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**DESIGNING THE KNOWLEDGE ENTERPRISE:
BEYOND PROGRAMS AND TOOLS**

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Designing The Knowledge Enterprise: Beyond Programs and Tools

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DESIGNING THE KNOWLEDGE ENTERPRISE: BEYOND PROGRAMS AND TOOLS

Executive Summary

Knowledge management has been closely identified with information technology tools and programs to encourage face to face sharing of knowledge among members of knowledge communities. Yet these tools and programs are often viewed by employees as separate from work, and often have little impact on the way work is done in the firm. In this article, we share the findings from the study of ten technology firms whose competitive strength depends on their ability to turn knowledge into products and services more effectively than their competitors. Our intent was to find out how to embed knowledge management in the organization as part of the way work is done, rather than as a special program.

We find that how effectively these firms generate, leverage, and apply knowledge is a function of four work behaviors: focusing on system performance rather than on narrow technical outcomes; following systematic processes; sharing knowledge, and trying new approaches. Firms seeking to improve their ability to gain competitive value from knowledge should focus on creating a context that encourages these four behaviors.

Based on study findings, we present a five-part organizational design framework for building knowledge management into the fabric of the organization. It includes: clearly articulating the knowledge strategy of the firm; building work structures that facilitate the four knowledge behaviors; ensuring that the four work behaviors are embedded in the work processes and management processes of the organization and that the information technology processes enable them; redefining the employment relationship so that contributing to organizational

knowledge is considered part of an employee's job; and aligning rewards with the desired behaviors, competencies, and outcomes.

DESIGNING THE KNOWLEDGE ENTERPRISE: BEYOND PROGRAMS AND TOOLS

The Strategic Knowledge Management Challenge

In the knowledge economy, the only sustainable competitive advantage is knowledge. Almost any product or process can be copied and transcended by competitors. Achieving strategic leadership demands ongoing innovation, creativity, and improvement that create product and service offerings and effective and efficient processes that leave competitors behind. Knowledge defines and is embedded in the competencies of a company; knowledge management is not a series of programs, computer information systems, or meetings. It is a core strategic capability that needs to be built into the fabric of the organization. There have been many historical examples that point up the costs of failing to capture the value of knowledge. In the 1970s, Xerox's Palo Alto Research Center invented much of the core technology of the personal computer. But Xerox ceded a major market when the rest of the corporation, headquartered on the other side of the country, failed to understand the implications of the knowledge that PARC had developed and to apply it in commercially viable products. Digital Equipment Corporation closed itself off from information about the emerging trend to the microcomputer – and in so doing, failed to develop the knowledge base to compete effectively as the computer industry unfolded. Key engineers, frustrated by the lack of interest in the knowledge they were creating, left companies like Digital Equipment, Xerox and IBM, and took with them RISC and other technologies that were rapidly incorporated in successful product offerings at Apple, Sun, Microsoft and Hewlett-Packard.

In today's highly charged competitive environment, companies have to make their knowledge count. Knowledge is a very special kind of resource - when it is used, it is not used

up. It can be shared and reused—leveraged throughout the organization without depleting the resource. Too often, employees in different parts of the organization spend their time rediscovering knowledge, learning the same lessons or reinventing solutions that already exist. Increased value can be derived from the knowledge of the firm by devising ways for employees throughout the company to have access to the best external knowledge available, to "know what the organization knows," and to avoid the hoarding of knowledge and the "not invented here" syndrome that prevents individuals and units from applying knowledge gained elsewhere.. As shown in Figure 1, knowledge management should focus on the entire knowledge cycle from attaining it, creating it, applying it, leveraging it, augmenting it, and deriving value from it faster than your competitors can.

Figure 1

Indeed, in the knowledge economy, a primary justification for the existence of the corporation is its capacity to share learning effectively across different parts of the global organization. Demonstrating that knowledge is being transferred and translated into business results more effectively internally than is likely to occur in the external marketplace provides a rationale for combining businesses under the same corporate umbrella, rather than breaking them into smaller, potentially more agile and focused units. It is not surprising that CEO's at companies such as General Electric and BP have personally devoted time and energy to making sure this happens, claiming that their ability to manage knowledge effectively is a prime driver of their stock market valuations.

Organizations have introduced a wide variety of knowledge management practices to make better use of knowledge. BP Amoco has saved time and leveraged knowledge by

establishing virtual teamwork and knowledge networks that allow employees throughout the world to access expertise wherever it is located. Problems get solved faster and knowledge is reused, not rediscovered. The U.S. Army's Center for Army Lessons Learned has championed an "After Action Review Process" that ensures that what is learned in maneuvers is surfaced and shared to become part of the knowledge base of the organization. Hewlett-Packard uses case-based approaches to bring experience-based knowledge to new customer service personnel, so they can learn more quickly to deal with a myriad of complex and dynamic product offerings and customer needs. And every major management consulting firm has created computerized knowledge-sharing capability and fostered the establishment of learning networks among their employees.

The Center for Effective Organizations recently completed a three-year, two-phase study of 10 leading technology-intensive companies operating across a range of sectors in North America, Europe and Asia. Our intent was to go beyond descriptions of programs and techniques that are commonplace in the popular literature, and to look at what it takes to fashion and lead a knowledge company – one where the knowledge orientation can outlive the departure of particular champions and where knowledge management is a strategic engine of the company, not the flavor of the month. The research includes analyses of a survey completed by over 4,500 scientists, engineers and managers; interviews and focus groups with more than 500 business and technical leaders and junior, mid-career, and senior technical experts; and analysis of written documentation of the knowledge management and human resource practices and the performance of these 10 companies. In this article we describe the challenges of knowledge management, and share the study findings and implications for practice.

Challenges in Managing Knowledge

We suspected, and we found, that knowledge management "programs" frequently swim upstream. Each of the 10 technology corporations in our study has a variety of initiatives in place to foster more targeted generation, sharing and application of knowledge. *But in every one of these companies, the majority of employees report that knowledge-sharing across boundaries rarely occurs.* Overall, only 28 percent of employees report that knowledge is regularly reused across the company-and only 12 percent report access to lessons learned elsewhere in the organization. Although a few individuals are heavily involved in these activities, most are not. We analyzed the data to determine what factors contributed to or impeded successful flow of knowledge and the translation of knowledge into commercial value.

It is not surprising that knowledge management programs have often led to disappointing results. Three key trends in today's business world – the growing complexity of global firms, the information explosion and speed of decision-making, and value and mobility of key employees – simultaneously increase the imperative for knowledge sharing and make it more difficult for organizations to do this effectively.

Complexity of the Organization

Just as the need to leverage knowledge effectively is increasing, the organizational challenges of moving knowledge effectively are multiplying. Companies are becoming more global and decentralized. Many are growing through mergers and acquisitions, and individuals in the different organizations often do not see themselves as part of a larger whole. The functional departments – often the main channels through which competencies are developed and shared – are being broken apart. In their place are much flatter, cross-functional, team-based organizations that are focused on bringing different types of expertise together to meet the needs

of a particular customer or product, but are often not designed to share knowledge effectively across the enterprise. The configuration of units that generate and apply knowledge is dynamic, and teams and team members are often geographically dispersed. Much work is done through temporary systems that may consist of members of different companies and, in some cases, may pair companies with their competitors or place employees in customer sites.

Whereas knowledge sharing may once have occurred naturally when experts in a particular area were co-located in a functional unit, it now is anything but natural. The lack of trust among the different parts of a global firm, plus differences in time zone, mindset, and language (not just English vs. French, but also science vs. business) can all impede the effective flow of knowledge. In addition, our research found that while vital knowledge was often shared effectively within a team, that it tended to stop at the boundary of the team, with key lessons failing to be shared with the rest of the organization. And we found many organizations are struggling with how to continue to build their technical expertise, now that the key holders of this expertise are distributed across cross-functional teams.

Information Explosion and Speed of Decision Making

The combination of the digital revolution and the Internet has meant that exponentially more information is being captured in a form that is more easily manipulated and shared than ever before. This wealth of information has tremendous potential to transform business processes, to enable much greater customization of goods and services, and to empower frontline employees to make the right business decisions. The instant availability of information in a globally interconnected marketplace, and the rate at which it is being turned into new business ideas, is creating unprecedented pressure for rapid decision-making.

Organizations experience tension when the tidal wave of information crashes against the limits of each individual's ability to process vast amounts of data in a timely manner. Already the hundreds of e-mails that many individuals receive each day have overwhelmed their capacity to respond to each of them effectively. In such a context, finding time to share knowledge and learn from others often assumes a low priority compared with simply keeping up with the most pressing daily work demands. A vital task for organizations is to turn the volume of information into usable knowledge – to ensure that knowledge management is built into the way work is done rather than taking time away from work.

Value of People and their Mobility

For an increasing number of companies, human and intellectual capital, rather than physical or financial capital, are the keys to competitive success. A quick comparison of the stock market valuations of Microsoft or Amazon.com with the value of their physical assets reveals that it is these companies' intangible assets – their people, the social networks they have built that enable them to operate effectively, the knowledge and expertise they possess, and the knowledge that they've created – that account for the vast majority of company value. However, it was clear during the economic boom of the 1990s that waves of layoffs and “right-sizing” had eroded company loyalty, leaving knowledge workers willing to change firms for career advancement, new opportunities, or better pay. Unlike the investments that firms make in new information technology or brand identity, the investment in attracting and then developing key talent can literally walk out the door at any time. Knowledge management strategies must address attracting and developing talent, and deploying this talent to optimally benefit from their knowledge while also addressing motivational and career issues. At the same time companies

must redouble efforts to ensure that what individuals learn becomes known more broadly in the firm.

Understanding the Knowledge System: What Makes It Work

Many companies have responded to the above pressures to manage knowledge more effectively by appointing a chief knowledge officer or creating separate new units charged with capturing and knowledge and controlling its dissemination. The problem with these approaches is that they do not address the underlying reasons why knowledge is not being shared effectively, and they are unlikely to work, at least on their own, in today's dynamic global firms. Knowledge management must transcend organizational units and be built into the design of the organization, its work processes, and the way it operates.

Knowledge provides the foundation for decision-making and action in pursuing the organization's strategy and goals. It includes discipline-based expertise, knowledge of the industry, and company-specific knowledge of products, services, processes and customers. New knowledge is created as employees face new challenges and problems, and learn by applying existing frameworks and by trying new approaches. In new product development, for example, learning occurs and knowledge is generated as existing knowledge is applied to make sense of particular development challenges, and new solutions are generated to the problem at hand. Because innovative solutions to many of today's problems entail the combination of various knowledge bases, the generation of new knowledge is often a collective sense-making process – involving people from different functions and disciplines.

For knowledge to be shared, knowledge workers must be connected with each other. Knowledge grows through the experience and interaction of employees, as they encounter and solve new problems. Knowledge gained through experience is often tacit. For example, an

experienced customer support engineer may be able to ask the correct sequence of questions to understand a customer problem and quickly isolate the probable cause. However, this engineer may be guided by lessons learned from personal experience, and may be unable to explain to a new employee how to determine the sequence of questions and hone in on the problem. Tacit knowledge all too often remains with the employee who possesses it. In order for this knowledge to become organizational knowledge, it must be shared with other employees – and eventually made explicit through the creation of documents, information repositories, protocols and standard processes and products that become readily available throughout the company.

Although important, sharing knowledge is not sufficient for increasing the value derived from the knowledge potential of the firm: the knowledge must be used. Organizational knowledge emerges as shared understanding when people use the knowledge to work together to solve problems. Therefore, the most effective forms of knowledge management focus on *action* – not simply disseminating knowledge, but instead making knowledge management an integral part of how the firm conducts its business. A global energy company that took part in our study provides a good illustration of this point: the drillers in this firm had developed such a strong community of practice that when they faced a problem anywhere in the world, they could send an e-mail or pick up the phone and be fairly certain of a rapid response from their colleagues. If knowledge management activities are seen as separate from the action requirements of a busy work environment, they will be seen as extra and irrelevant.

Our statistical analysis of these 10 companies identified four key types of action – or knowledge work behaviors – that relate to the effectiveness in generating, sharing and applying knowledge and enhancing performance in technical organizations (see Figure 2). These behaviors are:

Focusing on system performance: This involves attending to aspects of performance beyond technical performance, such as product cost, customer satisfaction, quality, and contribution to strategy. Employees view their work in the larger context, and consider a wide array of factors to generate solutions that deliver value to various stakeholders.

Following systematic work and decision processes: Explicit knowledge is embedded in standard work processes. Following such processes, assuming that they are continually infused with new knowledge, is a key way in which an organization avoids people spending time continually rediscovering knowledge, and makes sure that existing knowledge is brought to bear on new problems. Systematic processes are a platform for the reuse of knowledge and a springboard for the development of new knowledge, as well as enabling coordination and providing common frameworks that facilitate knowledge sharing.

Sharing knowledge: Knowledge that has not been encoded into systematic processes must be shared across the organization in other ways. Sharing is the focus of many knowledge management programs and tools. Explicit knowledge can be shared through contributing to and referring to databases and other documents that can be placed in various searchable forms. But the knowledge encoded in databases is never complete. Behind it are embedded assumptions and tacit understanding that cannot easily be grasped by the newcomer to the knowledge. And, knowledge continually grows and changes. Tacit and emergent knowledge must be shared in person-to-person interactions such as within communities of practice, or through expert referrals, or lessons learned sessions.

Trying out new approaches: Experimentation is core to both the reuse of knowledge in new settings and the generation of new knowledge. “Best practices” that are developed in one part of a firm, for example, almost never work in exactly the same way when used in another setting; rather, they are tried, modified, and ideally improved upon. In a well functioning knowledge system, new knowledge is continually being created by trying new things, testing whether they work, and then sharing the results and then replicating and adapting this experiment in other parts of the firm.

Figure 2

Our statistical analysis, as shown in Figure 2 where each arrow represents a significant positive predictive relationship, reveals that these four knowledge work behaviors are mutually supportive and collectively underpin the generation of knowledge outcomes in the new product development process. We found that focusing on system performance, because it entails more fully attending to the contextual requirements for the knowledge solution, seems to be a stimulus both to follow systematic work processes and decision processes and to share and reuse knowledge. Attending to system performance, rather than to a narrowly defined technical performance, by necessity brings together diverse contributors with different knowledge bases. For example, developing a product that incorporates new technical functionality, addresses customers’ critical business requirements and lifetime cost of ownership, as well as building in ease of service and manufacturability requires the application of multiple analytical frameworks from several disciplines. Given the pace of activity in an organization, this is most likely to happen if it is embedded in the systematic processes for how work is done.

We also found that trying new approaches, a very fundamental learning behavior, is more likely to happen when going about work in a very systematic way. People are more likely to try out new approaches if such experimentation is explicitly recognized and rewarded and built into the work processes of the organization. An electronics firm in our study, for example encourages project teams to include the identification of areas of experimentation in the project plan so that it is built into the time line. 3M has been known for making 15% of scientists' time available to them to work on ideas they find promising – thus formalizing the expectation that experimentation will occur. Following systematic processes also leads to sharing knowledge. Apparently, people are more likely to share knowledge with one another if this behavior is embedded in the standard way that work is done, as in our earlier energy example. In sum, rather than being separate from the work, connections to each others' knowledge must be built into it.

In the firms we studied, greater use of these four key knowledge work behaviors resulted in greater effectiveness in generating and incorporating knowledge and in making improvements to the way the company functions (see Figure 2). In turn, the new knowledge and applications and improved processes were strongly related to the ability of the company to continually increase overall company capability and were associated with higher levels of performance. Technical companies are truly competing on knowledge, and there is a definite business pay-off to focusing energy on knowledge management.

In summary, knowledge management can yield true value to the firm. But, it is best not thought of as a special program that can be introduced as a “time out” from work for sharing knowledge, or as state of the art information systems. Rather, it is about influencing how work is conducted to deliver value from knowledge. The challenge is to foster and facilitate work

behaviors that make it likely that busy knowledge workers will use and contribute to organizational knowledge and take advantage of the tools that are available for this purpose. In our study we also examined the features of the organization that managers can put in place to create the context where these knowledge behaviors thrive. In the final section we provide a framework for designing the knowledge organization along with a set of principles that can be used to increase the likelihood these desired behaviors will occur.

Building the Knowledge Organization

Leaders of the knowledge enterprise can and should stress the importance of knowledge and encourage knowledge-oriented practices. They can do this in many ways – e.g., by appointing high-profile executives with responsibility for maximizing the value of knowledge or by launching initiatives such as building knowledge repositories and communities of practice to facilitate knowledge sharing. In our study, however, we found that while executive pronouncements about the importance of knowledge sharing and discrete knowledge management programs were common, many companies failed to align key aspects of their organization with the goal of building an effective knowledge system. Below we adapt Galbraith's star model organization design framework to identify how the five key elements of an organization's design need to be aligned to increase the focus on the activities required for effective knowledge management (see Figure 3).

Figure 3

Strategy

A company's business strategy determines what knowledge domains are most critical to its success, helps the corporation determine where to invest scarce resources, and helps

employees focus their knowledge activities. It also helps employees to see their work in a larger context, one of the key knowledge work behaviors related to knowledge outcomes. Our study found that having a clearly articulated business strategy is positively related to a company's level of knowledge management in the organization-yet only 35 percent of employees in our sample firms felt that their companies had a clear strategy. This result is not too surprising since in many of these firms, the business strategy is not routinely shared with employees.

Because of the accelerated pace of knowledge generation, companies cannot possibly remain cutting-edge in all areas relevant to their mission. They must pick and choose what they will focus on and what competencies they will develop as their strategic differentiators. An electronics firm in our survey, for example, invested a large amount of money working toward world-class expertise in its business process information technology function. Many millions of dollars later, it realized that this capability was not central to its mission and that it could not afford the ongoing investment required to keep an internal function current. It decided to outsource that capability, keeping in house and investing more heavily in state-of-the-art electronic tools to support its global technical network and workforce.

An aerospace firm in a maturing marketplace decided to make state-of-the-art after-market services and upgrades a key part of its business growth strategy for the future. By defining the new knowledge areas that would be required to make this strategy successful – e.g., understanding the later phases of the product's life cycle, gaining more understanding of the needs of this customer segment, and a set of technical skills required for retrofitting systems – it was able to signal to employees what individual competencies they needed to develop, as well as giving them a heads up that their technical designs should take into account the requirements of the aftermarket.

Strategy does far more than help the company and its employees direct their knowledge and learning activities. Our findings show that a clear strategy is related to employee commitment, providing them with a sense that the company has a future and that there will be opportunities for meaningful employment. The new mobile workforce assesses the future of a company and determines whether to stay, based in part on whether employees feel the company is going to be a leader in the industry and provide opportunities for interesting work. In the words of one of our respondents, "People are jumping ship because they don't see a future. They don't think there's a viable strategy and believe that we'll become a secondary supplier. They want to go where the interesting work is."

Structure

Many of the organizations we studied find that organizing work in cross-functional units, focused on particular products or customers, can inhibit knowledge leverage across business/product units. In today's environment, these often have "stretch" goals that require new and higher levels of performance. Each product line, program or development unit becomes fully absorbed in meeting its own objectives, and in customizing and advancing its own technology. Rather than being an impetus to search out helpful knowledge that exists elsewhere, this is a situation ripe for redundancy and "reinventing the wheel." Specialists are operationally detached from their peers; and, in many cases, the contributors to projects are geographically dispersed and organizationally belong to different business units. Both seeking out knowledge and sharing knowledge are often seen as time consuming activities with uncertain pay-off.

If knowledge is to be leveraged, there is a compelling need to facilitate lateral connections so that members of different projects are able to work effectively together and learn from each other, despite being dispersed. Companies that create successful communities of

knowledge apply structural approaches that weave networks through the organization so that people can be resources to each other. In one aerospace company, for example, the new business development function pulled together working teams comprised of technical representatives from all programs whose work contributed to new technology thrusts that would be the basis for future business acquisition. These programs could learn from each other and identify areas where additional technological development was required. Their input was included in the strategic planning and technology investment processes of the firm.

New linking roles are being developed to build and nurture these networks, capable of diffusing best practices, promoting the growth and development of knowledge workers, and providing a foundation for collaboration across units. A global software firm in our study, for example, regularly moved key contributors across locations for temporary assignments in order to carry knowledge from one unit to another, and also to create stronger cross-location networks for knowledge sharing. Other firms created special technical fellows or principals roles that often had budgets for holding problem-focused working sessions that drew members from across projects. These individuals had a mandate to provide consultation to projects, and to make sure that important knowledge advances were disseminated and built into the tools and standard processes of the organization.

These structural approaches can be successful only if they have support from management and adequate resources, if participation is an expected part of people's roles, and if they focus on getting work done rather than being seen as draining time. These approaches break down company boundaries and connect people along dimensions where sharing helps advance and derive value from knowledge.

Processes

There are three distinct, yet related processes – work processes, management processes and the use of information technology (IT) – that each have important roles to play in the design of an effective knowledge system.

Work Processes: Although much knowledge work involves solving unique problems, even such non-routine work generally follows a predictable sequence of activities that describes how various parties come together and the steps they go through to accomplish the task. Knowledge management can be enhanced by building the combining of knowledge bases and the sharing of knowledge across the organization into the standard work processes of the organization.

For example, when a semi-conductor company realized that various projects aimed at establishing applications for its new technology were not sharing learning, it decided to build such sharing into its core project management processes. First, as each project completed the concept phase, it was expected to meet for open-ended discussions with a related project that was ending its design phase, in order to extract learning that might be relevant to their own design activities. The intent was to ensure that useful design information was passed on, while trying not to constrain the development of innovative concepts. Funding of the next phases for each project was contingent on this activity having been completed. Technical facilitators documented lessons learned during the session, sent them out in short news briefs to others in the division, and decided whether new knowledge had been yielded that should be incorporated in the division's standard technical processes. Although at first people in the division experienced these meetings as “extra”, they came to appreciate them as a source of knowledge that enhanced effectiveness, and to understand that through participating in these processes they were learning and contributing to broader divisional performance.

The companies we studied were investing heavily in embedding technical knowledge in tools and standard processes. However, they were just beginning to grapple with how they would continually update these tools and processes with new knowledge. Changing these processes was often seen as time-consuming and bureaucratic. Additionally, some firms were starting to incorporate the analysis of customer and field, cost of product, and cost of quality data in the work processes and tools. Without these capabilities, interviewees often spoke of management paying “lip service” to the broader goals of the system and to knowledge leverage and learning – while actually demanding faster and faster technical performance. As one engineer put it: “We have no tools to manage product cost so we end up focusing on technical capability and schedule. That seems to be what management cares about anyway”.

Management Processes: Goal setting, communication of company, business unit and team performance information, and communication of customer and competitor information, especially when linked to reward systems (see below), send strong messages to employees about what they need to focus on and have great impact on employee behavior. They lead to the focus on system performance, rather than on the narrow technical task out of context. Because work progress is often judged in relationship to the completion of milestones as well as the achievement of particular goals, we found that ongoing sharing of goals and performance information relates closely to following systematic processes. It also relates to trying out new approaches, presumably in service of finding new solutions to challenging problems and the stretch goals that characterize today’s corporations.

Given the high pay-off from providing direction by communicating company, business, and team goals and performance, it is astounding that only 45 percent of employees in our sample companies feel they are well informed about company plans, goals, and performance,

while only 63 percent say they have such information about their own unit. Our interviews suggested that the problem was not that these companies were neglecting their performance management systems and processes; in fact, they spent considerable time and energy on the design and implementation of performance appraisals and other elements of performance management. In their efforts to accurately provide goals and measure the performance of individuals, however, they have focused primarily on individual performance, giving less weight to the collective performances that yield knowledge and value.

Another surprising finding is that very few organizational units or individuals in the companies we studied have explicit knowledge goals. In an effort to deal with the lack of focus on knowledge goals, one aerospace company started explicitly identifying new company knowledge that was targeted as an outcome of each new project that they undertook. The generation of this knowledge became a goal not only for the people in the project, but also for others in division. Progress against knowledge targets was specifically measured and reported in quarterly all-hands meetings in order to emphasize the importance of cross-divisional collaboration around these goals, and to increase awareness of targeted knowledge generation activities that may be of general use.

The Role of Information Technology: The electronic network can also be an important tool for knowledge management, if designed to be accessible and user-friendly. But our study found that no matter how sophisticated, this network plays a supporting role. The quality of the information technology tools relates to two of the knowledge behaviors – following systematic processes and sharing knowledge. It also is the platform for other key contextual elements; for example, IT is a tool for sharing goals and performance information. Electronic systems not only connect people, but often are the medium for sharing key company and project information and

articulating systematic processes. Indeed, groupware and project management software often combine all three functions. Additionally, we found that IT quality relates to employee development, no doubt because of the increasing tendency to provide electronic training, and because of the increasing use of electronic searches as a way to obtain needed knowledge.

Thus, although knowledge management is not only about IT, IT makes possible many behaviors and capabilities that are directly related to knowledge capabilities of the firm. It is hard to imagine, for example, how just-in-time consultation with experts in another country would be possible without it. It would also be a challenge to do quick, real-time analyses of the impact of particular design decisions on cost of product without it. IT makes virtual work possible not only because of its project coordination capabilities, but also because it allows communication across communities of knowledge composed of people working on different projects and in different business units. But, it is behavior, not IT systems, that generate new knowledge, apply it in new settings, embed it in improved processes, yield shared meanings and common knowledge, and underpin the ability of the organization to derive value from knowledge.

People

Even the most sophisticated IT system for sharing knowledge will not work if people are not interested in using it. We saw too many firms who suffered from the “build it and they will come” syndrome, only to find that the large investment that they’d made in a new intranet site or database for sharing lessons learned was wasted because individuals did not choose to share their knowledge or to use each others’ knowledge even with the new tools available. At the core of any effective learning organization is convincing employees that it is in their interests to seek out knowledge from others and to share what they've learned with colleagues. The willingness to

engage in these activities depends on the psychological contract with the organization – i.e., employees’ understanding of their obligations to the company and what they in turn expect from the company. One of the study's most striking findings is that--for all the talk of learning organizations – sharing knowledge with individuals outside of the immediate unit and seeking knowledge from other parts of the organization are not defined by employees themselves or by their managers as explicit parts of their job. Instead, these behaviors are viewed as something extra, which may get done if they have the time and personal inclination.

The psychological contracts in the companies we studied are generally in the process of a major transition. The old sources of employee commitment and retention – job security and internal career advancement – have been undermined by intensified global competition and waves of downsizing and restructuring. Companies are still struggling to create a new deal that can attract and motivate employees and convince them to contribute their knowledge and effort to the wider success of the company. While attraction and retention of talent is a critical task in a knowledge enterprise, it is beyond the scope of this article to examine all the elements of a possible new deal for employees in detail. In our study, however, we found that the area of employee development was a particularly strong predictor of the effectiveness of the knowledge system. Development is crucial to the motivation and retention of key talent, as well as being a factor in the ability of the organization to generate and derive value from knowledge.

We found that an emphasis on development of employees is strongly related to all four of the knowledge work behaviors, as well as to the commitment of employees. Our measure of development dealt broadly with the emphasis in the organization on developing employee competencies through a broad assortment of approaches, not just through formal training. Job assignments and rotation, mentoring, attending conferences, visiting other companies, and

special assignments and experiences were included. Development gives people an opportunity not just to learn formal encoded knowledge about their discipline, but also to be exposed to and develop knowledge about the larger context, to connect with knowledge from experts and other co-workers, to learn from diverse experiences, and to become proficient in the processes of the organization. Broad knowledge and understanding of context makes it far more likely that new approaches can be tried while considering and managing risk. Because another article in this issue (Finegold, Benson & Mohrman) deals in some depth with development, we will not discuss it any further here.

Rewards

In today's tight labor market, companies that do not offer competitive reward packages are not in the running for top talent. But after meeting these "table stakes," it is how employees are paid, and not just how much they are paid, that has a significant impact on whether companies become effective knowledge organizations. Leaders need to design reward systems that can achieve the twin objectives of attracting and retaining key technology workers and encouraging them to share their knowledge. This requires a delicate balancing act, however, because our results show that rewards which help retain key individuals may conflict with those that foster knowledge sharing. Effectively linking pay to individual performance increases individual satisfaction with opportunities for career advancement and reduces interest in leaving the company. This is particularly true for members of Generation X; our analysis finds that tying pay to individual performance has a greater impact on reducing turnover of scientists and engineers who are under age 30, than those 31-50 and over 50.

There is a dark side, however, to tying pay too closely to individual performance. We found that pay based on individual performance can have a negative impact on the success of

corporations in generating and transferring new knowledge and the rate at which companies are improving their effectiveness. It appears to encourage employees to focus on their own results – and may discourage them from sharing their knowledge with others and from focusing on business performance. In contrast, tying rewards to the business performance of the team or organization – such as through bonuses and stock options – relates to enhanced knowledge sharing. Allowing the majority of employees, and not just top executives, to share in the wealth that they create for the company also has a positive impact on employee retention.

Conclusion

Our study of technical firms finds that effective knowledge management is about behavior: in particular, about the way people behave as they carry out their work. It is not about special programs and information systems. The key behaviors include focusing on the performance of the system, following systematic processes, sharing knowledge, and trying new approaches. It is through these behaviors that employees apply existing knowledge and generate new knowledge to solve the problems they face. We have outlined a five-part design framework that can be used to help firms build organizations that encourage these knowledge work behaviors. It starts with clearly articulating and communicating the company's strategy and the areas in which it will compete based on its knowledge superiority. Structures and processes should be designed to facilitate the knowledge behaviors and build them into the way work is done. We have also argued that human resources practices, such as development and reward systems, should be altered to motivate and build the capabilities of employees to perform effectively and contribute more extensively to knowledge leverage, generation, and application. This will require the redefinition of the employment relationship so that employees see this activity as core to their jobs.

In an era when speed is critical, performance pressures extreme, and employees are struggling to work in geographically dispersed units, knowledge management programs that are “add-on’s” to the work face an uphill battle. Individuals simply do not have the time to manage knowledge on top of everything else they have to do. We conclude, instead, that firms need to design the fabric of the organization to foster key knowledge behaviors, and to build knowledge management seamlessly into the way work is done, so that it helps expedite, rather than impedes the work process. This requires a new understanding of what it means to manage knowledge, and of what is required for the firm to increase the knowledge-based value it delivers to its customers and in so doing to increase overall firm capabilities and performance.

Figure 1
Leveraging Knowledge

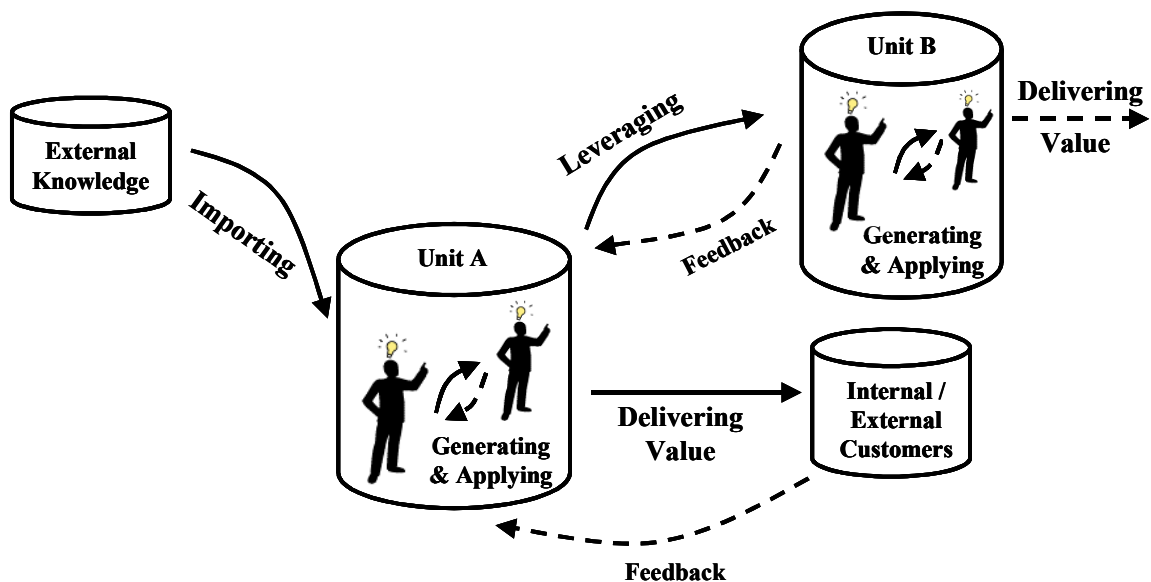


Figure 2
Deriving Value from Knowledge

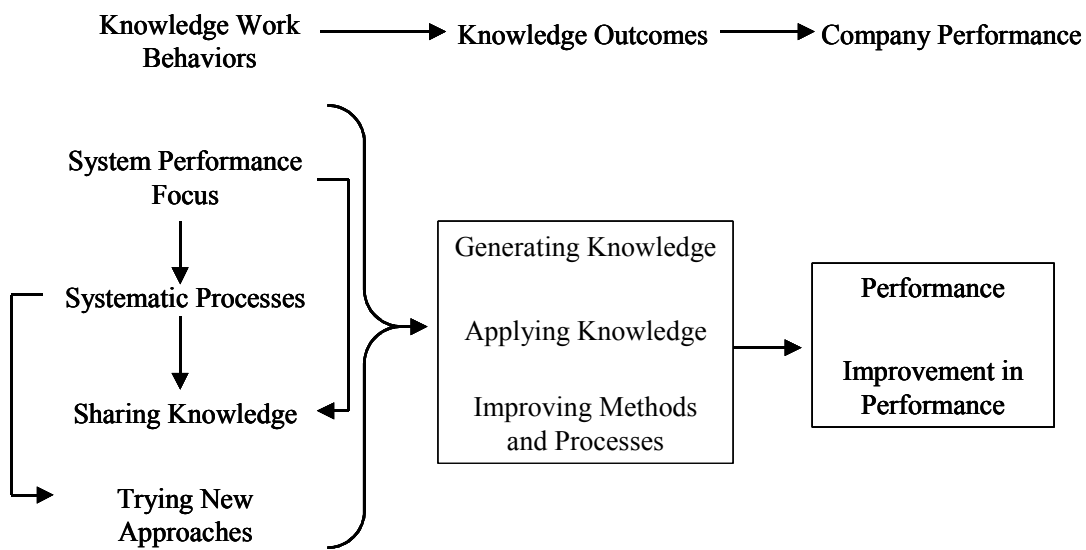
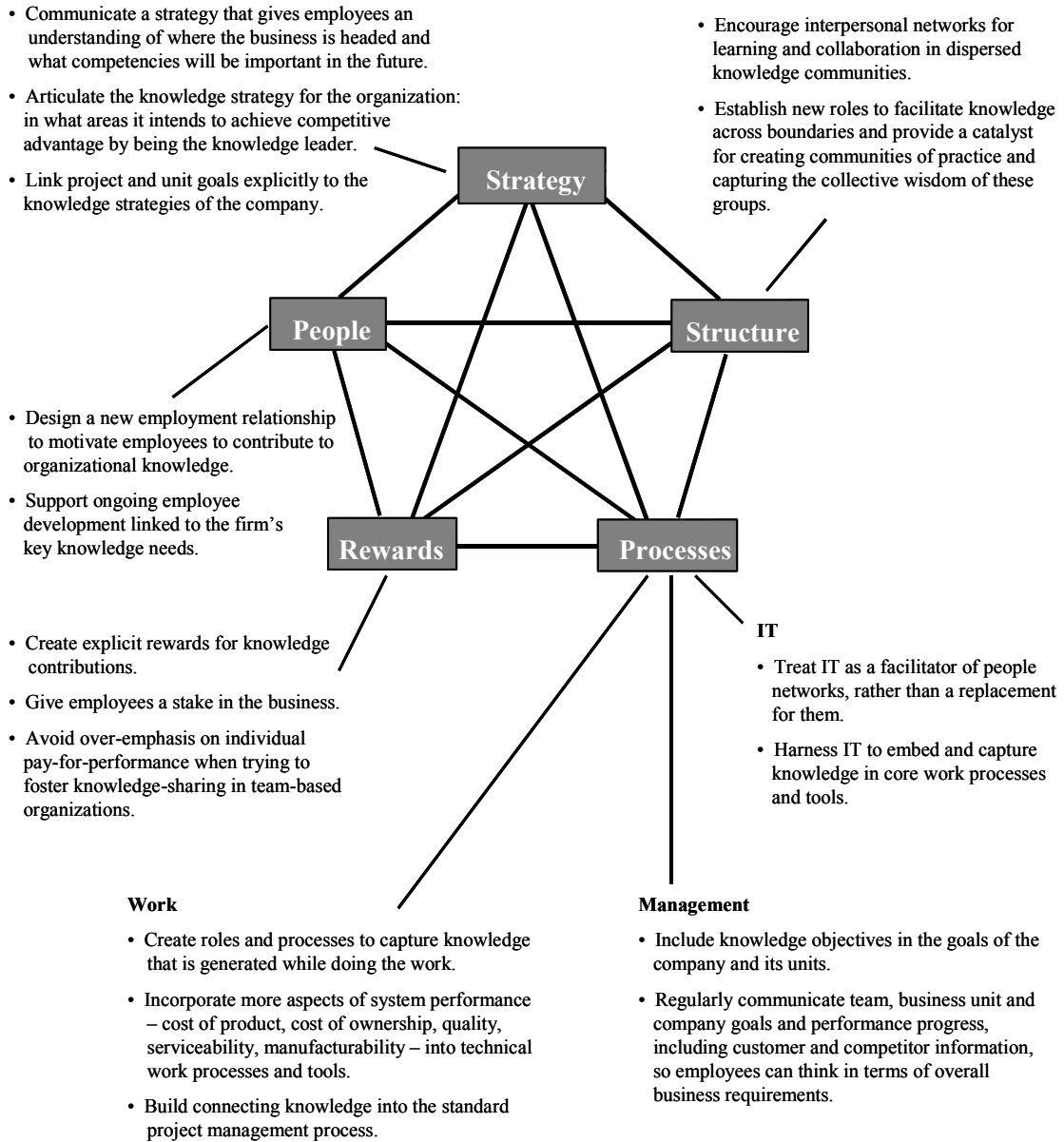


Figure 3
Designing the Knowledge Organization



SUGGESTED READINGS

On general knowledge management: Brown, J.S. and Duguid, P. (2001), *The Social Life of Information*, Boston, Harvard Business School Press; Leonard, D. (1995) *Wellsprings of Knowledge*, Boston, Harvard Business School Press; Von Krogh, G., Ichijo, K., & Nonaka, I. (2000), *Enabling Knowledge Creation*, Oxford, Oxford Press. For the technical write-up of this study: Mohrman, S., Finegold, D. & Mohrman, A.M. Jr. *An Empirical Model of the Organization Knowledge System in New Product Development Firms*, Center for Effective Organizations, working paper. For additional articles based on this study, focused on the changing employment relationship: Finegold, D. and Mohrman, S. (2001), *What Employees Really Want: The Perception vs. The Reality*” Report presented at the World Economic Forum, Davos, SWI. Finegold, D., Mohrman, S. and Spreitzer, G. (2002), “Age Effects on the Predictors of Technical Workers’ Commitment and Willingness to Turnover,” *Journal of Organizational Behavior*, **23**, 1-20. Focused on knowledge management in global firms: Mohrman, S.A., Klein, J.A. and Finegold, D (forthcoming). *Managing the Global New Product Development Network: A Sense-Making Perspective*. In C. Gibson and S. Cohen, (Eds.), *Virtual Teams that Work: Creating Conditions for Virtual Team Effectiveness*. San Francisco: Jossey-Bass. Forthcoming.

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