Chapter I 

Knowledge Power

This chapter focuses on how the power of dynamic knowledge can be harnessed. We look first at how knowledge enables competitive advantage and then discuss the nature of knowledge flows. The chapter concludes with five knowledge power principles and includes exercises to stimulate critical thought, learning, and discussion.

Competitive Advantage

Organizational strategists have long discussed competitive advantage, generally, in economic terms such as earning superior rents, gaining larger market share, raising barriers to market entry, locking out competitors, and locking in customers. Of the numerous "theories of the firm," the resource-based view is somewhat unique (Barney, 1986). This view articulates that competitive advantage stems from the specific mix of resources an organization is able to appropriate (assert ownership over) in addition to how such resources are used. The latter part of this point is key. If an organization bases its competitive advantage on some resources that can be obtained readily through the market, then there is little to prevent competitors from obtaining the same resources (Dierickx & Cool, 1989). Hence, any competitive advantage effected by the lead firm is destined to be ephemeral at best.

Competitive advantage based on information technology (IT), for the most part, falls into this category. For a period of time in the 1970s, for instance, a few banks offering automated teller machines (ATMs) to customers enjoyed some competitive advantages over those without this technology. But today nearly every bank offers ATMs. Instead of conferring some competitive advantage, ATM technology now represents just another cost of doing business in banking. Computerized reservation systems (CRSs), as another instance, similarly conferred some competitive advantage to the pioneering airlines behind their development and initial deployment in the 1980s. But today nearly every airline uses CRSs. Instead of conferring some competitive advantage, CRS technology now represents just another cost of doing business in air travel. Leading-edge financial investment firms, as a third instance, gained some competitive advantage in the 1990s through computer trading systems for securities such as stocks, bonds, and futures. But today nearly every financial investment firm trades securities as such. Instead of conferring some competitive advantage, this information technology now represents just another cost of doing business in securities financial investment. The list of similar instances goes on.

Indeed, this phenomenon is neither new nor unique to IT resources. The same applies also to other primary resources such as the traditional economic inputs of land, labor, and capital. For instance, in terms of land, for centuries the vineyards of France enjoyed considerable competitive advantage over wine producers in other regions. But today world-class, award-winning wines are produced in California, South America, Australia, and other regions. Fine wines are still produced in France, of course, but the land alone is no longer sufficient for competitive advantage over vintners in other fertile regions of the world.

As another instance, in terms of labor, for decades the relatively low cost and high quality of Japanese workers conferred considerable competitive advantage across numerous durable-goods and consumer-electronics industries (e.g., machinery, automobiles, televisions, radios). Then labor-based advantages shifted to South Korea, then to Malaysia, Mexico, and other nations. Today, China appears to be capitalizing best on the basis of labor. Japanese firms still remain competitive in markets for goods, electronics, and other products, but the labor force alone is no longer sufficient for competitive advantage over manufacturers in other industrializing nations.

Such shifting of labor-based advantage is clearly not limited to manufacturing industries. Today, a huge number of IT and service jobs are moving from

Europe and North America to India, Singapore, and like countries with relatively well-educated, low-cost workforces possessing technical skills. However, as educational levels and technical skills continue to rise in other countries, India, Singapore, and like nations enjoying labor-based competitive advantage today are likely to find such advantage cannot be sustained through the onset of new competitors.

As a third instance, in terms of capital, for centuries the days of gold coins and later even paper money restricted financial flows. Regional concentrations formed where large banks, industries, and markets coalesced. But today capital flows internationally at the speed of electrons. Global commerce no longer requires regional interactions between business people. Regional capital concentrations in places such as New York, London, and Tokyo still persist, of course, but the capital concentrated there is no longer sufficient for competitive advantage over other capitalists distributed worldwide. Only if an organization is able to combine, integrate, and apply its resources (e.g., land, labor, capital, IT) in an effective manner that is *not readily imitable by competitors* can such organization enjoy competitive advantage sustainable over time.

In a knowledge-based theory of the firm, this idea is extended to view organizational knowledge as a resource with at least the same level of power and importance as the traditional economic inputs (Grant, 1996; Spender, 1996). An organization with superior knowledge can achieve competitive advantage in markets that appreciate the application of such knowledge. Semiconductors, genetic engineering, pharmaceuticals, software, military warfare, and like knowledge-intensive competitive arenas provide both time-proven and current examples. Consider semiconductors (e.g., computer chips), which are made principally of sand and common metals. These ubiquitous and powerful electronic devices are designed within common office buildings, using commercially available tools, and fabricated within factories in many industrialized nations. Hence, land is not the key competitive resource in the semiconductor industry.

Likewise, people with training and experience in semiconductor design and fabrication are available throughout the world. Hence, neither is labor the key competitive resource in this industry. Similarly, even though semiconductor fabrication plants must be custom-designed, require over a billion dollars to build, and become obsolete within a few years, a great many nations and large corporations can afford to construct such expensive plants. Hence, capital too fails to qualify as the key competitive resource here. Yet one semiconductor

firm is hugely successful in financial terms such as earnings and market share. This firm *knows* how to design, fabricate, and market semiconductors better than its competitors do. Hence, knowledge is the key competitive resource in the semiconductor industry. This knowledge-based competitive advantage has been sustained for several decades now. Similar examples concerning computer operating systems software, networking equipment, and like knowledge-based products serve to reinforce this point.

Two competitors can possess exactly the same kinds of land, labor, capital, and IT but differ in terms of how such resources are combined in the organization, integrated through work processes, and applied to develop products and services. The one with better knowledge can win consistently and through time. Consider military combat (e.g., naval warfare), the history of which is replete with examples of "inferior" forces (in terms of land, labor, capital, and technology) winning battles and even wars. For instance, recall the colorful era of sailing ships with fixed rows of cannons along their sides. The outcomes of naval battles in this era were predictable generally on the basis of the number of ships in a fleet and the number and size of cannons on board ships. The countries whose land, labor, capital, and technology could produce fleets in greater numbers than those of adversaries fared well consistently in battles at sea.

However, such battles were commonly fought through broadside cannon exchanges between ships from opposing fleets sailing past one another in long, straight lines. "Crossing the T" (sailing perpendicular to the line of ships from an opposing fleet) represented a *tactic* (a set of actions based upon knowledge) that conferred competitive advantage even to a smaller fleet of lesser-equipped ships. Because ships of the day had difficulty shooting forward, the "crossing" fleet faced comparatively little cannon fire. Because cannons were relatively inaccurate in those days, the "crossing" fleet also had a long line of opposing ships to target lengthwise, whereas the fleet shooting broadside had comparatively small targets as ships pitched, rolled, and sailed on the high seas. Here tactical knowledge conferred competitive advantage even to fleets lacking material advantage based upon traditional resources of land, labor, capital, and technology. In our current era of network-centric warfare (Alberts, Garstka, & Stein, 1999), knowledge remains a key competitive resource in military combat.

Nonetheless, trying to sustain competitive advantage through knowledge as a resource can suffer the same limitations as noted previously in terms of sufficiency. Where a competitor can obtain the same kind of knowledge and apply it just as well, then any competitive advantage is unlikely to be sustain-

able. Information — and knowledge made explicit — falls generally into this category. When an organization attempts to take advantage of such information or explicit knowledge, it is required to guard it vigilantly or risk losing any advantage it enables. This is the fundamental motivation for keeping secrets (e.g., military, trade, stock picking) and underlies laws for patent and copyright protection in many countries, as well as espionage and organized intelligence collection. Thus, not all knowledge offers equal potential in terms of competitive advantage. Speaking generally, the more explicit that knowledge becomes, the lower its competitive potential becomes (Saviotti, 1998).

Alternatively, tacit knowledge, particularly knowledge that is specific to a particular organization, market, or domain, is not as susceptible to loss. Gained principally through experience and accumulated over time, organizational capabilities based upon tacit knowledge are difficult to imitate. Hence, knowledge-based competitive advantage can obtain and be sustained. Speaking generally, tacit knowledge offers greater promise in terms of competitive advantage than explicit knowledge does. Such inimitability represents a proverbial double-edged sword, however. Even in situations of planned technology transfer between different units of a single firm, for instance, in which management *encourages* knowledge to flow, such transfers are consistently problematic (Szulanski, 1996). The tacit knowledge is "sticky" (von Hippel, 1994), clumps in the transferring unit, and does not flow freely. Further, even where substantial knowledge has been made explicit (e.g., through drawings, procedures, lessons learned), in many cases, it is not sufficient to write down the work steps and to expect people in different offices, plants, companies, or regions to perform at comparable levels.

For instance, despite overt help and cooperation from Toyota, advantages stemming from producing low cost, high quality automobiles via the Toyota Production System have been elusive for numerous other companies attempting to replicate Toyota's success. As another instance, the U.S. government has encountered similar experiences. Many large contracts to produce weapon systems have required defense firms to provide detailed engineering drawings, manufacturing assembly plans, and production tools to enable competing firms to build the same weapon systems. The rationale was to introduce a modicum of competition in the defense procurement process. However, "second sources," as they are called, are rarely able to compete on a head-to-head basis. Even after being forced to share abundant explicit knowledge, the lead firm retains its knowledge-based competitive advantage. Tacit knowledge, which resists articulation and transfer, accounts in great part for this phenomenon.

Organizations that develop tacit knowledge — at the individual level as well as across groups, teams, and organizations — enjoy much greater power of appropriation and lower risk of imitation than organizations relying upon traditional resources. The problem is that tacit knowledge requires considerable time (e.g., years, decades) to develop and accumulate into an "inventory" sufficient to enable competitive advantage. Further, an organization's level of knowledge enhances its ability to learn new knowledge. The further behind one organization gets with respect to its competitors in terms of knowledge, the more difficult it becomes to catch up. Notice this represents a dynamic phenomenon. Not only is the *inventory* (knowledge level) important to enable competitive advantage, but also the *learning rate* (knowledge flow) is critical to sustaining any such advantage they may obtain. The more you know, the faster you learn. This maxim applies to organizations as well as to individuals (Cohen & Levinthal, 1990).

Knowledge Flows

Like mineral deposits that are rich in some geographical regions and sparse in others, knowledge is not distributed evenly throughout the world. Different organizations possess different kinds and levels of knowledge. We noted how differential knowledge between organizations can establish a basis for competitive advantage. However, we noted also how tacit knowledge is difficult to imitate, even when corresponding knowledge flows are encouraged by management within a single organization. This sticky nature of tacit knowledge is thus a mixed blessing. On one hand, it supports competitive advantage; on the other, it restricts knowledge flows within one's own organization.

To emphasize this important point, consider an organization that develops a knowledge-based competitive advantage through learning and application of an exceptional team of people in one particular plant, regional office, or product line. This organization would naturally seek to exploit such advantage and to capitalize on its knowledge differential over competitors. Keeping this exceptional team of people together and preventing defections to rival organizations represent two objectives management is likely to pursue to prevent knowledge from flowing out of its prize unit. Capabilities based on the tacit knowledge enabling this organization's competitive advantage will be difficult for competitors to imitate. This contributes toward sustainability of its knowledge-based

advantage. But at the same time, this organization seeks to leverage its competitive advantage by transferring key knowledge from its prize unit to other plants, regional offices, and product lines. The same attributes of tacit knowledge that make it difficult for competitors to imitate knowledge-based capabilities make it difficult also for other parts of the same organization to imitate. Such organization seeks methods and technologies to promote knowledge flows internally yet prohibit simultaneously external knowledge flows. This represents a challenging problem of harnessing knowledge dynamics that we address later in the book.

A case study of one successful automobile company in Europe (Loch et al., 2001) illustrates in part this difficulty of promoting internal knowledge flows. The company developed and implemented an effective means of improving research and development (R&D) decision making through the use of mathematical programming techniques. Despite demonstrating performance benefits of such techniques within the adopting unit, however, the company had little success in terms of diffusing the approach through other units within the firm. The manager responsible for the original advance had engaged external academic consultants contractually. Although this manager understood the benefits and overall approach of mathematical programming, he did not possess the detailed expertise to implement it in his unit of the company or in other units. Hence, the company failed to appropriate the mathematical programming knowledge. Rather, it remained dependent upon external consultants. When such consultants were not retained by the company to extend the decision-making techniques into other units, the corresponding knowledge and expertise left the company along with the consultants. Then, knowledge flows associated with the mathematical programming techniques ceased.

It is important to note that the objective of promoting knowledge flows internally within organizations is not restricted to select knowledge that enables competitive advantage. All knowledge required for an organization to perform its work processes and accomplish its mission needs to flow within such organization. Knowledge lies always on the critical path of work; that is, people must know how to accomplish a job before they can accomplish it. Hence, even routine knowledge necessary to perform ordinary work processes within an organization must flow across numerous dimensions.

For instance, we noted how knowledge flows between different organizational units are desirable where such knowledge enables competitive advantage. Inter-unit knowledge flows are important also for organizations that seek to maintain consistent work processes, technological environments, and product

quality levels across units. Whether the products of interest are semiconductors, pharmaceuticals, software applications, or government services, knowledge is required to perform the work processes, and such knowledge must flow between units to ensure consistent organization-wide performance. The aforementioned case of the automobile company illustrates well how failure of inter-unit knowledge flows can prevent some units within a single firm from enjoying benefits demonstrated in other units.

As another instance, knowledge flows across time are also necessary in addition to flows across different organizations and geographical regions. Consider where one shift replaces another in a factory, processing plant, or military watch. Management is interested in using the knowledge gained during a shift by one group to enhance the performance of the other group. Take a network problem, for example, in a global telecommunications firm. Such firms operate 24 hours a day, yet individual employees work generally only 8 hours at a time. When an individual customer service agent leaves at the end of a shift, it is important for him or her to convey what he or she knows about the network problem to the person taking over. Otherwise, the agent beginning a new shift may not adequately understand the network status to effectively relate with customers or to steer them toward work-around solutions to network problems. Similar examples in other settings (e.g., plant equipment problems in a petroleum-processing operation, health problems of a patient in a hospital intensive-care unit, intentions of commercial aircraft in flight as air traffic controllers change shifts) abound as well. Notice, such knowledge flows — across shift changes — represent dynamics occurring over relatively short periods of time (e.g., hours).

Alternatively, other flows require knowledge to move over extended periods of time. Consider how most organizations expect junior members to develop knowledge and expertise over time. Some aspects of knowledge and expertise can be acquired directly (e.g., through education and training programs), whereas others accumulate indirectly through experience (e.g., working on a particular kind of problem). Some kinds of knowledge are quite general and broadly transferable (e.g., engineering principles and methods), whereas others are specific to a particular company, department, and work assignment, hence, more restricted in terms of opportunities for application and transfer. In some cases, people can begin at a state of ignorance and incompetence yet develop knowledge and expertise through a process of repeated trial and error (e.g., on-the-job training [OJT]), whereas other work contexts require competent performance on the first attempt (e.g., surgery). In other situations,

knowledge and expertise apply to individuals (e.g., the previous examples), whereas group, team, and department interaction requires collections of people to learn how to work together (e.g., basketball teams, software development groups, police SWAT teams).

In every case, considerable time is required for learning (knowledge to flow). The amount of time *allocated* for learning represents a management decision. In the research university, for example, assistant professors are given six years to establish a positive national reputation, after which they face an up-or-out staffing decision. However, the kinds of work they perform (e.g., research, instruction) remain the same for the most part throughout this period (and in many cases, for years or even decades beyond). Most research universities have decided that six years of the same work after earning a PhD is enough time to become an associate professor. In a corporate employee-internship program, as a different example, new college hires may be rotated through different departments and jobs every six months. Unlike the research university, the kinds of work new hires perform change with each rotation. Such organizations have decided that six months of the same work after earning a college degree is enough time for rotation to another job. The U.S. Navy, as a third example, rotates its personnel roughly every three years. Here, *all of its people* (e.g., junior and senior, enlisted and officers, sailors and staff) change jobs at three-year intervals. This military organization has decided that three years of the same work after assignment to a new command is enough time for rotation to another job.

Knowledge flows between people denote a related instance. Of course, this transcends the other instances mentioned because, ultimately, nearly all knowledge flows in an organizational context take place between people. In the case of inter-unit transfers, people in the different organizations must learn from one another (e.g., about decision-making techniques). In the case of flows between shifts, people on the different shifts must learn from one another (e.g., about equipment problems). In the case of new employees, people must learn from some combination of the work itself (e.g., trial and error, OJT) and other people (e.g., supervisors, mentors, instructors, peers). Hence, knowledge flows across different organizational units, geographical regions, and points in time involve people and are necessary *just to accomplish the work at hand* (e.g., ordinary work processes), even where such knowledge may not necessarily lead to competitive advantage. This elucidates a critical point in terms of diagnosing knowledge-flow problems. Viewed in reverse, where knowledge fails to flow well, even to enable ordinary workflows, the organization may

experience competitive *disadvantage*, as it fails to perform its routine work effectively.

Consider the Business Process Re-engineering (BPR) movement in the 1990s. Conceived originally as an approach for radical change to effect dramatic performance improvements in organizations (see Davenport, 1993; Hammer & Champy, 1993), BPR provided a broad-based impetus and set of techniques to enable organizations to perform better with fewer resources. However, the focus of this approach shifted over time from one of superior performance to one of fewer resources. BPR was employed extensively then as a cost-cutting mechanism. Profits rose at many companies, and competitors followed suit to avoid being left behind. However, in the U.S. alone, many tens of thousands of jobs were eliminated through the process. Many such jobs belonged to knowledge workers and middle managers. After some period of time, it became apparent to several firms that critical organizational knowledge had left the company with the people who were "downsized." Such people had to be rehired — oftentimes as expensive consultants or for far more than their previous salaries. The short-term focus on cost reduction and job elimination took place at the expense of longer term performance and knowledge accumulation.

A similar situation is occurring at the time of this writing for a different reason. People from the Baby Boomers generation are nearing retirement age. Organizations lack the resources and techniques to ensure their knowledge flows effectively to Generations X, Y, and other groups that are performing junior- and mid-level jobs in such organizations. Indeed, the U.S. government estimates that roughly half of its workforce will be eligible for retirement before the end of this decade (Liebowitz, 2004a). This massive governmental organization has little clue as to how the corresponding knowledge can be preserved.

Even within a particular organization, knowledge can be observed to clump noticeably in certain people, groups, locations, and points in time. The phenomenon of knowledge distributing itself unevenly across different people has been studied extensively for years. Researchers have examined the nature of expert performance and tried to draw generalizable comparisons with the performance of novices, for instance. Many studies of leadership fall into this category. A whole industry of expert systems was developed around the idea of capturing expert level capabilities and formalizing them in computers. Indeed, knowledgeable people have been painting caves, chiseling stones, and writing books for millennia in attempts to share their expertise, and society has developed many other techniques for experts to share knowledge (e.g., stories, mentoring, apprenticeships, university courses).

Since expert knowledge is generally tacit, it is sticky (von Hippel, 1994), and the corresponding clumps remain difficult to distribute. For instance, it is recognized widely that roughly 10 years' sustained and dedicated effort is required to become an expert in a particular field with accumulation of some 10,000 chunks of corresponding knowledge (see Turban & Aronson, 1998). Trying to share such expertise encounters the well-understood problem associated with "the fish." Recall the parable of giving someone a fish vs. teaching him or her how to fish. In the former case, one feeds the person for a day, but he or she becomes hungry again the following day. In the latter case, the person learns to feed himself or herself for a lifetime, but such learning takes time. Ask an expert to solve a problem, and he or she solves the problem. This takes care of the situation until its next occurrence. But ask the expert to teach an apprentice how to solve the problem. The problem may go unsolved for some time, yet eventually a capable apprentice can learn how to solve the problem for himself or herself. Teaching how to solve problems is more time consuming than problem solving is. For knowledge to flow at the individual level, the expert (or simply more knowledgeable person) must be willing and able to share; the novice must be willing and able to learn; and the organization must be willing and able to help them do so. Very few organizations accomplish such individual learning well at present. As a general rule, individual knowledge does not flow well through most organizations.

Even more difficult is enabling knowledge flows at other levels. Because groups, teams, departments, firms, and even larger aggregations of people are comprised of individuals, all of the same individual-level problems previously noted are present within such organizations. In addition, knowledge is noted to clump in certain organizations as well as specific individuals. Accounts abound of groups, teams, offices, units, ships, crews, and the like that are practically identical except for the individuals comprising them, yet one organization outperforms the others, oftentimes dramatically. Identifying the sources of performance differences between apparently equivalent organizations is difficult, even though it often reduces to some kind of tacit knowledge that is shared within a particular group. Conceiving mechanisms for such shared knowledge to flow between two groups is very challenging. Because the shared knowledge is tacit, attempting to write it down and disseminate it via books, standard operating procedures, lessons learned, Web portals, workflow systems, and other explicit knowledge approaches offers limited potential for efficacy. This same point pertains to enterprises that are separated across time and space, as well as those separated by organizational boundaries. Think of a new group taking over a Y from a group that has been performing it effectively for some

time, or an organization in one geographical region that is able somehow to perform more effectively than its equivalent counterpart in another region. Knowledge flows are essential for power through competitive advantage. But enabling such flows remains a huge challenge for most organizations. This is the case in particular for large and bureaucratic enterprises that rely upon information technologies. We address such challenges in subsequent chapters.

Knowledge Power Principles

Five principles developed in this chapter help shed light on developing knowledge power: (1) knowledge is distinct from information in enabling competitive advantage; (2) knowledge is distributed unevenly, hence, must flow for organizational performance; (3) tacit knowledge supports greater appropriability for competitive advantage than explicit knowledge does; (4) knowledge flows must balance exploration through learning with exploitation through doing; and (5) enhancing knowledge flows requires simultaneous attention to personnel, work processes, organizations, and technologies.

Principle 1. Distinguishing knowledge from information is important. One effective operationalization is that knowledge enables direct action (e.g., correct decisions, appropriate behaviors, useful work), whereas information provides meaning and context for such action (e.g., decision criteria, behavior norms, work specifications). As a Gedanken experiment, consider two people tasked to perform a knowledge-intensive activity. These could be captains on the bridge of a ship, surgeons at the operating table, managers at the negotiating table, professors in a classroom, attorneys in a courtroom, or any similar situations requiring knowledge. Provide these two people with exactly the same information (e.g., books to read, charts and reports to reference, instruments to monitor, direct views and sounds, advisors to consult, etc.). Say one person has 20 years experience, whereas the other has much less experience (or possibly none). Most informed leaders, managers, and scholars would expect differential performance from these two people. Such differential performance can be attributed generally to differences in knowledge. **Hence, shuttling *information* around via computers, networks, reports, and communications does not address the flow of *knowledge*, at least not directly or on the same time scale**.

Principle 2. Knowledge clumps in particular people, organizations, regions, and times of application. Knowledge power through competitive advantage requires knowledge to flow, but tacit knowledge is sticky, difficult to imitate, and slow to move. This same property, which enables the sustainability of knowledge-based competitive advantage, inhibits simultaneously sharing within the organization. **Hence, knowledge clumps need to be identified, and knowledge flows need to be enabled through the organization**.

Principle 3. The second principle gives rise to a third principle, which is focused on differentiating between kinds of knowledge. In particular, explicit knowledge that can be articulated is distinct in many ways from the kind of tacit knowledge that accumulates, often slowly, through experience. Neither is individual expertise quite the same as knowledge shared across members of a group, team, or other organization. Knowledge can also be quite situated, ephemeral, and local, meaning a person on the "front lines" cannot always communicate the richness of what he or she knows to someone at headquarters. Yet people at headquarters tend to demand abundant information flows to support decision making that is better made on location. Of course, the person on the scene with detailed and local knowledge lacks the high-level integrative understanding of managers at headquarters, and the need for functional specialists to share specific knowledge for complex problem solving is well known. Central to the point of knowledge power is that tacit knowledge supports greater appropriability than explicit knowledge. **Hence, knowledge managers may benefit from an emphasis on tacit knowledge flows**.

Principle 4. Not all knowledge, not even tacit knowledge, is of equal value. Furthermore, not all knowledge needs to be shared to effect performance. Indeed, there is a classic tension between exploration and exploitation. Because resources such as time, energy, and attention are limited, investing in exploration of new knowledge and opportunities necessarily limits the resources available to exploit the knowledge and opportunities that exist, and vice versa. Moreover, to the extent that an organization focuses solely on exploitation, for instance, it can quickly develop competency traps (Levitt & March, 1988) and suffer from debilitations associated with single-loop learning (Argyris & Schon, 1978); that is, an organization can learn to do the wrong thing very well and not realize that its competency is no longer suited to the environment. In contrast, to the extent that an organization focuses solely on exploration, it can quickly see its demise, as competitors capitalize upon current

opportunities and take advantage of the organization's time away from task; that is, the organization can prepare itself well for a future environment but fail to survive until such future arrives. Similar tensions arise between learning and doing, sharing and hoarding knowledge, acquiring general vs. specialized expertise, and similar knowledge-oriented tradeoffs. **Hence, understanding the kinds of knowledge that are important in an organization's particular environment is essential for promoting the most important knowledge flows**.

Principle 5. It is well known that organizational personnel, work processes, structures, and technologies are tightly interconnected and interact closely (Leavitt, 1965). When seeking to redesign and change organizations to identify knowledge clumps and enhance knowledge flows, it is important to focus simultaneously upon all of these interconnected and interacting elements. Most people can quickly identify a technological "innovation" that failed to produce favorable results when implemented in an organization. Bringing in people or teams with different backgrounds in terms of education, training, skills, and experience represents a similar instance (e.g., conjuring up memories of failed implementation), as does changing work processes or organizational reporting relationships and responsibilities without addressing personnel and technologies. **Hence, the four organizational elements of personnel, work processes, structure, and technology operate as a cohesive system and should be addressed as an integrated design problem**.

Exercises

1. Describe a situation of knowledge enabling competitive advantage in an organization with which you are familiar. Explain how knowledge, and not other resources, is key.
2. Describe how additional knowledge could — but has not — enable improved competitive advantage in the organization of Exercise 1. What would have to be done to effect such improved competitive advantage?
3. Describe a situation of knowledge clumping in an organization with which you are familiar. What was done to address the clumping in such situation? What else could be done?

4. Conceive of an experiment or other empirical test to assess the relative value of two different chunks of knowledge that you possess. Briefly describe how the value of knowledge could be measured.