]. Established within the framework of Skandia's Intellectual Capital program and Futurizing initiatives, the Future Centre is a converted waterside villa where groups can meet for formal meetings, workshops, and seminars, and where individuals can go for quiet reflection. What is different is that the building is designed for "contactivity," or meetings that create contact and activity. Apart from a light and airy environment with views of the water, there are both open-plan and closed rooms. The dining area is a space where groups have to mingle because of the way self service and seating are designed. The garden and jetty into the sea are available for impromptu meetings and the whole center is self-organizing. Visitors to the Future Centre, whether from within or without Skandia, soon observe how they become involved in unexpected and stimulating encounters with others on an equal level even if hierarchically they are not equal. They talk of discovering shared interests, exchanging ideas and experiences, accidental learning, and building networks.

Another similar example is the new head office of British Airways at Waterside near Heathrow Airport. The offices are mainly open-plan to encourage communication and teamwork. However, it is the ground floor that is the bold experiment. It is built as a very wide, cobbled, medieval street that people have to keep walking down or crossing in order to navigate the building. On the side of the street are a café, a newsagent, and a convenience grocery store, among other facilities. So "the street" becomes a magnet for unanticipated encounters and a marketplace for conversations. It is a small step in logic to conceive that the combination of meeting people you would not otherwise meet, of having unprompted conversations, and of freeing small amounts of non-focused time could lead to exchange of surprise information or hidden ideas or discovery of hitherto unknown expertise. In other words, a medieval street is likely to facilitate exchange of both explicit and, more particularly, tacit knowledge. It is also a space where the quick message can be exchanged or a further meeting arranged. The whole building was designed to maximize the number of times you "bump into people."

Other examples of experiments with spatial design to break down knowledge barriers or free up knowledge exchange can be found. The former NatWest Markets constructed a ground floor coffee house, replicating the old exchanges of the City of

London, where employees were encouraged to hold less structured meetings with insiders or outsiders. This idea is a physical investment in what one chief knowledge officer described as "creating markets for conversations" [10]. Accenture has designed "knowledge buildings" to replace their more traditional offices. They bring together open-plan offices, knowledge cafés, kitchens on each floor, knowledge libraries, and brainstorming rooms into one integrated office suite.

To be seen as a knowledge management initiative, all these designs probably should have Skandia's principal of contactivity as a goal or the pursuit of unprompted learning and creativity. A real danger is that other metrics take over such as space utilization, occupancy, and premises cost per employee.

A second success factor would seem to be encouragement and legitimization. To borrow an advertising slogan from British Telecommunications, the concept is that "it is good to talk." And to repeat an often heard plea from executives and professionals nowadays, "Can we arrest the tyranny of e-mail and start meeting and talking again?" This is not just a complaint about e-mail overload: It is an observation on how more information-rich (or knowledge-rich) channels can be subjugated and illegitimized by technology solutions. So it is important that contactivity is promoted as desirable and beneficial.

The strategic school sees knowledge management as a dimension of competitive strategy. Indeed, it may be seen as *the* essence of a firm's strategy. For example, Skandia has positioned intellectual capital as the corporation's core capability. Former CEO Bjorn Wolrath stated, "Intellectual capital is at least as important as our financial capital in producing truly sustainable earnings." Likewise, Clarica, the Canadian insurance and financial services company, has pursued a program of intellectual capital development and located it within its corporate strategy unit. Both companies have developed conceptual models to articulate and explain the purpose and the character of intellectual capital. And both have invested in complementary knowledge management initiatives, to develop human competences as well as capture and share learning and know-how.

Skandia has become well known for developing its market value scheme or its balance sheet of intellectual assets to stimulate understanding and questioning of how intangible and intellectual assets contribute to value creation as much as financial and tangible assets do. Skandia also developed its Navigator, a derivative of the balanced scorecard [17] to help managers visualize and operationalize intellectual capital creation. These two instruments were devised not so much as management accounting or financial control systems in the conventional sense, but as information systems to inform discussion about strategic options, resource allocation, and performance improvement [9].

Both these artifacts initially were designed and implemented in the Assurance and Financial Services (AFS) division of Skandia, which enjoyed a ten-year period of transformation based on a strategy of building what AFS CEO Jan Carendi called "an intelligent organisation" and a "teaching and learning organisation." In other words, as is normal for formulation and enactment of competitive strategy, a strategic approach to knowledge management is likely to be conceptualized and promoted at the

level of either the business unit or the corporation. The aim is to build, nurture, and fully exploit knowledge assets through systems, processes, and people and convert them into value as knowledge-based products and services. This is why value creation models developed by companies such as Skandia and Clarica stress structural capital, human capital, organizational capital, and customer capital as well as intellectual capital and why they see knowledge management as a key integrating idea.

The actions that follow from such strategic change programs are widely varied. For example, Skandia has knowledge-based systems, knowledge networks, knowledge cafés, the Future Center, knowledge-sharing agreements with intermediaries, and competence development schemes. In other words, the strategic school could provide an umbrella for pursuit of all the other schools in Table 1. But what makes it a school is that knowledge or intellectual capital are viewed as *the* key resource. The firm chooses to compete on knowledge. In many ways, the firm is conceptualized as a knowledge business and so knowledge creation and use drive competitive strategy rather than just support it.

Unilever provides another, but somewhat different, example where several knowledge management initiatives were justified by two key sentences in the group's corporate purpose statement. "Our deep roots in local cultures and markets around the world are our unparalleled inheritance and the foundation for our future growth. We will bring our wealth of knowledge and international expertise to the service of local consumers—a truly multi-local multinational." Initiatives included knowledge management workshops in business units to help executive teams examine, as they formulated business strategies, how product, process, customer, and research knowledge could be better exploited for competitive advantage; documenting and codifying what a business knew about the science of certain foods to discover ideas for new product development; completely different businesses with a common science or technology thread, visiting each other to exchange ideas and experience; and identification of new information systems opportunities in the knowledge management domain. Once again, knowledge is seen as a source of value creation, as well as of value realization, and not just as a commodity or process to support and enhance enactment of business strategies.

Buckman Laboratories is another example of this school, where knowledge is seen as a source of differentiation as well as a necessity in the speciality chemicals business. The CEO, who has also acted as CKO, argues that his is a knowledge-intensive business and without access to knowledge on how chemicals are applied to customers' problems, the company would not succeed for long [4]. Buckman chooses where it competes based on its superior knowledge of how to apply its chemicals to customers' process plant problems [34]. These visions have led to development of worldwide networks in which Buckman links technical specialists to field staff, builds customer-focused knowledge repositories, and invests in a worldwide on-line conferencing capability. Two and a half percent of revenues are reportedly invested in knowledge management.

The strategic school is essentially concerned with raising consciousness about the value creation possibilities available from recognizing knowledge as a resource. This is why rhetoric of corporate mission and purpose statements which embrace knowl-

edge is important. It is also why artifacts, such as Skandia's balance sheet and Navigator and strategy techniques and processes (such as those developed by Unilever), are important to operationalize the somewhat intangible concepts of knowledge and intellectual capital and to then measure progress in building knowledge capabilities.

The potential contribution of IT is manifold once "knowledge as strategy" drives knowledge management initiatives. One can expect quite an eclectic mix of networks, systems, tools, and knowledge repositories.

## Using the Taxonomy

ON THE PREMISE THAT THE TAXONOMY is grounded in the different experiments organizations have been conducting in knowledge management, there are three possible sets of implications and uses.

The first is *pedagogical*. Whether in *academe* or business, the seven schools do emphasize that not only is there more than one set of ideas or practices in knowledge management, but also that knowledge management is more than just another IT application. To judge from most knowledge management products and services offered in the marketplace, there is a risk of dismissing the potential of knowledge management as just another technology solution in search of a problem or a "rebadging" of some earlier movements in MIS. It should be clear from the description and analysis of the seven schools that there are non-technological interventions that can be made and, second, that even those schools that are very much enabled by IT also require complementary investments of a behavioral or organizational nature. Davenport et al. [4] have argued that successful knowledge management projects require both technological and organizational infrastructures.

In terms of *practice*, the taxonomy could help a firm select a knowledge management "strategy" or even answer the question "Where do we start?" Furthermore, the implication of at least three parameters in Table 1—aim, unit, and critical success factors—could be that there is a fit or alignment dimension in such choices. In this spirit, Figure 1 suggests a high level methodology for linking knowledge management to business strategy.

If a statement of corporate purpose that embodies or embraces knowledge exists, such as that found in Unilever or Skandia, the knowledge business vision is inherited. Otherwise it may well have to be crafted iteratively as the suggested methodology in Figure 1 is deployed. The key is that the vision should encapsulate the contribution that knowledge-based value creation can make. The analysis can then jump to step 4.

Analyzing performance gaps in the business can be a grounded way of discovering where knowledge management initiatives might be aimed. For example, there could be quality problems, customer service issues, a shortfall in new product development, or a weakness in making alliances or joint ventures work. Zack [34] advocates a SWOT (strengths, weaknesses, opportunities, threats) analysis to identify a "strategic gap" and step 2 in Figure 1 is essentially the same procedure, identifying where a firm's capabilities do not match its intended or required strategy. Discovering critical

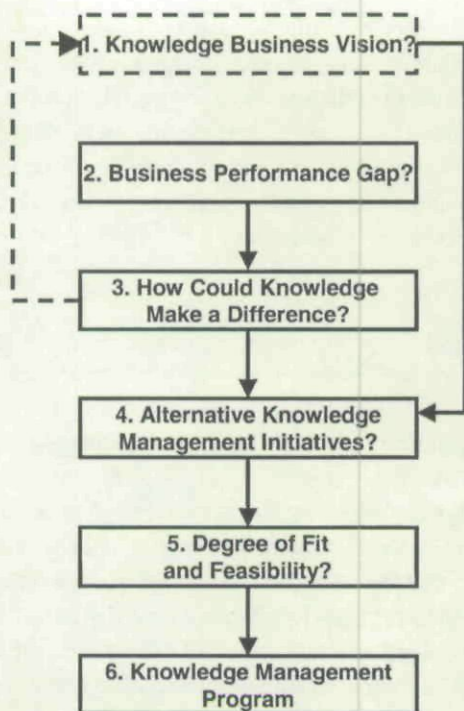


Figure 1. Formulating a Knowledge Management Strategy

performance gaps is one way to align knowledge management initiatives with competitive strategy.

Step 3, asking how could knowledge make a difference, is then a means of examining how better acquisition, distribution, use, or protection of knowledge could help remedy the performance gap. Executives rarely find it difficult to identify where knowledge is inadequate or underexploited. Having highlighted knowledge opportunities, a bigger question then can be asked, What could we do differently or how could our competitive strategy change if we now conceptualized ourselves as a knowledge business? This question is more likely to be productive in step 3, once performance gaps and knowledge opportunities have been identified, rather than by trying to answer it as a first step. However, if a realistic conceptualization emerges, this can be framed as the new knowledge business vision. In this way, knowledge as a determinant of, or variable in, business strategy can be addressed rather than just exploring knowledge as a support or derivative of business strategy (as mainly articulated by Zack [34] and other writers). Either way, this methodology has a good chance of ensuring that knowledge management initiatives are linked to business strategy as Zack [34] and Davenport et al. [4] advocate.

Step 4 is required to identify and examine possible knowledge management initiatives—to operationalize the knowledge strategy intent. This is where the taxonomy of seven schools of knowledge management can be particularly helpful because the frame-



work not only suggests different sorts of knowledge management initiatives, but also the parameters indicate whether particular schools or initiatives make sense for a particular organization. Rather than use conceptual frameworks and taxonomies of knowledge that rarely suggest what to do or how to do it, the seven schools—particularly the parameters of philosophy focus and aim—represent alternative, tangible recipes, which can be discussed and selected.

Step 5 is a validity test where the question is asked do the initiatives or schools selected fit the organization's strategy and culture? The critical success factors highlighted in the seven schools taxonomy provide a useful guide to answer this question. They also indicate the degree of top management commitment and support required.

Step 6 is to confirm the Knowledge Management Program, allocate resources to it, and plan its execution. The term "program" is used because there may be several projects or initiatives. Indeed there is no suggestion that the seven schools are mutually exclusive. Some can be complementary and some exist side by side. For example, initiatives akin to the systems, organizational, spatial, and strategic schools can be found in Skandia and examples from the process and commercial schools can be found in Texas Instruments. It seems likely that multiple initiatives or schools will emerge and be promoted over time in most firms [2].

Finally, the taxonomy does suggest some obvious questions for further, more rigorous *research*. The first is whether these seven schools exist and are distinguishable—and whether there are others. Second is how to make them work. Are the suggested critical success factors the necessary and sufficient conditions for effectiveness? Third is the issue of contingency: do certain schools fit certain generic competitive strategies or industry settings or corporate cultures? Is there an evolutionary path or do some schools coexist better than others? Indeed are some more effective than others? There may be other research implications.

## Conclusion

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TO MANY MANAGEMENT THINKERS, knowledge management seems an obvious imperative in the knowledge economy. To those who believe in resource-based theories of the firm, knowledge management appeals not least because knowledge tends to be firm-specific and knowledge management can be difficult to imitate. To many executives observing the daily failings of organizational endeavor, knowledge management is intuitively appealing. However, it is the next step that is often the challenge, namely, identifying what can be done to improve the creation, protection, and use of knowledge.

The purpose of the research and inquiry that support this paper was to make sense of the many corporate initiatives undertaken in recent years and to provide a frame of reference for both scholars and practitioners. A further discovered purpose has been to highlight different options as a defense against those who dismiss the potential of knowledge management because a simplistic early project (quite often a relabeled IT application) failed or did not match initial expectations.

The seven schools suggest that knowledge management not only can be defined in different ways, but that there is considerable choice in both what to do and how to do it. They are ideal types recognized, described, and guided in execution by the parameters of philosophy, focus, aim, and unit of analysis. In this sense, the primary purpose of the seven schools taxonomy may be to help managers identify alternative knowledge management initiatives or solutions, understand what is required to make them work, and make sense of and improve the effectiveness of any existing, inherited, or early knowledge management projects.

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*Acknowledgments:* The author thanks editor Thomas Davenport and two anonymous reviewers for very helpful criticisms and suggestions made in the course of producing this paper. He is also grateful to his colleague, Ian A. Scott, for encouragement and helpful conversations through the life of this paper.

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#### NOTE

1. Conducted through a network of chief knowledge officers organized and moderated by the Centre for Research in Information Management at London Business School.

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