KNOWLEDGE MANAGEMENT IN THE CORPORATE SECTOR: IMPLICATIONS FOR EDUCATION

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In the corporate sector as elsewhere, the message is that our most important resource today is knowledge and not land, labor or capital (Snyder, McManus, & Wilson, 2000), citing Drucker's *Post-capitalist Society* (1993). Corporations or firms are urged to re-design themselves as social learning systems because the primary rationale for a "firm's existence is to create, transfer and apply knowledge" (Hitt, Ireland, & Lee, 2000, p. 232). This is also the purpose of schools and universities. Firms are not schools and universities; they differ in fundamental ways. On the other hand, the corporate approach to knowledge may suggests insights into how to manage knowledge to improve schools and universities.

Despite the importance assigned to it, what to do with knowledge remains a controversial issue in the corporate world. Some argue that the key turns on "knowledge management," a methodology for retrieval, integration, storage and dissemination of knowledge assets (Gupta, 2000). There is, however, more than one way to manage knowledge. For example, one position prefers an "extension model" that emphasizes dissemination of knowledge over use and is research-to-practice focused. An alternative camp urges a problem-solving approach in which knowledge is generated "at the bottom," with external agencies supporting but not controlling knowledge generation (Louis, 1992 #242).

This paper reviews recent studies and opinion about knowledge management practices in public and private corporations. The findings contradict conventional wisdom about knowledge and organization for knowledge management. An initial section summarizes the state of the art with respect to knowledge management: we are still learning. The second section argues that knowledge management systems work best when they take into account the compound nature of "knowledge". A third section discusses different forms of learning—the name given to change in or growth of knowledge—and their relevance for knowledge management. The next section argues that requisite knowledge is produced in multiple sites: within firms, between firms, and external to a system of firms. The focus of the fifth section is how firms integrate different types of knowledge and sources of learning. A final section draws some implications for knowledge management in the education sector.

1. Earlier Corporate Experiences and Outcomes

Although the term "knowledge society" is only about 25 years old, corporate concern for the production, diffusion and utilization of scientific knowledge is long-standing. As early as 1826, for example, British scientists and industrialists had formed a Society for the Diffusion of Useful Knowledge which disseminated scientific information through a Penny Magazine that reached 200,000 subscribers. The endeavor eventually failed, its promoters frustrated by difficulties in getting people to read the Magazine, much less to actually use the knowledge it contained (Weiss, 1991). The industrialists' interest in knowledge production and utilization did not die, however, as witnessed in continued corporate finance of universities and other centers of research and active participation in national science policy.

Is the Problem Knowledge Management?

Although corporations have invested heavily in knowledge, results have often been disappointing and sometimes negative (Pfeffer & Sutton, 1999). Knowing what to do is not enough, the critics argue: the challenge for managers is to figure out how to do what they know needs to be done. Similarly, there is doubt that we understand enough about how knowledge leads to innovation. The search for knowledge is likened to the search for the Holy Grail. More important than knowledge management, it is claimed, is management of the commitment of employees to innovate (Waters, 2000). Despite extensive research, the corporate world still has not solved the problem of knowledge utilization.

> "…the results of systematic research, regardless of its disciplinary focus, express uncertainty if not major disquiet, about whether there is a proper instruction book for building 'info-structures' or using them to help accelerate the development process." (Mansell & Steinmuller, 1999, p. 92)

Although there are now several competing approaches to knowledge management, none has an adequate foundation of empirical research to support it (Kluge & Schilling, 2000). The following sections examine current work on knowledge management.

2. Types of Knowledge

A major source of uncertainty in research on knowledge management flows from the variety of terms used to describe different types of knowledge.[1] Each type of knowledge has unique sources and responds in different ways to structures and procedures for management and utilization. Failure to attend to these differences results in conflicting reports in studies of the effectiveness of knowledge interventions.

Explicit and Tacit Knowledge

Some authors distinguish between explicit knowledge and tacit or implied knowledge (Spender, 1996). Explicit knowledge is defined with terms such as tangible and observable. It can be represented in symbols (such as words, numbers, codes), and can be possessed and transferred to others in the process called communication. We measure explicit knowledge by asking persons to make correct answers. It is declarative; it makes statements about things. The content of reference books is a prime example of explicit knowledge.

Tacit knowledge is defined with terms such as intangible and implicit or unobservable. It cannot be represented in symbols and therefore is difficult to transfer to others. The possession of tacit knowledge generally is recognized in performance rather than in communication, and is therefore called procedural. We measure tacit knowledge by observing how people do things. For example, star athletes know how to size up situations and move in response to others' movements without being able to articulate the set of principles that guides their movement. Artists produce their works without manuals or even conscious thought. What distinguishes the best surgeons from others is not their extensive explicit knowledge of anatomy but rather their noncommunicable skill with their instruments. High-performing politicians and executives have excellent memories filled with explicit knowledge but also an intangible ability to size up situations and react to intangible cues in other's behavior.

Both types of knowledge can be held by individuals or in organizations (Nakata, 1999). What we call "conscious knowledge" is individual explicit. The automatic or reflexive knowledge that enables persons to function in rapidly changing situations is individual tacit. When we do research we seek to make knowledge objective, that is, knowable by others. The result is collective explicit knowledge. The kind of knowledge that is shared by persons in close relationships, as for example when members of a work crew "know" that they can trust their partner to respond appropriately in an unanticipated situation, is collective and tacit (Spender, 1996).

Distinctions in Content

Another distinction focuses on content. Knowledge about individual persons or things is called "component" knowledge, and distinguished from "architectural" knowledge which focuses on linkages among persons and things (Henderson & Clark, 1990). Component knowledge can be transferred in discrete units outside of context, while architectural knowledge cannot. The technological knowledge that is the focus of corporate attention

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[1] In English, knowledge is defined as "the sum of range of what has been perceived, discovered or inferred.". [Morris, 1978 #261]. Romance languages use two words to designate knowledge. In French, for example, *conaissance* is knowledge as familiarity. One knows another person or a situation. *Savoir* is used to refer to knowledge about things or people, such as knowing the square root of pi. A similar disitnction is made in Spanish, using *conocer* and *saber.*

includes all types. Individual skills can be explicit or tacit; procedures can be explicit (e.g., procedural manuals) or tacit (inferred from corporate routines).

Distinctions in Where Knowledge is "Stored"

An alternative distinction is made on the basis of how knowledge is stored. These types include:

1) Symbolically expressed knowledge, which can be transferred via print media or on floppy disks;
2) embodied knowledge, residing, for example, in athletes' muscles;
3) embrained knowledge, lurking in our individual synapses; and
4) encultured knowledge, located in social collectivities.

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Measurement of How Much Knowledge a Firm Has

A common mistake in looking for reasons for a firm's success is to focus exclusively on how much explicit knowledge the firm has. We do this because explicit knowledge is visible and easy to measure. The explicit knowledge can be observed directly by traditional measures of human capital (for example, levels of education and training of employees) and structural capital measures, such as facts in a database output measures. Corporate researchers suggest, however, that explicit knowledge is only a fraction of the total stock of a firm's knowledge. It is important in a limited range of situations, for example those involving routine or well-understood activities.

Because firms today operate in a turbulent, non-routine environment, their success depends on use of their total knowledge stock. Tacit knowledge has to be estimated by indirect measures inferred from behaviors or outputs of the firm. Analysts use measures such as prestige and reputation, customer capital or satisfaction, and overall value of the firm (market to book and market value to replacement cost ratios). Each of these latter three measures points to an aspect of the firm's performance.

The assessment of knowledge use and impact is difficult because process or operational knowledge (most often tacit) is used (and therefore detectable) in multiple sites over time. Perhaps the difficulty in measuring all of it explains why many successful firms have no idea of how much intellectual or cultural capital they have. For example, although 76% of Fortune 500 companies rate core competencies, morale and corporate culture as important, only 36% bother to "measure" how much they have (Stivers, Covin, Green, & Smalt, 1998).

What Kind of Knowledge is Best for Firms?

Most of the corporate research on knowledge management seeks ways to improve firm performance in situations of rapid change in markets and technologies. In this context, the researchers conclude, collective tacit knowledge is "the most secure and strategically significant kind of organizational knowledge" (Spender, 1996, p. 52). Explicit knowledge is considered to be of relatively lesser importance in the firm's performance. I return to this point later.

The importance given to tacit knowledge poses a daunting task for the designers of knowledge management systems. Tacit knowledge is difficult to transmit and the dialogic processes most helpful in stimulating and sharing tacit knowledge resist systematization. Tacit knowledge is critical in the success of knowledge management, but is not transferable across organizations (Noh, Lee, Kim, Lee, & Kim, 2000). On the other hand, explicit knowledge is of little use to

> "people in high organizational positions…[who] compress dozens of large and small decisions in the category of knowing their business and doing their work. In consequence the conscious use of research to guide specific decisions is a relatively uncommon event." (Weiss, 1980, p. 403).

The next section discusses how corporations change and increase both types of knowledge, that is, how they learn.

3. Learning: Acquisition and Production of Knowledge

Explicit and tacit knowledge are not necessarily different kinds of knowledge "stuff" so much as the result of two different kinds of human action. The distinction is similar to that made by March (1999) (and others) between the two kinds of learning: acquisitive or imitative, and experiential. In the former the learner attempts to model or copy the symbols and behaviors associated with someone else's knowledge: "best practices" discovered elsewhere are used as an instruction book. Experiential learning, on the other hand, occurs inside the firm or in its interactions with other organizations. Knowledge is transferred (and therefore is explicit) in acquisitive learning; in experiential learning it is produced by the learner and primarily is tacit. Knowledge gained through experience, March argues, is superior, not only for its fit to context, but also because it facilitates further innovation.

How the Two Types of Learning Contribute to Firm Success

The two kinds of learning combine explicit and tacit knowledge in three levels of knowledge production. Lower-level (single-loop) learning involves associations between behaviors (based on explicit knowledge and skills) and outcomes. Knowledge transfer can be highly effective for lower level learning. This kind of learning permits a firm to carry out its fundamental tasks, to operate as a business. What is learned by individuals are specific behaviors for (recurring) specific situations. Lower level learning is short-term problem-solving and can be highly effective in stable environments (Argyris & Schon, 1996). It contributes to the first requirement for a firm to survive: its ability to acquire and manage explicit knowledge, from the outside as well as internally.

The second requirement is that firms must experiment systematically with their procedures and structure to improve their performance. This requirement is met by double-loop, higher level learning. Double-loop learning builds on explicit knowledge to develop interpretive schemes to understand or explain sets of situations. The higher-level learning process is often intuitive and insightful (i.e., tacit) and therefore difficult to chart. Its advantage is that it broadens the range of behavioral options available at any given time. It permits an organization to experiment with modifications in components and architecture through changes in its frame of reference. These explanations permit adaptation to a changing environment. The best firms maintain a balance between use or exploitation of existing knowledge, and exploration or production of new knowledge, in a combination of explicit and tacit knowing.

The third requirement is the ability to elaborate "dynamic routines" to share technological knowledge throughout the firm. These routines generate patterns of interaction (much like cultural norms and rituals) among members of the firm. Over time they result in unique (and non-transferable) organizational features and abilities (Lei, Hitt, & Bettis, 1996). The process is described in more detail in section 5.

Common or shared knowledge is essential for a firm to be able to develop new ways of defining and solving problems, thereby creating new technological knowledge. An effective knowledge management system must therefore be concerned with horizontal as well as vertical processes of knowledge transfer. When all three factors are present and balanced the firm reaches the level of meta-learning. Now it can design and implement fundamental changes in mission, structure and performance. The most effective firms are those that can learn how to integrate different types of knowledge from different sources.

4. Learning and Sources of Knowledge

The complex nature of "knowledge" calls for the use of multiple and hybrid supply channels (de Vries & Brijder, 2000). Sources of knowledge can be located:

- outside of an industry (for example, in university research centers or productivity centers),
- among collaborating firms within an industry, or
- within individual firms.

Knowledge sources vary in what they can offer that is useful to a firm.

Sources and Utility of Knowledge

Firms require three types of knowledge about any given innovation: contextual, operational and functional knowledge. Partners located "upstream" from the firm have difficulties in obtaining contextual knowledge, that is, understanding whether their experiential knowledge will work in another setting. Internal sources produce contextual knowledge but do not have full access to knowledge about new products and processes and their impacts.

The importance of source is seen in the limited use by corporations, public and private, of externally-generated policy research. Contrary to what researchers might like, externally-generated research knowledge has little impact on states' choices among policy options. For example, a 1988 survey on policy decisions in hazardous wastes, economic development, welfare and education found that US state-level officials relied primarily on peers, counterparts and politicians for advice. Use of research was linked with characteristics of the state : greater use of policy research was made in wealthier, conservative and "moralistic' states. More experienced and better educated officials made less use of research than those with less experience and education (Lester, 1993).

Although external knowledge may have few direct effects on a firm's actions, it may have indirect effects. A study of 100 randomized social experiments—controlled use of externally-supplied research information in public sector service organizations—reports few visible substantive effects, that is, explicit changes in products or structures. On the other hand, there are many subtle outcomes. These include embellishment or elaboration of existing structures or products, changes in symbols, and changes in agendas or concerns. In the table below, a + signifies observable impacts.

Table 1.

The Effects of External Research Knowledge on Organizations

LEVEL/TYPE	Substantive	Elaborative	Symbolic	Persuasive
Concrete		++	++	+
Conceptual	+	+		+

Source: (Greenberg, 1991)

Another study shows that policy research is most often used to define problem areas, or "enlighten" rather than to define solutions (Sabatier & Jenkins-Smith, 1988).

Does More Knowledge Always Lead to Better Performance?

Knowledge transfer can have negative as well as positive impacts on a firm's performance. Substantive changes in an organization can disrupt existing routines and result in performance degradation. This is more likely when the transfer process is from top to bottom in the organization, as learning is not consistent throughout. If organizational changes include either expansion or sharp reduction in firm size the negative effects can be greater (Lin, 2000). A study of 24 knowledge intensive commercial organizations showed that while knowledge-based systems raise overall organizational competencies, they also threaten the performance of some tasks. In general, their introduction initially results in a slight decrease in the quality of work in the firm. Smarter knowledge systems do not always make for smarter organizations (Hendriks, 1999).

Transferring Explicit and Tacit Knowledge

The transfer of knowledge from external sources is complicated by whether it is explicit or tacit. External knowledge sources may unwittingly embed tacit knowledge in what they seek to transfer. The outsider's tacit knowledge is based on a context that might be quite different from that of the intended recipient. As a consequence, the degree of tacitness of knowledge packages from external sources is considered to be the major constraint to learning: the more tacit, the less is acquired by the target (Simonin, 1999).

The problem is especially acute when one attempts to transfer knowledge across cultures as these differ in the ways in which they organize knowledge. For example, Japanese

firms emphasize collaboration between manufacturing and planning to achieve product development. British firms, on the other hand, seek product development through role specialization. Joint ventures between British and Japanese high-tech firms resulted in poor performance, asymmetrical knowledge transfer and a breakdown in collaboration because these differences were not taken into account (Lam, 1997).

On the other hand, elimination of tacitness may sharply reduce the value of what is transferred. In situations of rapid change, explicit knowledge may be irrelevant. This is seen in the current criticism of decision-making systems that rely on formal explicit knowledge. Artificial Intelligence devices, once the rage, are now seen to constrain innovative or "out-of-the-box" thinking. They fall short of expectations because they fail to recognize the complex nature of knowledge and the mind by:

a. defining knowledge as a discrete activity;
b. using codes and symbols to represent knowledge, replacing dialogue;
c. emphasizing acquisitive over inquisitive behavior; and
d. insisting that knowledge structures are easily modeled.

Some knowledge management system designers have made the same errors as those made earlier by designers of AI systems (Falconer, 2000).

The answer lies, it is claimed, in recognizing multiple sources of knowledge—external to the industry or sector, in firms within the sector, and within an individual firm—and in integrating the explicit knowledge they provide through dynamic routines developed within the firm. The next section describes proposals for organization of firms and sectors to maximize knowledge integration.

5. Organizing for Knowledge Integration

Most research on knowledge use to date has assumed that knowledge is acquired through transfer from a research producer to a user such as a decision maker or a worker in a firm. The conventional approach to this task has been reliance on consultants and external knowledge management systems (Svensson, 2000). More sophisticated studies include the possibility of user interacting with producer, shifting from a dissemination model to a collaboration model. In the collaboration model, the researcher uses knowledge produced by the user, for example a worker who has experimented with a new sequence of operations. In a third, more elaborate, model knowledge is received and generated also by decision-makers, who interact with operators in the firm and with external researchers (Boggs, 1992).

Reality is even more complex than these three models. Knowledge can be transferred not only from external producers but also from internal producers. External producers can be other firms as well as researchers. Knowledge varies in explicitness and tacitness, and is both individual and collective. In their efforts to integrate all sources of knowledge corporations have organized knowledge management systems within firms, across firms, and with external suppliers of research. The following are examples of what is being done.

Internal Knowledge Management

One approach constructs Group Support Systems in an effort to integrate external information and that scattered within the firm, building on tacit and explicit knowledge at the individual and work group levels, and compiling it into organizational knowledge. The procedure uses a "fuzzy" set theory approach in which boundaries between types of information are intentionally not well-defined. The Group Support System (in contrast with external Knowledge Management Systems) includes user agents (representing decision makers and operators both within the firm), information management agents, and a fuzzy model manager. The approach increases knowledge sharing, improves the quality of group decision processes, and leads to high consensus about decision outcomes (Lee & Kwok, 2000).

Internal knowledge management is enhanced by internal knowledge production. Firms that do their own research are more innovative than those that use only a centrally-located research and development unit (Hoskisson & Hitt, 1988). Individual experimentation is not enough, however. The firms that are best able to integrate their own knowledge have

1) high levels of internal communication;
2) high levels of common knowledge; and
3) management capability to access and use the special knowledge employees have (Grant, 1996).

Knowledge Management Among Firms

There is another argument as to why internal generation of knowledge is not enough. Some analysts claim that the increasing complexity of technology and knowledge indicates that the ability to foster and maintain relationships across firms in the future will be more important for an individual firm's success than its own internal organization (Turpin, Garrett Jones, & Rankin, 1996). Products will be increasingly complex and technologically hybrid, requiring knowledge from a variety of sources and disciplines. Technological dynamism, that is, continuous learning to perform better, involves both knowledge-using and knowledge-making. The critical task is integration of the various knowledges. The task for management is to stimulate learning in the context of interaction between firms, and with clients and suppliers (Millar, Demaid, & Quintas, 1997).

Firms linked within an industrial sector are referred to as clusters, networks, strategic alliances or joint ventures. Networks allow small and/or isolated firms to increase their technological knowledge not only through their own limited research and development expenditures, but also by absorbing knowledge produced in other firms with a similar function. How much knowledge will be absorbed depends not only on the capability of the individual firm, but also the degree of connectivity of the network, that is, how much all firms are linked together (Antonelli, 1996; Hakansson, Havila, & Pedersen, 1999).

For example, the Danish government has sought to increase the performance of small firms by constructing a network of service institutes that transfers technological knowledge to and across the firms. Industry advisers work with groups of fewer than 15 firms, linked with local authorities. Initially knowledge dissemination was top-down, but over time firms have imposed their own interests on the system changing the nature of the network and internal relationships to generate more firm-produced knowledge (Huggins, 1996). The effectiveness of the knowledge systems of clusters or networks can be assessed along dimensions of passive-active cooperation, vertical and horizontal flows of information, and as closed or open systems (Bell, 1999)

Alliances and joint ventures depend on mutual satisfaction and development of trust. This requires efforts to maintain some measure of reciprocity in relationships. Firms enter into these relationships matching what they lack (in terms of knowledge) against what other firms can supply. The alliances start out as agreements among equals but firms learn at unequal rates as a function of differences in initial conditions and learning capability. Alliances and joint ventures with learning objectives are therefore inherently dynamic, that is, they are unstable and require control processes that can reconfigure the relationship if necessary (Makhija, 1997). These control processes make it possible to move from conventional knowledge transfer relationships to double-loop or strategic learning.

Learning From External Sources

Networking also can include external partners in the process of sharing knowledge, such as universities, research centers or firms in other sectors. The inclusion of a source of "basic" knowledge changes the dynamic relationships among firms, and increases the rate of innovations or new knowledge development. Knowledge flows not only between firms, but also toward and from research centers. The bilateral relationships of the joint venture become trilateral relationships that foster meta-learning. This approach is being used in Mexico, where public research centers in material sciences, biotechnology and telecommunications collaborate with firms in the construction of "knowledge spaces" (Casas & Santos, 2000).

Linking Knowledge from All Sources

Firms do best when they are able to link together knowledge, explicit and tacit, from external, inter-firm and internal sources. This process requires and enables rethinking of the firm's mission, structure and operation. This meta-learning is enhanced by construction of "webs of meaning" that make sense out of the learning that is occurring. This sense-making links new knowledge with structures and operations consistent with the firm's or network's

identity or mission, itself subject to changes through learning. A firm's web of meaning can be understood as a shared theory of itself as an organization operating in time and space, governing the knowledge that is made sense of, and the sense the firm itself makes. Innovative organizations, that is, those that produce knowledge, see themselves as creating value, and seek to bring tacit and explicit knowledge together despite the tensions that involves (Dougherty, Borrelli, Munir, & Sullivan, 2000).

Success in the construction of webs of meaning results in a new organizational form sometimes called a "community of practice" (Kreiner, 2000; Liedtka, 1999). Firms organized around communities of practice are characterized by loose command structures and flat hierarchies. Case studies demonstrate greater use of strategy, new product lines, wider spread of best practices and competency levels across employees and lower turnover, in both public and private corporations.

A fundamental shift in management is required. Management's primary task shifts from control to coordination, from command to stimulation of knowledge production and sharing (Wenger & Snyder, 2000). Firms characterized by communities of practice make high use of internally generated tacit knowledge. They stand in contrast to firms that primarily use external, explicit knowledge. These latter firms work best with vertical command structures and rely on conformity to expert-defined rules and procedures to obtain high productivity and quality control.

6. Implications for Knowledge Management In Education Systems

Schools and universities can be taken as the metaphorical equivalent of firms, and a study of how the business sector manages knowledge could yield useful insights for education. This is not, however, a call for mechanical transfer of experience from one sector to another: these constraints should be kept in mind.

First, concern about knowledge management is not indicated in all cases, but rather only in those sectors with a changing external environment. Not all firms have to innovate in order to survive and prosper. Some societies may be changing so slowly that schools can continue to use traditional curriculum and teaching. Where, however, consumers demand new products and there is strong competition among firms, survival requires product and process innovation. Similarly, in societies buffeted by the political and economic winds of globalization, education seeks new methods and new contents to better prepare its student-clients.

A second constraint is the fundamental differences in the social purpose and organizing values of schools and firms. The main purpose of firms continues to be to produce profits for their particular owners, while schools are intended to produce knowledge and knowledgeable citizens. There is nothing in the research reviewed above that would justify recommending that schools compete in an open market.[2] The process of transforming human beings is much more complex than that of transforming physical material or providing services.

On the other hand, schools and firms (and many other kinds of organizations) share three important conditions. First, they rely on knowledge for the accomplishment of their unique missions. Second, they operate with varying degrees of autonomy. Third, their effectiveness requires matching structure and operation to local context. Given these similarities, it is reasonable to look for parallels in the organization and management of knowledge.

The Importance of Capturing Knowledge at the School Level

Like firms, schools have the capacity through their performance to generate explicit and tacit knowledge that could be used to increase quantity and quality of learning. As currently organized, however, most schools and ministries of education lack the means to

[2] For a detailed discussion of public and private markets in education see Welsh and McGinn [, 1999 #262]

capture and share what their members know. The sad irony is that schools and ministries seldom are learning systems, but instead repeat year after year the same routines which over time decline in effect and increase in cost.

There is useful knowledge outside the system, for example about the best practices and curriculum reforms of other systems. Knowing what other systems have tried can suggest ways to solve short-term problems and to improve learning outcomes. Use of this knowledge, however, makes no lasting contribution to the intellectual capital of the importing system. After a one-shot input, staff turnover and memory decay result in performance declines.

Most transfers have been limited to component knowledge in discrete bits (e.g., about textbooks, or curriculum units, or instructional technologies) without knowledge about support structures and practices. More recently some systems have attempted to transfer knowledge about relationships or architecture through brokers or mediators. Even when local users are allowed to define their problem, however, it is difficult to transfer process and architectural knowledge from the outside. Much of what is most important in the broker's knowledge is tacit, and cannot be transmitted as such. Furthermore, routines built on transfers of explicit knowledge from outside often act to suppress the use of internally-generated knowledge that is contextually appropriate.

Examples of Internal Control of Knowledge

Some of the best national school systems (in the OECD countries) locate control over knowledge within schools. This allows them to give priority to internally-generated tacit knowledge, but also make selective use of transferred explicit knowledge from national and international sources (Center for Educational Research and Innovation, 1995). These effective systems were not designed as such but instead developed experientially. Over time they have developed their own dynamic routines and webs of meaning that make them learning systems and communities of practice. Their success has depended not so much on level of training and material resources as on relationships among practitioners.

Escuela Nueva was an example of such a knowledge management approach in a developing country, and an illustration of how difficult it is to transfer knowledge. Rural Colombian teachers were trained to share instructional units they considered effective with other teachers, who in turn tested them with their students. Teachers met frequently to identify effective units and to invent more. Over time teachers built a large collection of tested units that could be combined to match the context in which instruction was given. There were significant gains in learning outcomes and teacher competencies, and it appeared as though the system would continue to learn and improve. The experiment ceased, however, when the Ministry of Education codified the explicit knowledge part of the experiment into an official curriculum. Teachers no longer were encouraged to invent and share instructional units. Efforts to transfer the codified curriculum to other countries failed to produce the exciting results of the experiment (McGinn, 1998).

The lesson from the corporate sector is that schools require both explicit and tacit knowledge, acquired and learned by doing, but that the integration of that knowledge should occur within the school, and not externally. In practice that means that:

--knowledge "needs" should be determined locally and not externally;

--local knowledge management capacity takes priority over external capacity;

--training in sense-making within communities of practice must accompany training in knowledge assimilation.

The lesson to be inferred from advances in the corporate world is that improvement of a national education system requires increasing knowledge capacity in local schools while also pursuing their integration with others. This has serious implications for international agencies committed to development of national education.

The mission of these agencies should be to assist countries to develop their own internal networks of knowledge production and utilization. The agencies should not confuse this mission with the task of improving their own knowledge management capacities. To do so may improve an agency's competitiveness but have no benefit for schools and ministries of education. The more an agency develops its own internal coherence and consensus, the more tacit will be its knowledge, and the less able it will be to help others with their own problems.

If, however, an agency defines itself as part of a larger system, then it can work with others in construction of shared knowledge that benefits all. Agencies contribute most to improvement in ministries and schools not by telling them about someone else's best practices, but by enabling them to have and identify effective practices of their own.

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