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THE KNOWLEDGE REPOSITORY: ORGANIZATIONAL MEMORY INFORMATION SYSTEMS

An organizational memory information system (OMIS) is a tangible conceptualization of the nebulous concept of knowledge. It combines the attributes of culture, history, business process, human memory, and fact into an integrated business system. Such an integrated system can facilitate a major step in the capture of the knowledge assets.

IT IS IMPORTANT TO CONCEPTUALIZE knowledge as distinct from data or information. While the definitions of data and information are relatively straightforward

in the domain of computer technologies, our understanding of knowledge is somewhat more elusive. Data and information can be exactly the same thing, since their distinction lies in the context to which they are applied. One person's data could be another person's information. Although data often refers to the raw codification of facts, usually useful to few, it could be information for someone who could apply it to a decision or problem context. Typically, data is classified, summarized, transferred, or corrected to add value, and becomes information within a certain context. This conversion is relatively mechanical, and it has long been facilitated by storage, processing, and communication technologies. These technologies add place, time, and form utility to the data. In doing so, the information serves to "inform" or reduce uncertainty within the problem domain. Therefore, information is dyadic within the attendant condition, i.e., it has only utility within the context. Data, on the other hand, is not dyadic within the context. Independent of context, data and information could be identical.

Knowledge is a higher order concept than either data or information. People who are knowledgeable not only have information but also have the ability to integrate and frame the information at hand within the context of their experience, expertise, and judgement. In doing so, they can create new knowledge that expands the range of possibilities and in turn allows for further interaction with experience, expertise, and judgement. Therefore, in an organizational context, all new knowledge stems from people. Existing data and information are incorporated in organizational artifacts such as processes, structures, and technology. The more these manifestations of knowledge are formally embedded in such inflexible structures, the less useful

they are for sustaining competitive advantage in an environment in which the basis of competition is dynamism.

Let us conceptualize knowledge as a process, which almost always involves people and cannot be captured in a systems context devoid of people. What can be captured, however, is all the data or information that describes knowledge and can be used to generate new knowledge. This is organizational memory. In other words, organizational memory is the "means by which knowledge from the past is brought to bear on present activities, thus resulting in higher or lower levels of organizational effectiveness."(n1) Activities in this context refer to the decision-making, organizing, leading, designing, controlling, communicating, planning, and motivating functions of the management process. Organizational memory is also affected by the social, business, governmental, environmental, and political interactions that can affect communication and ultimately what information is stored and why it is stored.

Communication is also threatened by factors that may cause breakdowns in communication. Comprehensibility, truth, trustworthiness, and appropriateness must but be present within the communicative process for it to be valid.(n2) A communique must be comprehensible so that the receiver can understand the sender. It must be true so that the receiver can share the sender's knowledge. The intentions of the sender must be expressed truthfully so that the receiver can trust the sender, and the communication should be appropriate within some normative context so that the receiver can agree with the sender within his or her value system. Should any of these factors be found lacking, communication would be disrupted. Organizational memories may be applied to the communicative process to mitigate and possibly restore communication between sender and receiver.

A good way to look at organizational memory is in terms of six bins labeled individuals, information, culture, transformations, structures, and ecology.(n3) Human intelligence may draw from these bins and add value by creating knowledge.

The individual bin. Individuals have their own recollections of what has transpired. These observations should be stored in a format that human beings can use as a memory aid. Organizational memory must include direct experiences and observations of individuals in a suitable format that matches individual cognitive orientations and value systems. E-mail messages, project reports, and interoffice memos are examples.

The information bin. The formal information system contains a wealth of data and information that represents details of transactions, decisions, and exchanges. This is a more tangible form of organizational memory.

The culture bin. Organizational culture is a learned way of perceiving, thinking, and feeling about problems that are transmitted by members of the organization to the organization. Past experience has a direct bearing on issues to be faced in the future. Any knowledge creation must consider organizational culture. Cultural memory is difficult to change because cultural beliefs are repeatedly transmitted. And both the detail and context of the information may be lost or altered, but it can be reflected in much of the organization's documentation and information exchange.

The transformation bin. Transformations are business processes within a firm that occur frequently. There is always a predictable logic that flows from a standard input to an expected output. The retrieval of how past and current processes work has a bearing on how future processes will work or how current processes might be altered.

The structural bin. Organizational structures must be considered in light of their implications in individual role behavior and their links with the environment. Individual roles provide a repository for organizational memory. Power positions or positional authority all impact how information is stored or interpreted. These positions represent informal and formal rules of behavior that help put information in a situational context.

The ecology bin. Ecology is the physical structure of the organization. The physical setting represents the status of the hierarchy of the organization. It also represents how members of the organization feel about the organization and how people outside of the organization view a particular firm.

The content of organizational memory manifested in these six bins could be both short-term and long-term memory. Many of the cultural and structural attributes of the organization reflect long-term memory and are difficult to change, while information and individual bins include short-term components. The challenge is, therefore, to formalize the organizational memory system by capturing all relevant data and information on these bins in a manner that can facilitate effective transfer among organizational members. The resulting system would bring together past knowledge of management functions and environmental constraints in a way that would overcome threats to communication to create knowledge that endows a firm with competitive advantage.

ORGANIZATIONAL MEMORY AND INFORMATION SYSTEMS

As both large corporations and small firms attempt to develop global contacts and build communication systems that interconnect multiple organizations and people, it is still who we know and what they know that make the individual knowledge worker effective in the workplace. This collection of personal contacts contains operating intelligence and historical memory, and it disseminates both formal and informal information. The problem is managing the complex interweave of informational sources so that it enhances individual performance and the overall performance of the organization by extending human memory.(n4) The addition of information technology to these informal processes will formalize a greater number of working relationships by searching faster and in more places, providing quicker information retrieval, storing more facts, and exploring relationships never thought possible.

Within the rapidly shrinking global business environment, it will be essential that organizations exploit collaborative technologies that make full use of the capabilities of commercial hardware and software to access existing databases of information. The technologies of the Internet allow access through client/server technologies that may be thought of as primitive OMISs. But before we discuss the future, let us review the past. File cabinets and desk drawers are filled with reports and proposals that detail the collective experience of many years of work. This information is often forgotten or thrown away when it might be of use were it more assessable. In many places we still continue to produce reports that are not read or shared with those who might benefit from them either on paper or in forgotten files. Various sources estimate 10 to 20 percent of business data is actually used. If we were to make this information available to the collective intelligence of the organizational work force, we would have a huge database of historical information upon which to draw.

Some researchers and practitioners contend that this information is only marginally useful, but others believe that access to this core experience would be of use in a variety of situations. For instance, historical information is often essential to understanding the updating or renegotiating of contracts. Many important details and intricacies are grounded on facts that would be difficult to rediscover, especially if the original people who did the work are gone. OMISs should be capable of capturing and then capitalizing on this treasure grove of information/data of the organizational memory.(n5)

The defining processes involving organizational memory are acquisition, retention, maintenance, and retrieval (see Exhibit 1).(n6) These processes provide the means by which knowledge from the past is brought to bear on the future. Acquisition gathers the data, information, and knowledge from all available sources. This should be thought of as acquiring new information not already being maintained. The search must always go on for more information that updates, corrects, or adds to the organizational memory base. These include both the capabilities for assimilating knowledge from outside (such as competitive intelligence systems acquiring information about other companies in the same industry) and capabilities for creating new knowledge from the reinterpretation and reformulation of existing and newly acquired information (such as executive information systems or decision-support systems).

"The Federal Express Corporation developed the Optically Recorded Information Online Network (ORION) system in response to the increasing inability of alternative methods (paper, microfilm, microfiche) to cope with the massive employee documentation requirements of an ever-increasing worldwide workforce, currently at over 90,000 employees. ORION provides the ability to scan paperwork and store digital images on optical disk. This system eliminates all manual data entry through the innovative use of modern scanning technologies, provides secured and instant access to documents worldwide, and allows bi-directional transfer of documents traditionally handled as hard copy to and from an image database."(n7)

Retention is perhaps the most important component of organizational memory. Several mechanisms have been proposed as a means to retain organizational information. These can be classified into three main categories: schemas, scripts, and systems.(n8) A schema is an individual cognitive structure that helps people organize and process information effectively. Schemas can be thought of as obvious groupings of people, places, and things. For instance, the information bin can be ordered by schemas (i.e., in a database) to make them more understandable to the user. Scripts describe the appropriate sequencing of events in conventional or familiar situations. Personal routines, or the way individuals work, involve scripts. Organizational scripts are personal scripts organized by communication. Systems can manage these schemas and scripts by automating them and connecting them in a manner that facilitates a common objective. Databases, distributed information systems, and artificial intelligence systems, among others, facilitate the retention of memories related to organizational activities.

Lawyers are now taking knowledge management to a new level of sophistication. Scanning and searching documents are augmented by databases stored on CDs and accessed through the Internet to provide access to documents whenever and wherever they are needed. CyberDocs from PC Docs (www.pcdocs.com) allows lawyers in remote locations to access documents through a browser easier and more reliably then dialing directly into a firm' s computer network. Access to documents is controlled through a password, and only documents pertaining to a particular case are available through Internet access. Each document is profiled when scanned to speed searching. Profiling provides easy access to information, so new lawyers can search documents online to quickly brief themselves on current and past cases.(n9)

Maintenance is another process fundamental to memory. Memories must be maintained if an organization wants access to its knowledge and expertise. One of the major difficulties of maintaining an organizational database is in deciding how and when to update, retain, and delete files. Obviously, incorrect data should be fixed, and old or obsolete data should be deleted. But just because data is old does not mean it is not or will not be useful in the future. These decisions need to be integrated and evaluated using criteria that directly pertain to the business and its goals.

Dataware (Cambridge, MA) and Altris (San Diego, CA) offer document management systems that connect experienced individuals with others in the organization in need of that expertise. These products track queries executed, documents reviewed/authored/read, and projects participated in for each user. That input is used to build user profiles that capture the experience level of each user in various subject areas. As a result, knowledge seekers who pose questions to the knowledge base not only receive explicit sources of relevant information, but they are also put in contact with individuals in the organization with whom they can gain additional expertise.(n10)

Retrieval is the fourth major memory process. Organizational memories can be called forth to support decision-making and problem solving. However, solving managerial problems requires appropriate data or information be retrieved in a timely manner to be useful. Another problem that can occur is too much information. If one queries the system just to find out what is there, a problem of recalling too much information may overwhelm the decision-makers. Some selection criteria must be defined.

The phrase 24/7 -- 24 hours a day, 7 days a week -- is one the medical community lives by. Secure electronic retrieval of patient records is available through the Web by medical records vendors such as MedPlus (www.medplus.com). Using ChatMaxx, doctors and nurses may capture patient information electronically at the patient' s bedside. These same records are available locally within the hospital or from remote sites for review and analysis. No more lost lab reports or misfiled medication orders. By retaining records electronically, a California hospital has been able to reduce support staff by two full-time employees and assigned the remaining staff the additional duties of coding patient records to ensure payment from insurance companies and government agencies. The need to rent off-site storage space and use outside copy services was reduced by half.(n11)

"SCISOR is a prototype system incorporating information retrieval into an integrated system that uses partial analysis of text to carry out its processing. A filtering process selects only articles on corporate mergers and acquisitions, extracting information on target and suitor companies and dollar-per-share amounts. These items are stored in a knowledge base that handles queries."(n1)

The discussion so far has focussed on defining organizational memory in the context of data, information

and knowledge, describing key components (bins) of this memory, and describing how information technologies can facilitate the processes involved in organizational memory. It should be noted, however, that organizational memory is a broader concept than the OMIS. Part of the challenge is to harness as much organizational memory into the OMIS as feasible and appropriate.

ORGANIZATIONAL MEMORY AND LEARNING

To truly leverage organizational memory, organizations must explicitly consider organizational learning. Organizations that do not adapt well have failed in the past, and in an increasingly merciless marketplace, they will fail in the future. In the early 1980s, Royal Dutch/Shell' s planning group uncovered some startling statistics: One-third of all companies listed in the Fortune 500 in 1970 had vanished by 1983, and the average life span of most companies was only 40 to 50 years --roughly half that of a human being.(n12) Many of these companies failed to develop succession rules or became too dependent upon certain individuals. According to Arie de Geus, former director of planning at Shell, a company' s survival depends on its ability to detect and adapt to critical changes in its environment.(n13) Managing internal change by foresight, rather than by crisis, is possible only if the changes in environment are foreseen in time and acted upon. Shell planners then searched for companies that were older, relatively important in their industries, and over the years had experienced fundamental changes in their business environment and survived with their corporate identify intact. They came up with only a handful -- companies such as DuPont, the Suez Canal Company, and the Hudson Bay Company. These firms survived because they adapted better than their competitors to a dynamic environment and actively experimented with new knowledge. Their corporate environment encouraged learning and experimentation. This had the overall effect of keeping corporate leadership better informed. They had effectively institutionalized a process for constantly pushing the edge of their learning boundaries, leading to the creation of a learning organization.

Organizations learn through two interrelated mechanisms. This can be better understood in the context of single- and double-loop learning.(n14) Single-loop learning occurs when information workers detect errors and make changes to preserve the central features of the organization as defined by the norms of performance. Double-loop learning occurs when members detect conflicting requirements and try to resolve those conflicts by changing prevailing norms, values, and systems. It is interesting to note that higher order learning takes place by trial and error. In this context, each failure is at least as important as each success.

Daniel Kim suggests a learning infrastructure that allows workers to step out of the system and work "on" it and not just "in" it. This kind of learning cycle creates a bridge between performance (working in the system) and practice (working on the system). The learning cycle of Observe, Assess, Design, and Implement (OADI) links the two processes together (see Exhibit 2). During the Observe stage, information is gathered along with relationships and conflicting opinions. The Assess stage requires the knowledge worker to determine the accuracy and correctness of facts and relationships. The Design stage develops alternative solutions to the problem at hand, and the Implement stage selects a solution and puts it into practice, at which point, the cycle begins anew. Assess and Design are emphasized more in the practice field, while Implement and Observe are emphasized more in the performance field. The most important link in the learning cycle lies in the Observe and Assess steps, because our business decisions can be only as good as the assessment on which they are based. We must be willing to learn and unlearn our memories to revise the relevance of our experiences to better assess new situations that we encounter.(n15)

The cultivation of organizational memory is fundamental to companies that want to establish, grow, and nurture a learning organization. Individuals and organizations grow intellectually and expand their knowledge by unlearning inaccurate information and relearning new information. Human cognitive ability allows us to replace new knowledge with another and relegate the old knowledge to distant memory to be recalled if appropriate circumstances warrant its use. Many times it is the ability to quickly recognize and implement new knowledge that separates success from failure. This dichotomy is the essential difference between doing it the way we always did it (single-loop learning) and arriving at an innovative solution that establishes new patterns and relationships (double-loop learning).

Much of the recent push for business process change must be based on double-loop learning. Consider a large insurance company that routinely processes insurance claims through a 25-step sequential process that involves 15 individuals focusing on their own narrow specialization in processing the claim. No one questions the process because there is no incentive to challenge the system, only to follow it as efficiently as

possible. From an organizational perspective, however, the environment in which this 25-step process was once useful no longer exists. A more educated work force willing to take broader responsibility, demand for faster cycle time and customer service, and vastly improved information technologies, all require that the company engage in rethinking its process through second-degree learning if it wants to be successful. Doing this requires a breakaway from the comfort of the status quo.

A good organizational memory system is a prerequisite to double-loop learning. As shown in Exhibit 3, single loop learning operates in a corrective vein within the parameters of the organizational memory system. People adjust their inputs and adjust the organizational memory that is imbibed within existing processes and structures to achieve the desired output. Higher-level learning occurs when we challenge the criteria on which single-loop learning is based. In other words, continuous observation and assessment of organizational memory can yield a higher level of memory incorporated into new structures and processes. This is the learning organization, one that learns and profits from past experience. These collective experiences serve to create a firm personality and corporate culture that impacts how an organization functions. The result can be a successful company that embraces change or one that fails to see the future and falls by the wayside. Successful mangers engage in and encourage revision of organizational memory by opening themselves up to different viewpoints and exchanging knowledge between peers and fellow workers who have different skills and resources. By extension, successful organizations undergoing environmental changes form links across traditional functional lines to gain access to previously hidden resources that could facilitate higher-order learning.

Exhibit 4 attempts to show in a more practical sense how a familiar business process can be used to develop an organizational memory that can adapt to changing circumstances by learning from the available information. In these examples, first-degree learning occurs only within the parameters of the existing problem and process. However, organizational memory processes promote second-degree learning when they look beyond the existing process and problem by continuously observing and evaluating data for new ways to define the existing process. This may lead to a new or refined process that better serves the customer and the firm.

AN ARCHITECTURE OF AN ORGANIZATIONAL MEMORY INFORMATION SYSTEM

The previous discussion highlights the five key elements of any organizational memory information system:

1. The six memory bins that are tangible manifestations of organizational knowledge can be represented by organizational memory ranging from human experience to culture, processes, and structures.
2. The actual OMIS, which is a subset of organizational memory and depicts the formalized data and information captured through information technology.
3. The processes involved in acquisition, retention, maintenance, and retrieval of memory, all of which can benefit greatly from today's information technologies.
4. The intangible knowledge core, which is the integral part of every organization, represented by the more tangible organizational memory.
5. The importance of double-loop learning where the existing organizational memory is continually observed and assessed to promote flexibility and adaptation. True double-loop learning results in the expansion of the knowledge core.

By combining these five elements, one can see that the success and ultimate survival of a firm revolves around the stability and growth of the knowledge core. The knowledge core embodies those critical success factors without which a firm withers and dies. An OMIS might be thought of as a sprinkler system carrying essential nutrients to the roots so that the entire plant survives and blossoms. Exhibit 5 depicts these elements and the integrated nature of the OMIS architecture.

While the architecture described above provides a conceptual basis for looking at an OMIS, organizations need operational OMIS systems. In other words, there is a need to appropriately integrate a myriad of rapidly changing technological options, facilitate the extraction of appropriate information from the memory as and when needed, and create an environment that fosters organizational memory and promotes higher

level learning.

MAKING OMIS WORK

It is becoming increasingly important and feasible to select technological options that are based on open architectures that allow for modular expansion. This should be true at both the physical levels (i.e., the actual hardware), as well as the logical levels (i.e., a conceptual schema of OMIS). Many new technologies offer significant capabilities for OMIS applications. SAP AG (R/3 software) is a German software company that integrates factory, warehouse, accounting, headquarters, and other common business modules into an integrated business package.(n16) New RAID and client/server systems increase memory storage and speed of access. Three-dimensional graphics give more details by storing information in ways both familiar and natural to people. Artificial intelligence (AI) can be used to update and maintain the OMIS databases with accuracy not achievable by human beings alone. Finally, intranets are used to interconnect employees and extend the reach of employees past the confines of an enclosed world to expand their imagination to include a virtual world of interconnected enterprises.

By using existing client/server system applications and off-the-shelf Web browsers, firms are allowing employees to sort through data warehouses, launch workflow applications, track work items, and distribute information to remote users rapidly. This is exactly what companies that have survived for hundreds of years have been doing, but now technology allows more firms to develop, institutionalize, and use a learning corporate culture. The problem, of course, has always been to deliver internal information to the right people, particularly in the form of documents. People have had difficulty finding information because an assortment of inconsistent tools has been developed to assess documents. In other words, people have tried to develop OMISs, but it has been done piecemeal and we have not had the possibility of synergetic effects, until now.

People know instinctively what knowledge they deem important and build networks of contacts that access this knowledge. Of course, what is important varies from individual to individual. The beauty of today's Internet/intranet/Web technologies is that each individual can store and organize information in a format that he or she can use and still allow effective access to others. Increasing numbers of corporate, government and educational developers are turning to hypertext markup language, hypertext transfer protocol, e-mail, Network News (NNTP), Internet Relay Chat (IRC), Portable Electronic Document (PED) formats and similar technologies to create collaborative environments. This kind of IS architecture makes information and training available to everyone in a firm. An intranet is a system of connected computers that essentially emulates what is happening on a global scale on the Internet. The concept offers the ability to integrate multiple tools into a firmwide system that all employees can access. This system is also conducive to learning. Training sessions, seminars, and group meetings can all be conducted and documented. Not only is individual performance improved, but also access to the training materials, notes, and student perceptions can all be accessed and stored for later use. With an intranet system representing most of the OMIS, employees have access to a widening pool of online information that is presented in an easy-to-use format. Browsers with intelligent agents searching on criteria selected by the searcher and filtered through the system empower all workers to be innovative, contributing members of the firm.

MANAGEMENT OF OMIS: CRITICAL SUCCESS FACTORS

To be truly useful, organizational memory must be explicit, communicable, integrated, and timely. Explicit means we know exactly what our information assets are, where they are, and how they got there. Information must be communicable with each member of the organization and must provide differing levels of expertise depending upon the situation. Pockets of information must be integrated so that decision-makers can pursue holistic perusal of a problem. And the element of timeliness requires data to be delivered virtually instantaneously and be able to provide store-and-forward or batch-processing of the more routine applications the business performs.

Another critical success factor for an OMIS is its widespread usage. Like any network-oriented system, its value grows with the number of users. Therefore, a key aspect of management is promoting and encouraging usage of the system. This usage encompasses both the supply side (i.e., provision of information) and the demand side (use and application of information). An OMIS that is constructed by an IS group as opposed to a group of organizational representatives and is predicated on the basis of an "if we

build it, they will come" philosophy is destined for failure. Successful OMISs are ongoing organizationwide endeavors that require top management support. The dynamics of managing OMISs are complex but increasingly manageable, as the Internet and other technologies are evolving to streamline the the acquisition, indexing, filtering, linking, distribution, and application of OMIS management processes.

An important factor in achieving usage of an OMIS is the ability of users to match information with a particular set of circumstances that actively promotes innovation, responsiveness to customer needs, or resolution of a unique problem. There are four basic considerations for "matching:" externalization, internalization, intermediation, and cognition.(n10) Externalization is the process of capturing knowledge repositories and matching them to other knowledge repositories. This requires integration of sources of knowledge in the system that allows users to relate one source to another in a business context. Internalization seeks to match bodies of knowledge to a particular user' s need to know (transfer of explicit knowledge). This can be accomplished through the use of good taxonomic schemes that allow users to search for history, guidelines, projects, clients, and information based on key ideas, concepts and problem domain. Intermediation matches the knowledge seeker with knowledge by focusing on tacit knowledge or experience level in the organization. An OMIS should clearly identify tacit (non-codified) sources of expertise, their experience, and project success. Cognition is the ability to make decisions based on available knowledge by matching knowledge with firm processes. This would require codification of institutionalized knowledge such as business processes, rules, procedures, forms, structures, objectives, and policies. Explicit identification of such knowledge is imperative to promote higher-order learning. We have to know the system before we can change it.

Managers should wish to build a knowledge culture that promotes information sharing, breaks down functional parochialism, and provides the slack to be innovative and even radical, which is important for leveraging an OMIS. Such organizations create a natural organizational memory through widespread awareness of key centers of expertise and other "memory bins." The OMIS then is a logical part of the organizational memory, since it mirrors and reinforces much of what is known. Such a context is very different from the mechanistic view of the world, which epitomizes the circular argument -- there is one way to do things, which is the way they have always been done.

All organizations use networks to communicate both vertically and horizontally between members of the organization. Similarly, employees build networks of both formal and informal information sources that extend their individual memories by accessing the memories and experiences of other competent men and women. This web of individuals allows the knowledge worker to put his finger on the right fact or make the correct connection to get something done. These are the people retained for their expertise, excellence, and problem-solving skills in their particular field. Over time, strands of the web must weaken, strengthen, or break based on value judgments to determine the level of trust each member of the web deserves. Thus, the appropriateness, accuracy, and ultimate benefit of the information received by each employee determine the level of trust. In this context, the organizational memory of the firm is a reflection of the depth and breath of the knowledge employee' s ability to develop innovative and effective solutions to difficult problems. As such, OMISs must not only be built and integrated into existing business processes, but they must also be part of the everyday routine of every employee.

CONCLUSION

Data, information, technology, people, processes, and structures are all interconnected to create a knowledge base essential to the long-term survival of any company. The more firms know, the more successful they will be. An understanding of what information is available, who has it, where it is, how can it be accessed, what one can do with this information all directly impact decisions affecting both the current and long-term strategies of the firm. These strategies, in turn, impact the long-term survival of the firm. Having the basis of past decisions immediately available to the decision-maker, at any level, can only make better decisions possible. The caveat is that knowledge workers should remain aware of the importance of creative thinking and need to generate new ideas. OMISs can be used to share new ideas, save new ideas for future consideration, and better serve customers who are confident of the long-term commitment of their supplier to provide the level of service expected in today' s collaborative environment. Knowledge management will continue to evolve as a concept, and building OMISs makes the concept less nebulous and more tangible.

DIAGRAM: EXHIBIT 1 Processes of Organizational Memory

DIAGRAM: EXHIBIT 2 0ADI Learning Cycle

DIAGRAM: EXHIBIT 3 Organizational Memory -- Organizational Learning Loop

EXHIBIT 4 Organization Memory Processes and Learning

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Legend for Chart:

B – First-Degree Learning
C – Second-Degree Learning

A                B
                   C

Acquisition      ATM machines collect basic account
                 data from clients.

                    ATM machines collect customer
                    information with the intent of improving
                    relationship with the firm.

Retention        ATM data is retained in a temporary
                 repository and then sent to permanent
                 storage.

                    ATM data is stored in a manner that
                    facilitates profiling of customers and
                    targeting of tailored services.

Search           ATM data is searched only when there is
                 a problem.

                    ATM data is mined and continuously
                    studied for new future opportunities.

Retrieval        ATM data is retrieved only as an exact
                 data item.

                    ATM data is retrieved within a context of
                    data elements to facilitate broader and
                    better interpretation of the data item.

Maintenance      ATM data is maintained for the statutory
                 period and then deleted.

                    ATM data and any interpretations or
                    information gleaned from the data is
                    maintained permanently for firm
                    employees to access.
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DIAGRAM: EXHIBIT 5 OM Architecture

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