

INFORMATION
MANAGEMENT
FOR THE
INTELLIGENT
ORGANIZATION

The Art of Scanning the Environment

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Chapter I

The Intelligent Organization

Organizations are societies of minds. Actions and decisions are not the simple outcome of any single, orderly activity: they emerge from an ecology of information processes. A diversity of participants and points of view collaborate together as well as challenge each other. We now recognize this dynamic, open character of organizations. Yet for a long time we cherished a static view--organizations were places where we went to work everyday. They could be counted on to produce the goods and services we want, and some of them were responsible for preserving and protecting, structures and values that underpin our society. Their very stasis and stability was a source of comfort.

Organizations saw themselves almost as fortresses, with walls and boundaries that etched their domains of activity and influence. From time to time they would open the gates to send out produce or to receive material, but this was not their primary concern. Early students of organizations made the simplifying assumption that organizations were closed systems, and the effective organization was one that could buffer its operations from the vicissitudes of the outside world and thus concentrate on improving its internal form and function. For most purposes, the external environment was a given in the short run: markets changed sluggishly, and could sometimes be manipulated; technologies moved in small steps and could be assimilated incrementally; relationships with other organizations were clear-cut and cautious; economic conditions turned in periodic cycles that could occasionally be predicted. On the whole, most organizations, especially the larger ones, felt that they were in control of their own destinies.

What magical trick makes us intelligent? The trick is that there is no trick. The power of intelligence stems from our vast diversity, not from any single, perfect principle. Our species has evolved many effective although imperfect methods, and each of us individually develops more on our own. Eventually, very few of our actions and decisions come to depend on any single mechanism. Instead, they emerge from conflicts and negotiations among societies of processes that constantly challenge one another.
(Marvin Minsky 1986, The Society of Mind, Section 30.8)

Now, this static representation of organizations has become a relic. Today's organizations are no longer circumscribed by walls and boundaries. Their borders are porous, through which materials, energy, and information continuously flow. Instead of trying to do everything, they now parcel out their work to other organizations so that each can maximize its strengths and advantages. A significant proportion of organizations do not live long. Some fall and disappear altogether, while others pursue alliances and linkages to increase their leverage and survivability. They spin networks that include competitors, customers, and suppliers. Rather than fortresses, they are more like species of organisms seeking sustenance and growth in a dynamic environment. Their credo says "evolve or perish." Their eyes are perpetually fixed on the external environment, watching markets shift from day to day, industries jostle to reconfigure themselves, technological innovations intrude at an unremitting pace, and government policies constrain or create options. Today's organizations realize that aiming to insulate themselves from their environments is a lost cause. Instead, they now behave as complex, open systems that share many features with living biological systems. Above all, they recognize that their survival and growth is ultimately conditioned by their capacity to learn and adapt to a changing environment.

This chapter looks closer at the relationship between organizations and environments--why do some organizations survive and grow decade after decade, while something like a third of the companies in the Fortune 500 list have disappeared over the last five years? We suggest that survivability is dependent on the organization's ability to process information about the environment, and to turn this information

into knowledge that enables it to adapt effectively to external change. Further, we suggest that such adaptability through learning is the hallmark of the intelligent organization. Learning is the key to intelligent organizational behavior in a fast-changing environment.

Organizations and Environments

Soon after the Second World War, the relationship between organizations and environments became a subject of frequent research. In organization theory, we may differentiate between three ways of analyzing the relationship between organizations and their environments. The external environment may be viewed as a source of information, as a pool of resources, or as an ecological milieu (Aldrich and Mindlin 1978, Aldrich 1979).

Environment as a Source of Information

One of the first researchers to view the environment as a source of information was Dill (1958, 1962). He suggests that the best way to analyze the environment is not to try to understand it as a collection of other systems and organizations but rather to

treat the environment as information which becomes available to the organization or to which the organization, via search activity, may get access. It is not the supplier or the customer himself that counts, but the information that he makes accessible to the organization being studied about his goals, the conditions under which he will enter into a contract, or other aspects of his behavior (Dill 1962, 96).

Changes, events, and trends in the environment continually create signals and messages. Organizations detect or receive these cues and use the information to adapt to new conditions. Arrow (1964) proposed a theory of control and information in large organizations in which managers receive "signals" from the environment and from other managers. These signals modify their perceptions of the state of the job-related world. When decisions are based on these messages, further information is generated and transmitted, and these in turn lead to new signals and

decisions. This informational view of the organizational environment is implicit in the work of several other researchers, with the common thread that because uncertainty is inherent in the environment, a basic management task requires coping with this uncertainty (Burns and Stalker 1961, Cyert and March 1963/1992, Lawrence and Lorsch 1967, Thompson 1967, Galbraith 1973, and Weick 1979).

Early studies examined how organizations adapt to external environments characterized by rules, procedures, and clear hierarchy of control. Conversely, firms in rapidly changing environments had organic structures that were freer and more flexible, and decision making was decentralized. They conclude that an essential part of a top manager's job is to interpret correctly the external uncertainties facing the firm, and so decide on the appropriate management structure. Another classic study of organizations in three industries (Lawrence and Lorsch 1967) found that the more varied and uncertain the environment confronted by an organization, the more *differentiated* the organization structure needs to be. At the same time, the more differentiated the structure, the more effort must be given to the *integration* of the various subunits. For an organization to be "co-aligned" with its environment, the differentiation and integration of the organization as a whole should match its environment. According to Thompson (1967), the fundamental problem facing complex organizations is managing the organizational task environment. He proposes that organizations will vary systematically in structure and behavior to reflect the level of uncertainty inherent in their environments. The more heterogeneous and shifting an organization's task environment, the more boundary-spanning differentiation it will show, the more attention it will give to environmental monitoring activities, and the more it will rely on planning to achieve adaptation.

Environment as a Source of Resources

Another perspective views the environment primarily as a source of resources upon which the organization depends. Three structural characteristics of the environment affect resource dependence: munificence, or the abundance of resources; concentration, the extent to which power and authority in the environment is widely dispersed; and interconnectedness, the number and pattern of linkages among organizations in the environment. The degree

of dependence would be great when resources are scarce, and when entities in the environment are highly concentrated or interconnected:

To survive, organizations require resources. Typically, acquiring resources means the organization must interact with others who control those resources. In that sense, organizations depend on their environments. Because the organization does not control the resources it needs, resource acquisition may be problematic and uncertain. Others who control resources may be undependable, particularly when resources are scarce. Organizations transact with others for necessary resources, and control over resources provides others with power over the organization. Survival of the organization is partially explained by the ability to cope with environmental contingencies; negotiating exchanges to ensure the continuation of needed resources is the focus of much organizational action. (Pfeffer and Salancik 1978, 258).

An organization can manage increasing dependence by setting up coordination links and connections among the interdependent organizations in its environment. Pfeffer and Salancik (1978) identify four general strategies. First, it can adapt to or avoid the external demands: for example, when confronted by powerful external organizations, it can use secrecy or restriction of information to avoid influence attempts. Second, it can alter the patterns of interdependence through growth, merger, and diversification--in other words, it can absorb the parts of the environment on which it depends. Third, it can establish collective structures of interorganizational behavior through the use of interlocking directorates, joint ventures, industry associations, and non-native restraints--forming a "negotiated environment." Last, it can create the organizational environment through law, political action, and altering the definitions of social legitimacy--forming a "created environment."

Environment as a Source of Variation

In the third perspective, the environment is viewed as an ecological milieu that differentially selects certain types of organizations for survival on the basis of the fit between organizational forms and

environmental characteristics. The focus here is on the action of environmental *selection* processes, with the organizations being relatively passive and unable to determine their own fates. This ecological view, developed principally by Hannan and Freeman (1977, 1989) and Aldrich (1979), applies evolutionary biology to explain why certain forms (or species) of organizations survive and thrive, while other types languish and perish (a 1987 *Forbes* magazine survey found that of the top 100 industrial firms in 1917, only 17 survived in 1986).

Organizational change takes place through three stages of variation, selection, and retention. The *variation* stage may be introduced by the creation of new organizations or the transfer of existing organizations to new owners. In the *selection* stage, the purest form of environmental selection is the survival or elimination of entire organizations. Organization forms survive or fall depending on their fitness for a particular environmental niche. In the *retention* stage, several organizational mechanisms preserve structure and knowledge. Bureaucratic administrative structure and procedures, socialization of new members, leadership succession, and so on, help preserve organizational forms, increasing the probability of their retention, if environmental selection criteria are met. Positively selected variations survive and reproduce similar others, which then form a starting point for a new round of selection (Aldrich and Pfeffer 1976).

Summary

The relation between organizations and environments continues to be a major area of study in organization theory. Indeed, the shift towards an "open systems" view of organizations in recent years has concentrated attention on the role of the environment as "the ultimate source of materials, energy, and information, all of which are vital to the continuation of the system." (Scott 1987, 91) In the information view of the environment, decision makers use information from the environment for maintaining or changing organizational structures and processes. The resource view focuses on how dependent the organization is on others (especially other organizations) for the resources it requires. The population ecology model analyzes environmental factors as the forces of change, and studies organizations as populations or species rather than as individual systems.

Organizational Information Processing

Organizations as Information Processing Systems

A number of important theories treat organizations as information processing systems. The information processing approach seeks to understand and predict how organizations perceive stimuli, interpret them, store, retrieve, and transmit information, generate judgments, and solve problems (Larkey and Sproull 1984). Although no unified theory of organizational information processing exists, the field appears to concentrate on organizational participants as information processors, and on organizational systems and structures that contribute to information processing. The accelerating interest in the information processing view is driven by the deficiencies of theoretical views that ignore information processing behaviors, the rapid diffusion of information processing technologies, and the increasing information processing content of organizational tasks.

It is possible to differentiate two research orientations in the literature on organizational information processing (Choo 1991). The first regards organizations as rational, decision making systems. Unfortunately, the individual as decision maker is bounded by cognitive limitations. The task of organization design is thus to control the decision premises that guide decision making behavior. Information is processed in order to reduce or avoid uncertainty. The organization sets its goals first, then searches for alternatives, and selects courses of action which lead to goal attainment. This decision making perspective was first developed by Herbert Simon, James March and Richard Cyert, and became very influential in organization theory.

The second orientation sees organizations as loosely coupled social systems. Individual actors enact or create the environment to which the organization then adapts. The task of organizing is to develop a shared interpretation of the environment and then to act on the basis of this interpretation. Information is processed in order to reduce or resolve equivocality. Actions are often taken first and then interpreted retrospectively: in other words, action can precede goals. This "enactment" perspective was suggested by

Karl Weick who, together with Richard Daft, later proposed a model of organizations as interpretation systems.

Organizations as Decision Making Systems

According to Simon (1976), the human mind can only exercise bounded or limited rationality, so that the individual in an organization constructs a simplified model of the real world in order to deal with it and then looks for a course of action that is satisfactory or good enough ("satisfices"). (Simon 1976, xxvii-xxx) A basic problem of organizing is to define the decision premises that form the organizational environment: "The task of administration is so to design this environment that the individual will approach as close as practicable to rationality (judged in terms of the organization's goals) in his decisions" (Simon 1976, 240-241).

The organization influences its members' behaviors by controlling the decision premises upon which decisions are made, rather than controlling the actual decisions themselves (Simon 1976, 223). Because of the limitations of the human mind, decision making in organizations requires "simplifications," particularly in the use of action or performance programs that constrain the decision behaviors of individuals.

A theory of organizational decision making must consist of a theory of *search* and a theory of *choice* (Cyert and March 1963, 10). Decision makers are not automatically presented with problems to solve and alternative solutions to choose from. They must identify problems, search for solutions, and develop methods to generate and evaluate alternatives. In other words, the decision makers must actively search for the required information, since such information is not readily available (Stabell 1978).

According to Cyert and March (1963), information search in organizations is "problem-motivated," "simple-minded," and "biased." The recognition of a problem initiates the search for ways to solve it, and once a way is found then the search stops. Search is "simple-minded"--when a problem occurs, search for a solution is concentrated near the old solution and often relies on available and familiar sources of information. Search is "biased" in that it reflects the training, experience and goals of the participants.

Organizations as Interpretation Systems

In contrast to the perspective of organizations as decision-making systems, Weick (1979) proposes a model of organizations as "loosely coupled" systems in which individual participants have great latitude in interpreting and implementing directions. He stresses the autonomy of individuals and the looseness of the relations linking individuals in an organization.

Although he also views organizations as information processing systems, the purpose of processing information is not decision making or problem solving in the first instance.

Instead, the focus is on reducing the *equivocality* of information about the organization's external environment. Managers as information processors receive information about the external environment and then create or *enact* the environment to which they will attend. In creating the enacted environment, managers separate out for closer attention selected portions of the environment based on their experience. Weick, together with Daft, later extended this enactment theory into a model of organizations as interpretation systems (Weick and Daft 1983).

Organizations receive information about the environment that is ambiguous. Within the organization, various subunits adopt dissimilar frames of reference to view changes in the environment.

Weick and Daft conclude that

organizations must make interpretations. Managers literally must wade into the swarm of events that constitute and surround the organization and actively try to impose some order on them Interpretation is the process of translating these events, of developing models for understanding, of bringing out meaning, and of assembling conceptual schemes. (Weick and Daft 1983, 74)

What is being interpreted is the organization's external environment, and how the organization goes about its interpretation depends on how analyzable it perceives the environment to be and how actively it intrudes into the environment to understand it. Whether the organization perceives that the environment is objective and that events and developments are analyzable, or that the environment

is subjective and essentially unanalyzable, will affect its choice of interpretation mode. Furthermore, some organizations scan, interpret, and learn. Scanning is the moni

Summary

Both the decision making and interpretation perspectives are complementary ways of understanding information seeking and use in organizations. Rational, systematic decision making is probably better suited to solving problems where issues are clearly identified. On the other hand, collective interpretation may be needed in dealing with problems where issues are unclear and information is ambiguous. Any attempt to study the use of information in organizations would benefit from applying the two points of view. James March, one of the preeminent scholars of organizational decision making, recently observed that

decision makers often operate in a surveillance mode rather than a problem-solving mode. In contrast to a theory of information that assumes that information is gathered to resolve a choice among alternatives, decision makers scan their environments for surprises and solutions. They monitor what is going on. They characteristically do not "solve" problems; they apply rules and copy solutions from others. (March 1991, 112)

The Intelligent Organization

The picture we have so far is of an organization that behaves as an open system that takes in information, materials, and energy from the environment, and transforms these resources into knowledge, processes, and structures that produce goods or services that, in turn, are consumed by the environment. The relationship between organizations and environment is thus both circular and critical: organizations depend on the environment for resources and for the justification of their continued existence. Because the environment is growing in complexity and volatility, continuing to be viable requires organizations to learn enough about the current and likely future conditions of the environment, *and* to apply this knowledge to change their own behavior and positioning in a timely way.

Students of organizations have wrestled with the concept of organizational intelligence for several

decades. Wilensky (1967) discussed organizational intelligence in terms of the gathering, processing, interpreting, and communicating of the information needed in decision making processes. Information is not only a source of power, but a source of confusion--information oversupply has exacerbated the problem of intelligence. The roots of organizational intelligence failures can often be traced to doctrines, structures, and problems and processes that increase distortion and blockage. In Wilensky's analysis, much of an organization's defense against information pathologies lies in managers' attitudes toward knowledge, and in information specialists' capacities to influence strategic discourse.

March and Olsen (1979) believed that organizational intelligence is built on two fundamental processes: "rational calculation" and "learning from experience." Rational calculation is the choice of alternatives based on an evaluation of their expected consequences according to preferences. It looks ahead into the future to anticipate outcomes. Learning from experience is the choice of alternatives based on rules developed from an accumulation of past experience. It looks backwards at history to find guidance for future action. March and Olsen observed that as we have come to recognize the limitations on rational calculation, interest in the potential for organizational learning as a basis for organizational intelligence has increased. Organizations and the people in them learn through their interactions with the environment: "They act, observe the consequences of their action, make inferences about those consequences, and draw implications for future action. The process is adaptively rational." (March and Olsen 1979, 67)

Recently, Quinn (1992, 373) described an intelligent enterprise as "a firm that primarily manages and coordinates information and intellect to meet customer needs." The intelligent enterprise depends more on the development and deployment of intellectual resources than on the management of physical and fiscal assets. Its functions are disaggregated into manageable intellectual clusters that Quinn calls "service activities." Information technology has made it possible to delegate and outsource many of these service activities to other organizations. Instead of focusing on products, the intelligent enterprise excels in a few core knowledge-based service activities critical to its customers and surrounds these with other

activities necessary to defend the core. Then it uses advanced information, management, and intelligent systems to coordinate the many other diverse and often dispersed activity centers needed to fulfill customer needs.

Apple Computer Inc. is an example of creating value by leveraging on a few critical knowledge-based service activities. The Apple II computer was primarily a software and marketing breakthrough that helped to launch the PC revolution. The machine retailed for about \$2000 but cost less than \$500 to build, with 70 percent of the components purchased from outside. Apple did not try to manufacture its computers' microprocessors, circuit boards, housings, keyboards, monitors, or power supplies. All of these components were outsourced while Apple concentrated on concept design, software, logistics, systems integration, and product assembly (Quinn 1992, 42).

Until today, Apple's human-computer interface design guidelines still set the standards for elegance and user friendliness. Outsourcing was not limited to hardware. Apple worked with Dan Breklyn to develop Visicalc (the first spreadsheet) and for over a year, Apple II was the only computer to support Visicalc. The Apple brand name and logo was designed by the public relations agency Regis McKenna to help project Apple's image at a time when the company had almost no sales. For product distribution, Apple joined with Bell & Howell, a reputable supplier to the education market, to help place Apple products in schools. As a result of its concentrating on a few knowledge-adding services while developing partnerships in complementary areas, Apple was able for many years, to attain sales per employee figures that were two to four times higher than its competitors.

Haeckel and Nolan define an organization's intelligence as its "ability to deal with complexity, that is, its ability to capture, share, and extract meaning from marketplace signals." (Haeckel and Nolan 1993, 126) In turn, an organization's complexity is a function of how many information sources it needs, how many business elements it must coordinate, and the number and type of relationships binding these elements. According to their analysis, an organization's intelligence quotient" is determined by three critical attributes: the ability to access knowledge and information (connecting); the ability to integrate and

share information (sharing); and the ability to extract meaning from data (structuring). *Connecting* means that information sources, media, locations, and users are linked in such a way that accurate information can be captured and made available to the right users at the right time and place. *Sharing* means that people in the organization can share data, interpretations of the data, as well as their understanding of the core processes of the organization. *Structuring* means that insight or meaning is obtained by matching and relating information from multiple sources so that some form of pattern or trend emerges.

An organization achieves structuring by creating information about information, for instance, how data are organized, related and used. Classification categories indexes, tables of contents, and data models are some examples of filtering and structuring data. Haeckel and Nolan believe that structuring holds the most potential for the strategic exploitation of information. To illustrate a firm applying the connecting-sharing- structuring loop, they describe the system used by Wal-Mart and its suppliers to replenish stocks. For example, Wal-Mart transmits detailed data about the day's sales to its jeans supplier Wrangler every evening. Sharing is not limited to data: the two firms also share a model that interprets the meaning of the data, and software applications that act on the interpretation to specify quantities of jeans of the right sizes and colors to be sent to particular stores from specific warehouses. As fashion seasons or pricing patterns change, the shared data model is

adjusted accordingly, thus allowing both organizations to learn and adapt.

There are two distinct meanings to the concept of intelligence: the possession of knowledge and the creation of knowledge (Gregory 1981, 1994). Possession provides a pool of knowledge that can be called upon to solve problems and give understanding. The creation of knowledge takes place when novelty is generated to solve new problems for which adequate solutions cannot be found in the knowledge base. Indeed, the creation of successful novelty is a convincing mark of intelligent behavior. The context of intelligent behavior is thus problem solving, and problem solving implies the pursuance of goals and objectives. The requirement for novelty is linked to the appearance of new problems, situations, and experiences. Intelligence may be conceived as a quality of behavior: behavior that is adaptive in that it represents effective ways of meeting the demands of environments as they change (Anastasi 1986). We see therefore that intelligent behavior is both goal-directed and adaptive (Sternberg 1982. Sternberg and Detterman 1986). and it will be the capacity of organizations to possess, create, and apply knowledge that will make the crucial difference.

An organization works with three classes of knowledge: tacit knowledge, rule-based knowledge, and cultural knowledge (Choo 1998). Tacit *knowledge* consists of the hands-on skills, special know-how, heuristics, intuitions, and the

Table 1.1. Three Types of Organizational Knowledge

| <i>Type</i> | <i>Form</i> | <i>Examples</i> | <i>Use</i> |
|-----------------------------|--|--|---|
| Tacit Knowledge | <ul style="list-style-type: none"> –Procedural –Embedded in action | <ul style="list-style-type: none"> • Know-how • Heuristics • Intuitions | <ul style="list-style-type: none"> • Ensures task effectiveness, stimulates creativity |
| Rule-based Knowledge | <ul style="list-style-type: none"> –Declarative –Encoded in programs | <ul style="list-style-type: none"> • Routines • Standard operating procedures • Record structures | <ul style="list-style-type: none"> • Promotes efficiency, coordination, control |
| Cultural Knowledge | <ul style="list-style-type: none"> –Contextual –Expressed in discourse | <ul style="list-style-type: none"> • Stories/metaphors • Mindsets/worldviews • Visions/scenarios | <ul style="list-style-type: none"> • Assigns significance to new information and knowledge |

like that people develop as they immerse in the flow of their work activities. Tacit knowledge is deeply rooted in action and comes from the simultaneous engagement of mind and body in task performance. Tacit knowledge is personal knowledge that is hard to formalize or articulate (Polanyi 1966, 1973). The transfer of tacit knowledge is by tradition and shared experience, through for example, apprenticeship or on-the-job training. Tacit knowledge in an organization ensures task effectiveness - that the right things are being done so that the work unit could attain its objectives. It also provides for a kind of creative robustness--intuition and heuristics can often tackle tough problems that would otherwise be difficult to solve.

Whereas tacit knowledge is implicit, *rule-based knowledge* is explicit knowledge that is used to match actions to situations by invoking appropriate rules. Rule-based knowledge guides action by answering three questions: What kind of situation is this? What kind of person am I or What kind of organization is this? and finally, What does a person such as I, or an organization such as this, do in a situation such as this? (March 1994) Rule-based knowledge is used in the design of routines, standard operating procedures, and the structure of data records. Rule-based knowledge enables the organization to ensure a high level of

operational efficiency, coordination, and control. It also facilitates the transfer of learning within the organization.

The third kind of organizational knowledge is cultural *knowledge*. This is knowledge that is part of the organization's culture and is communicated through oral and verbal texts such as stories, metaphors, analogies, visions, and mission statements. Cultural knowledge includes the assumptions and beliefs that are used to describe and explain reality, as well as the conventions and expectations that are used to assign value and significance to new information (Schein 1991). Cultural knowledge assigns significance to new information by supplying values and norms that "determine what kinds of knowledge are sought and nurtured, what kinds of knowledge-building, activities are tolerated and encouraged. ... Therefore, values serve as knowledge-screening and -control mechanisms." (Leonard-Barton 1995, p. 19)

All three forms of knowledge can be found in any organization (Table 1.1). The intelligent organization however, is skilled at continuously expanding, renewing, and refreshing its knowledge in all three categories. The intelligent organization promotes the accumulation of tacit knowledge to increase the skill and creative capacity of its employees, takes advantage of rule-based knowledge

to maximize efficiency and transfer learning, and develops cultural knowledge to shape purpose and meaning in its community. In effect, the intelligent organization has mastered a fourth class of knowledge - a higher order or metaknowledge--that it uses to create, integrate, and invigorate all its intellectual resources in order to achieve superior levels of performance.

Is the kind of intelligent organization we have described an unattainable goal or do such firms exist in reality? We believe that examples of intelligent knowledge creation may be found in Japanese companies such as Canon, Honda, Matsushita, NEC, and Sharp. These companies are widely admired for their ability to innovate continuously, recognize and respond swiftly to customer needs, dominate technologies while they are still emerging, and bring new high-quality products to market with impressive speed. For example, Canon reinvented the 35mm camera, pioneered the personal photocopier and color copier, invented the laser printer and ink-jet printer, and is now working on using ferroelectric liquid crystals for large flat panel displays. Judged by the number of United States patents granted, Canon can claim to be the world's most consistently creative company-for a fifth of the R&D budget, Canon has obtained about as many patents as IBM (Johnstone, 1994a). Or consider Honda's history of agile adaptiveness: it gained a late but successful entry into the highly competitive automobile market, won victory in the motorcycle war against an established leader (Yamaha), and developed its own automotive engine that set new standards in fuel-efficiency and pollution control. Many regard Honda as one of the best managed companies in the world (Pascale 1990).

A Japanese scholar explains the success of companies such as Canon, Honda and Matsushita:

The centerpiece of the Japanese approach is the recognition that creating new knowledge is not simply a matter of "processing" objective information. Rather, it depends on tapping the tacit and often highly subjective insights, intuitions, and hunches of individual employees and making those insights available for testing and use by the company as a

whole. The key to this process is personal commitment, the employees' sense of identity with the enterprise and its mission. Mobilizing that commitment and embodying tacit knowledge in actual technologies and products require managers who are as comfortable with images and symbols ...

A company is not a machine but a living organism.] important, how to make that world a reality....

In the knowledge-creating company, inventing new knowledge is not a specialized activity-the province of the R&D department or marketing or strategic planning. It is a way of behaving, indeed a way of being, in which everyone is a knowledge worker-that is to say, an entrepreneur. (Nonaka 1991, 97)

The intelligent organization adopts a holistic approach to knowledge management that successfully combines tacit, rule-based, and background knowledge at all levels of the organization. Tacit knowledge is cultivated in an organizational culture that motivates through shared vision and common purpose. Personal knowledge is leveraged with explicit knowledge for the design and development of innovative products, services and processes. Strategic vision and operational expertise are fused in creative action.

Intelligence Through Organizational Learning

An intelligent organization pursues its goals in a changing external environment by adapting its behavior according to knowledge about its external and internal settings. In other words, an intelligent organization is a *learning organization* that is skilled at creating, acquiring, and transferring knowledge, and at modifying its behavior to reflect the new knowledge and insights (Garvin 1993). Learning thus begins with new knowledge and ideas that may be created in-house, or may come from external sources, but must

be applied to change the organization's goals and behaviors in order for learning to be complete. Failure to learn often means failure to survive: nearly 30 percent of the corporations in the Fortune 500 list of five years ago are missing today (Pascale 1990); and for every successful turnaround there are two declining firms that do not recover (de Geus 1988).

When the Royal Dutch Shell Group surveyed 30 firms that had been in business for over 75 years, it attributed their longevity to "their ability to live in harmony with the business environment, to switch from a survival mode when times were turbulent to a self-development mode when the pace of change was slow.... Outcomes like these don't happen automatically. On the contrary, they depend on the ability of a company's senior managers to absorb what is going on in the business environment and to act on that information with appropriate business moves. In other words, they depend on learning." (de Geus 1988, 70).

Much of an organization's learning is from past experience. After the problem-plagued launch of their 737 and 747 planes, Boeing formed an employee group called "Project Homework" to compare the development of the 737 and 747 with that of the 707 and 727, hitherto two of the firm's most lucrative planes. After working for three years, Project Homework identified hundreds of lessons learned and recommendations. Some group members were moved to the 757 and 767 start-ups which eventually produced the most successful, error-free launches in Boeing's history (Garvin 1993). In another example of learning from the past, British Petroleum established a five-person project appraisal unit that reported directly to the board of directors. Every year, the unit reviewed six major investment projects, wrote them up as case studies, and derived lessons to guide future planning. This form of review is now done regularly at the project level. (Gulliver 1987).

Single-Loop and Double-Loop Learning

Effective learning must stretch beyond detecting and correcting past errors. Sometimes, basic

questions about the norms, policies, and goals of the organization need to be answered afresh. In a classic discussion, Argyris and Schon (1978) describe organizational behavior as being governed by the organization's theory of action which includes the norms for organizational performance, strategies for achieving norms, and assumptions which bind strategies and norms together. Organizational learning takes place when members respond to changes in the external and internal environments by detecting and correcting errors between outcomes and expectations. Error correction is through modifying organizational strategies, assumptions, or norms in order to bring outcomes and expectations back into line. The altered strategies, assumptions or norms are then embedded into the organization's memory.

Two modes of organizational learning are possible (Figure 1.1). Learning is *single-loop* when the modification of organizational action is sufficient to correct the error without challenging the validity of existing organizational norms. In other words, there is a single feedback loop between detected outcomes to action which is adjusted so as to keep performance within the range set by organizational norms. The goal of single-loop learning is therefore to increase organizational effectiveness within existing norms. Learning is *double-loop* when error correction requires the modification of the organizational norms themselves, which in turn necessitates a restructuring of strategies and assumptions associated with these norms. Learning in this case is double-loop because a double feedback loop connects error detection not only to organizational action but also to the norms. The goal of double-loop learning is therefore to ensure organizational growth and survivability by resolving incompatible norms, setting new priorities, or restructuring norms and their related strategies and assumptions. While single-loop is adaptive and is concerned with coping, double-loop is generative learning and has to do with creating new mind sets.

One loop is generative learning and has to do with creating new mind sets.

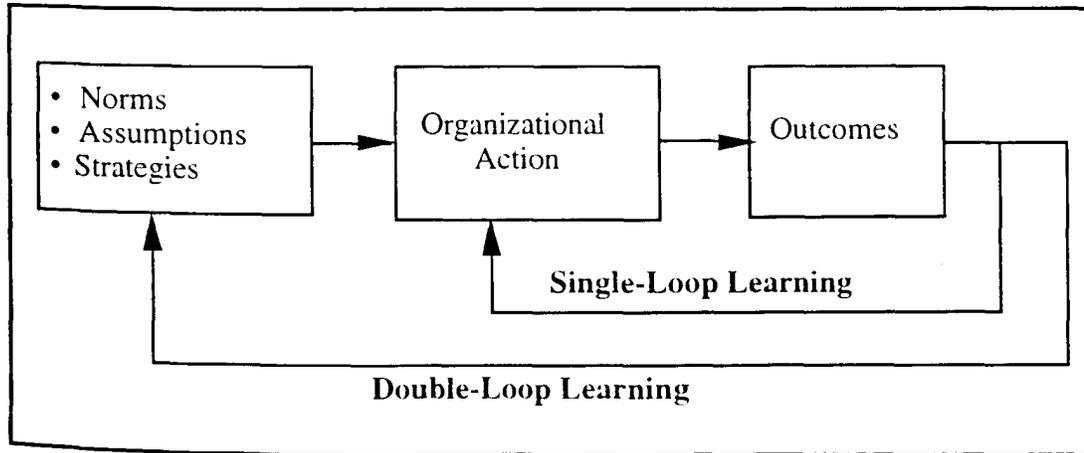


Figure 1.1 Single- and Double-Loop Learning

Many organizations have become quite good at single-loop learning—they measure their performance according to objectives, and correct deviations by changing operational procedures. Far fewer organizations are adept at double loop learning, and not many organizations challenge their own norms, goals, or policies in relation to their changing environments. If budgeting is the archetypal mechanism for single-loop learning, then strategic planning is the tool for double-loop learning.

Current uncertainty about the value of strategic planning may reflect as much on the inability of organizations and their managers to engage in generative learning as on the inherent difficulty of strategic planning. Royal Dutch/Shell benefited from double-loop learning through its preparedness for the 1973 oil crisis. From its scenario planning exercises, Shell was able to change the conceptual frames of reference that its managers used to perceive reality about the world (Wack 1985a, 1985b), Shell's managers have been assuming that oil demand will continue to grow at rates higher than GNP in a calm political environment where oil supply was unproblematic, a set of norms that the managers had taken for granted for some time. The planning scenarios forced them to challenge these norms and to think about a low-growth world where oil consumption was increasing more slowly than GNP, where oil producers were reaching the limits of their capacities and were reluctant to raise output further because they were unable to absorb the additional

revenues. As a result, Shell management was better prepared for the 1973 oil shock, and was able to more quickly revise its assumptions and strategies to respond to the new realities of tight oil supply-demand.

Although many organizations realize that change and learning are needed, they have difficulty stepping out of their existing mental models to learn from the experience of change. Organizational learning should not be equated with organizational change. Incremental change based on existing assumptions and parameters does not constitute learning. Instead, the intelligent organization learns to change as well as learn from change (McGill and Slocum 1994). The key is to unlearn the past, discard processes and practices that are previously known or believed to be smart. Intelligent organizations learn by assimilating their experiences with customers, competitors, partners, and so on, and using this knowledge to rejuvenate their mental frames of reference.

McGill and Slocum (1994) distinguish between four kinds of organizational intellects: the knowing organization, the understanding organization, the thinking organization, and the learning organization. The knowing organization is dedicated to finding the "one best way" to do business. The understanding organization believes in a "ruling myth" and uses strong cultural values to guide actions and strategies. The thinking organization sees business as a series of problems that need to be solved or fixed. Finally, the learning organization sees every business experience as

an opportunity to improve-it models learning,
encourages experimentation, and promotes dialogue.

Future Learning

It is not enough to learn from the past, the intelligent organization must also be able to learn about the future. Hamel and Prahalad (1994) call learning about the future developing "Industry foresight" and assuming "intellectual leadership." Developing foresight starts by gaining a deep understanding of the trends and discontinuities in technology, demographics government regulation, and social lifestyles--forces that will draw the competitive space of the future. Developing foresight is creating a point of view of the future that answers three key questions: What new kinds of benefits for customers or clients should the organization provide in the future'? What new competencies are needed to offer these benefits'? and How will the interface with customers or clients need to be redesigned?

Identifying future opportunities requires not only a profound understanding of the underlying drivers but also the courage and capability to imagine the future. Envisioning possibilities "grows out of a childlike innocence about what could be and should be, out of a deep and boundless curiosity on the part of senior executives. and out of a willingness to speculate about issues where one is, as of yet, not an expert." (Hamel and Prahalad 1994, 82-83) Having the knowledge and imagination to develop industry foresight will establish the organization as intellectual leaders who can influence the direction and form of the industry it is in, and so allow the organization to regain control of its own destiny.

An example of envisioning and enacting the future on a national scale is the National Computer Board (NCB) of Singapore. the agency responsible for designing and implementing the country's national plans to use information technology to move Singapore into the front ranks of the information age (Choo 1995). Singapore is a small island state with a population of 2.8 million that enjoys one of the highest living standards in the world. Devoid of natural resources, Singapore recognized early that information technology must lever the skills and diligence of its citizens. The NCB was established in 1981, and one of its first responsibilities was to manage an ambitious program to computerize the civil service. The future vision was to provide the public with a Significantly better and wider range of services while improving productivity. At that time, the missing competency was

indigenous expertise for information systems development. The NCB actively promoted a number of joint projects with foreign partners, training centers, overseas education and training schemes, incentive measures, and so on, to quickly build up a critical mass of Computer professionals. The civil service computerization is an ongoing success--a recent audit showed that the government had obtained a return of over

2.7 dollars for every dollar spent on information technology in the program, and had avoided the need for some 5000 posts (NCB 1992). In the ensuing National Plan (1986-1990), the focus moved to the private sector, where the new vision was to create a strong export-oriented, local IT industry, and to exploit IT to enhance business performance. The required competencies were to be an awareness and understanding of how IT could be used strategically, and tile local technical capabilities to develop world-class IT applications.

Through partnership programs, joint ventures, showcase projects, the innovations of local R&D institutes, promotional activities, incentives and subsidies, and so on, a vibrant local IT industry emerged, growing at a compound annual rate of 30 percent between 1982 and 1990. A number of leading edge IT applications made their debuts, including a national electronic data interchange network (TradeNet) linking traders and government departments, and an expert system for ship planners in the port of Singapore. Both applications are used as case studies of exemplary strategic IT applications in the leading business schools of North America, and have spawned even more ambitious sister projects in Singapore. In 1991, the republic set its sights higher and launched its current IT2000 master plan, to use advanced information technologies to transform the city-state into a networked, intelligent island. According to the IT2000 vision, IT will enable Singapore to turn into a global business hub, boost its economic engine, enhance the potential of individual citizens, link its communities both locally and globally, and improve the quality of life (NCB 1992). The new competencies now include expertise in working with broadband networks, multimedia, and telecomputing; and building an information infrastructure based on technical and legal standards. The role of the NCB as master planner and architect of Singapore's IT destiny

has been in defining future visions of Singapore as an IT-enabled society, in acquiring and developing the required competencies, and in reaching out to industry, government, and the public to promote the use and acceptance of IT.

The Intelligence/Learning Cycle

For the intelligent organization, learning and adaptation are behaviors that must paradoxically embrace their own opposites. Organizational learning necessarily includes *unlearning* about the past—the organization should not restrict learning and exploration to its existing markets, products or practices, but should rediscover new goals and responses by stepping out of habitual frames of reference and reexamining norms and assumptions (Hedberg 1981). Similarly, adapting to an environment necessarily includes *creating* an environment that is advantageous to the organization. After all, the external environment consists of other organizations, and every organization is in fact part of larger

ecological systems whose members are bound together by common interests and interlocking activities (Moore 1993). In creating the environment, an organization, either by itself or with its partners, develops foresight about future benefits that it can deliver, grows capabilities to provide these benefits and so ensure a future for itself (Hamel and Prahalad 1994). Creating the environment is more than reactively enacting or interpreting the environment, and more than finding a matching fit with the environment. In effect, the intelligent organization can engineer such a fit through its deep understanding of the forces and dynamics that give shape to the future.

The organizational intelligence/learning process is a continuous cycle of activities that include sensing the environment, developing perceptions and generating meaning through interpretation, using memory about past experience to help perception, and taking action based on the interpretations developed (Figure 1.2).

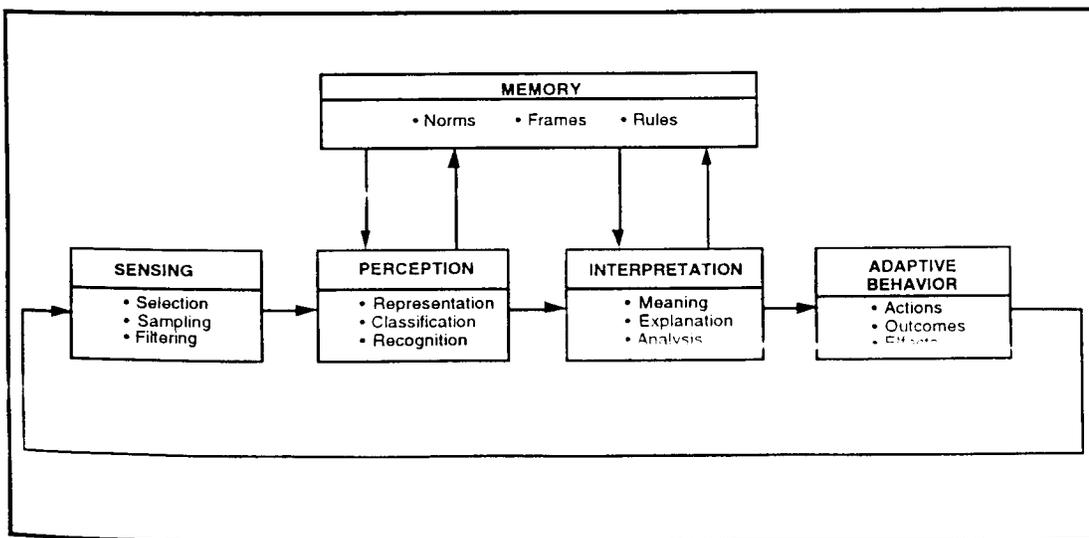


Figure 1.2 Organizational Intelligence/Learning Cycle

-- *Sensing* is collecting information about the external and internal environment. Because the organization cannot attend to every event or development, it must select areas of priority, filter incoming data according to its interests, and sample events for learning.

-- *Memory* is derived from the experiences of the organization in interacting with the environment, and is expressed formally (documents, procedures) and

informally (beliefs, stories). Experience develops rules that are used to match situations with appropriate responses, and frames that are used to define problems and their salient dimensions.

-- *Perception* is the recognition and development of descriptions of external events and entities using the knowledge that is available in memory. Perceptual strategies include developing a representation of an external scene, classifying objects

and events according to categories that are known or have been encountered before, and recognizing the identity and main attributes of interested objects. Organizational perception depends heavily on the norms, frames, and rules that members use as lenses to view trends and developments.

-- *Interpretation* is at the center of the intelligence cycle as it attempts to explain "What is really going on here?" in terms that are meaningful to the organization. Interpretation is hard because it must balance conservatism (to interpret data according to existing beliefs) with entrepreneurship (to interpret data for the exploration of new alternatives). Interpretation leads to understanding and creative insight by which future consequences and opportunities are anticipated and evaluated according to preferences. Ultimately, interpretation is the making of meaning about where the organization was in the past, what it is today, and where it wants to be in the future. Finding meaning is a social process, requiring people to socialize and exchange information.

-- Finally, *adaptive behavior* initiates a new cycle of learning as the organization makes decisions and takes actions that result in effects and outcomes. These are fed back into the loop by modifying sensing strategies (adjusting selection and sampling criteria) and by modifying frames and rules in memory (changing existing beliefs, adding new rules).

Building the Intelligent Learning Organization

Building the learning organization requires creating a climate that encourages learning, designing information processes and systems that promote knowledge Creation and use, and recognizing and managing intellectual assets. The organization should allow the time and develop the skills for its employees to reflect on their current work practices, analyze customer needs, and think of ways to improve operations. In a learning organization, knowledge creation is everyone's activity, and not the responsibility of a specialized few. Information sharing should be facilitated by dissolving organizational boundaries that block information flow and isolate groups who cling to old perceptions.

Rotation *of* transfer of staff has been found to be an effective way of sharing knowledge within an

organization. Special programs or events such as strategic reviews, system audits, benchmarking, and study missions may be initiated to explicitly provide opportunities for learning (Garvin 1993). From time to time, the organization should engage in double-loop learning by reexamining its basic assumptions and norms. Outside change agents such as consultants may be helpful in synthesizing and putting down on paper the organization's mental models, which may then be critically evaluated.

Information technology should be used to enhance learning. Computer models, for example, can be powerful learning tools because they handle a great number of variables simultaneously, trace their interaction through a large number of iterations, and so reveal relationships that are initially hidden because their cause and effect are widely separated in space and time (de Geus 1988). Computer-based information systems not only process data but also generate new information that describe, explain, and summarize the operations they automate. By rendering visible the rules, assumptions, and constraints that are embedded in the automated operations, this "informing" ability of computerized systems allows employees to learn a broader and deeper view of their work activities (Zuboff 1988).

The organization should also explicitly recognize, measure, their knowledge workers (Stewart 1994).

Peter Senge, Director of the Center for Organizational Learning at the Sloan School of Management, Massachusetts Institute of Technology, and a man whom *Fortune* magazine has called "Mr. Learning Organization" (Dumaine 1994), prescribes an architectural plan for building a learning organization.

The architecture requires three essential building blocks: guiding ideas;

Guiding ideas are the vision, values, and purpose shared by people in an organization. Senge maintains that the learning organization sees itself not as collections of objects and people working in networks of contractual commitments for economic transactions, but rather as patterns of interactions between people and activities, where people are part of a community that learn and change together. Using the generative power of language, they interpret and re-interpret their experiences to create new realities and re-examine existing beliefs and values.

Theory method, and tools are the practical items that help people to learn. Tools must be derived from theory, and only tools that are grounded in important new theories have the power to change the ways that people think.

Innovations in infrastructure supply people with the resources they need in order to learn: time, information, money, management support, contacts, and so on. Innovation examples include learning laboratories where employees can try out new systems and practices in mockups of the workplace, and management flight simulators where managers can hone and rehearse their skills in areas such as new product development and skillful discussions for collective thinking.

With the architectural elements in place, the learning organization must undertake lifelong programs of study and practice in five learning disciplines:

Personal Mastery--learning to expand our individual capacity to create the results we most desire, and creating an organizational environment that encourages all its members to develop themselves toward the goals and purposes they choose.

Mental Models--reflection upon, continually clarifying, and improving our internal pictures of the world, and seeing how they shape our actions and decisions.

Shared Vision--building a sense of commitment in a group, by developing shared images of the future we seek to create, and the principles and guiding practices by which we hope to get there.

Team Learning--transforming conversational and collective thinking skills, so that groups of people can reliably develop intelligence and ability greater than the sum of individual members' talents.

Systems Thinking--a way of thinking about, and a language for describing and understanding, the forces and interrelationships that shape the behavior of systems. This

discipline helps us see how to change systems more effectively, and to act more in tune with the larger processes of the natural and economic world. (Senge, et al., 1994, 6-7)

To Senge's five learning disciplines, we add a sixth: next chapter discusses the design and management of these information processes.