Knowledge Retention in Oil and Gas Companies: Focus on the Individual
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The Individual Approach to Knowledge Retention

Among other priorities, when talking about the important subject of knowledge management (KM), lingo is more important than you may think. Have you ever become confused when someone uses the terms information, data, knowledge, and intellectual capital all in the same discussion? If yes, you hopefully interjected, “what exactly are you talking about?” If an organizational objective is to identify, capture, store, and disseminate useful “---------” (fill in the blank with one of the italicized terms) in a way that enhances organizational learning and performance, which term fits? Hopefully you picked the term “knowledge” since it is the human assimilation and conversion of the other three into something directly useful and actionable. A savvy knowledge manager might also suggest that another key term is missing -- “experience”. The collective experience of the organization is built on a foundation of individual experiences which are rooted in the human aspect of knowledge. Vast amounts of individual experiences are recorded either explicitly (e.g. written down) or tacitly (e.g. in someone’s memory) while workers perform their daily jobs. In more of a top-down fashion, many enterprise KM initiatives focus on systems for collecting and organizing organizational or collective knowledge without spending much time on the needs of individual workers. The authors of the 2008 reference book on enterprise knowledge capture, Business Metadata (Inmon et al., 2008), state that, “The discipline of knowledge management seems to ignore the problem of knowledge capture from individuals.” The experiences of individuals and not those of organization as a whole -- including how individuals and work groups store, retrieve, and use their experiences -- should be the starting point when designing efforts to capture and retain knowledge. Here’s why.
Since individual cognitive issues influence the thinking and actions of each and
every employee in an organization, it makes sense that these factors must be
considered when designing a knowledge capture or retention solution. The fact is
that knowledge management is an extremely broad and complex confluence of sub-
disciplines that includes cognitive science, linguistics, information architecture and
systems, database engineering, content management, taxonomy, library science,
software engineering, human-computer interaction, and instructional design.
Beneath this complexity is one universal building block -- individual experience. The
concept of experience -- how things are sensed and interpreted, how experiences
are selectively stored in the human brain, and how stored experiences are
remembered and shared with others -- not only is the engine of knowledge, it gets
at the root of human existence and all social interactions. When designing a
knowledge retention strategy, the ways in which humans process, store, and
retrieve experiences is not trivial in any sense. In fact, it is universally ingrained to
the extent that many critical cognitive processes are shared by all people regardless
of origin, and while these processes can be interrupted or enhanced, at a biological
level they cannot be made to function differently. Since organizations are by
definition organizations of humans collaborating with a common business purpose,
the ways we think about the experiences of workers -- and how we plan for
collecting and organizing knowledge so it can be used by others -- has to use the
cognitive needs of the individual worker as a foundational building block.

The company’s knowledge retention initiative should become the act of capturing
relevant individual experience; cataloging it so it can be retrieved; and then
delivering it to others in a form that is actionable -- but as many organizations have
discovered the hard way, for this significant investment in time and money to
deliver value, a culture of widespread participation has to be facilitated. KM
initiatives are capable of helping individuals share knowledge within work domains
or communities of practice, reduce redundant work, and reduce training time; but a
return on this significant investment is largely dependent on utilization. As a
strategic objective, organizations invest in KM initiatives and systems for
continuous acquisition, storage in a knowledgebase, and dissemination of
knowledge in support of the continuous improvement of organizational performance
-- a process called “organizational learning” (Thomas, 2001). Historically, the
conventional technical focus of KM systems on database-driven lists or hierarchical
taxonomic structures and non-intuitive system interfaces (Uden in Zilli et al., 2009)
has contributed to lower than anticipated utilization of enterprise KM systems.
Without utilization, there can be no transfer of knowledge. More specifically, without
widespread, ongoing inputs (contributions) to the knowledge-base, there can be no
value created as measured in terms of useful, actionable outputs. From a
behavioral perspective, without realizing the value of relevant inputs or outputs,
there is no reason for workers to use the knowledge-base. In oil and gas
organizations, maximizing the contributions of experienced employees is critical for
organizational learning and the retention of knowledge.
The oil and gas industry is battling rapid generational attrition but knowledge retention (capture) efforts are capable of enabling the highly valuable activity of preventing the loss of expert knowledge within organizations, also called “knowledge destruction” (Kakabadse et al., 2001). Knowledge destruction due to retirement or reassignment is averted by acquiring and preserving relevant knowledge before experienced employees leave. At increased cost, knowledge can also be “recovered” by bringing back retired employees as consultants but why not take advantage of known retirements and acquire their relevant knowledge before they leave? On its face, that may seem like a relatively intuitive, simple task but in practice it has proven to be more difficult than expected. Again, individuals, working in specific work groups and environments, have individual ways of thinking about their work and the work of others. Tapping into that way of thinking creates a connection that opens up the flow of knowledge.

In order to better understand the experience of workers and work groups, research in cognitive science and “sensemaking” within organizations has produced new ways to impact KM system utilization. Studies have shown how knowledge acquisition may be improved if the KM system is representative of the individual and group schemas existing within an organization (Harris, 1994). Schemas are contextual frameworks produced by individuals when encoding their experience into long term memory. In a work setting, it is a pattern or framework we create to connect related memories such as the office where we work, the room where a meeting was held, or the topic of discussion at the time. New experiences are “fitted” into the context of our existing schemas like adding more details to a story. The activation of our schema in long term memory, and the related knowledge, occurs when we are presented with information or a physical situation that we have encoded into our schema. This is why walking into a classroom where we took a course five years ago suddenly triggers a string of memories of what happened during the course -- such as who was there and parts of the curriculum. These memories become suddenly accessible again although you may have assumed it was forgotten. The bottom line is that understanding the influences on individual cognition, and individual schemas about their work and the work of others, is a key success factor in knowledge capture.

► Design and Planning

Although we all have certain cognitive abilities and we share defined organizational objectives, just about every other individual attribute is unique. Knowing that, why would we still demand that interactions with a conventional knowledge-base must become uniform as an artifact of using a commercial “software solution”? In other words, the software itself requires that all workers are trained, as software users, to use the application in uniform, repeatable ways. Can the same interfaces and functionality be equally intuitive to both experts and novices; managers and workers; people who speak different languages; or people with advanced degrees and those with no formal training at all? If utility is measured by participation and
results, how do we design a knowledge capture system as part of a knowledge-base that has high utility for each individual in this diverse assemblage of workers?

Successfully approaching the business challenges associated with creating a knowledge-based, learning organization involves the establishment of a top-down framework during design and planning but once designed, the new approach functions in both a bottom-up and horizontal fashion. Once again, I’ve provided no mention of software solutions because the design and planning should not be driven by a top-down technology solution. The determination of the unique needs of the learning organization and its knowledge workers will dictate the requirements for a technology solution. So irrespective of the ultimate supporting technologies required, the design has to begin with the framework of the common purposes the learning organization was formed to achieve and functionally including the practical implications of becoming a learning organization -- then consider the unique attributes and aligned purposes of individuals in various work domains or communities of practice -- and finally, it has to be based on the basic needs of the individual users across a diverse set of locations, languages, and cultures.

In order to make sure the focus of the knowledge capture process remains on the needs of individual workers using the knowledge-base, a concept modified from “customer-centric” initiatives in other industries is the concept of “worker-centric”; similar to “user-centric”. The word “worker” can be substituted with the appropriate term used by a given organization to describe the individual, e.g. employee, user, etc. Typically, organizations planning for an enterprise-wide adoption of a new process or software tool, will ask, “how do we get employees to participate (i.e., comply)?” This is an expected question in evaluating the best way to implement a KM initiative since as we have discussed, utilization is critical to project success. The appropriate question for a worker-centric initiative is:

*How do we give individual workers and communities of practice what they need in order maximize the utility of the knowledge-base in improving individual and group performance?*
In the case of a knowledge retention initiative, we must focus on the user’s work experience and what motivates individuals and groups to make relevant contributions that have performance-improving value. Guided by top-down design and planning; and a bottom-up, worker-centric approach; the problem becomes how we identify and address the unique needs of individuals and groups within a diverse oil and gas company; and identify skills needed across the organization to make the initiative successful.

**Success Factors**

While the oil and gas industry fits the most fundamental knowledge-based model by employing humans as workers, all of whom are gathering and sharing experiences, it also has some of the most complicated organizational dynamics of any industry. These dynamics include separate departments of specialized personnel (e.g., reservoir, drilling, and production engineers; land, finance, environmental, accounting, legal, etc.) each representing silos with their own technical language; global operations across many languages and cultures; and personnel disseminated across remote locations, field, regional, and corporate offices. To make a knowledge retention initiative work effectively, once a common set of organizational learning objectives (framework) is distilled down and made relevant for each operation, team, work group or community of practice, and individual, individuals must have the freedom to create and share knowledge in the manner that has the highest utility for them. In spite of all of the alignments and communication necessary to make a diverse organization function, the fundamental unit of knowledge acquisition, retrieval, and sharing remains the individual worker within the context of their work group or community of practice.

Given the task of providing the impetus for an active, successful learning organization, all workers will have to do three basic things often and very well:

1. Make frequent contributions of relevant knowledge to the knowledge-base
2. Routinely retrieve knowledge that is relevant to job performance
3. Act on the knowledge retrieved in ways that are correct and supportive of the objectives of individual, CoP, and organization

![Diagram](image-url)

**Fig 2.** Necessary behaviors of the knowledge worker
So on an individual level, contributions, retrieval, and appropriate action are abilities or skills that have to be shared by all workers within this diverse learning organization. Before clouding this discussion with issues related to supporting technologies, the following questions should be answered:

1. Do we have a clear understanding of the organizational context and objectives for the knowledge capture initiative?
2. Do we know the organizational learning needs and dynamics at the individual and group levels across the organization?
3. Which schemas are meaningful to a cross-section of workers within each community of practice?
4. How do we facilitate the necessary participation into routine, daily operations?

► A Simplified Example – XYZ Oil and Gas

At XYZ Oil and Gas there is a large corporate office in downtown New Orleans, and field offices around the world near active areas of exploration and production. All of the typical supporting departments exist at XYZ. Workers outside the corporate office include a blend of expats and locals. Most knowledge is shared via internal company communications, periodic meetings, and instructional programs held at training centers. Explicit knowledge in papers, manuals, reports, and other documents is centrally managed in a document management system. Tacit (experiential) knowledge is shared informally. While this is a fairly typical scenario, XYZ management realizes that the organization’s experiences over time, and the knowledge derived from those experiences, is being permanently lost through a high rate of employee attrition due to retirement. They conclude that there has to be a better way to preserve this knowledge and make it usable for training younger, less-experienced employees.

Some of the common organizational dynamics represent barriers to achieving this goal. After mapping the communities of practice within the organization, it was discovered that each group has unique knowledge needs. Among other factors, their needs vary in terms of the timing and the required quality of the information. For instance, a drilling engineer may need to access certain types of knowledge quickly if the well is suddenly taking fluid - and when working on a deep exploration well, the information they access had better be timely and accurate -- it can’t just be one person’s anecdotal advice. In contrast, an environmental engineer may need to access knowledge pertaining to certain types of impacts but when working on a big report, they have time to accept opinions from multiple sources and then draw their own conclusions. So one problem becomes how to describe the knowledge needs of current workers so that more experienced employees nearing retirement know what types of knowledge they need to contribute.

Interviews with members of each community of practice (CoP) or work group also reveals that certain types of categorizations or representations of the work domain are more effective than others in triggering schemas that include their past work experience. For instance, in the research lab, the retiring Director can remember the times that pressure
test vessels have unexpectedly burst when looking at a diagram of the current test procedure but that knowledge doesn’t appear in any manuals. The same vessels are still used in the lab but without experiencing an explosion, the younger workers have no way of knowing what conditions produced this type of accident. Two other workers in the lab are experienced and have witnessed some accidents although the majority of workers have less than five years of experience. In truth, most of their knowledge is explicit -- gained from classroom training and printed in operations manuals.

Management decides the best way to address the knowledge destruction caused by retirements is to begin capturing the experiential knowledge of experts in the lab, storing it in a knowledge-base, and using it to train the less-experienced workers. The initiative is important financially and strategically since repeated accidents in the lab have high associated costs and staying on the cutting edge of technology is essential for supporting field operations. Management begins by reviewing the company’s goals and objectives for the laboratory and how that framework influences their day to day functioning in terms of knowledge. They then look at how best to define this group of knowledge workers. In other words, who exactly participates in knowledge sharing related to the laboratory’s projects – this set of employees will become the laboratory CoP. Finally, what types of expert knowledge (both explicit and tacit) would be valuable to members of this CoP; and considering the experts in the laboratory who will be making knowledge contributions; and what is the best way to collect, filter, and store their experiences?

After some research, it turns out that the laboratory CoP includes a wide network of people throughout the company. Knowledge sharing between the lab and the field organization occurs on a daily basis so key individuals in the field are added to the scope of the CoP. This is a significant development since the profiles and needs of knowledge-base users in the field are different from those in the lab. From a cognitive standpoint, there is a completely different schema associated with the field operation compared to the lab. While an expert working in the lab would have the current lab work environment and practices ingrained, they may not have formed a schema around the field operations where their collaborators work. If they had travelled to the field and seen the environment, they may have formed an additional field schema, or expanded their lab schema to include the field, for cataloging their knowledge about how the lab’s work is applied. Given common goals regarding research but separate work environments and levels of experience, the knowledge capture approach to this CoP has to address these differences. This scenario would apply to any case where members of a CoP work in separate locations, unique work environments, or are members of separate departments or work groups. So in conclusion, it is apparent that an expert like the lab director would have any easier time contributing his relevant knowledge about the lab operation and harder time contributing knowledge relevant to the portion of research projects conducted in the field. Possibly less intuitive is the fact that he must also contribute knowledge that is relevant to everyone else rather than him -- meaning it will be relevant to other workers and their job performance. These other workers have to be able to fit the contributed knowledge into their schemas so the expert contributor (lab director) needs a way to understand the schemas of others in the CoP, including the schemas of novice workers.

In an effort to collect all of the relevant knowledge of the lab director, he is given access to the knowledge repository with instructions to make some time each day for a “brain dump”. Rather than asking him to contribute knowledge into a conventional hierarchical structure of preset categories (XML-type structure); two more sophisticated approaches are considered which allow him to contribute and tag free form text or write conversationally using plain
language followed by a text analyzer that locates key words and parses his writing, cataloguing it in chunks. But wait, before spending any more time on supporting technologies, XYZ has to consider the types of contributions that would be most valuable to the organization. Should the lab director just contribute whatever knowledge he thinks is important? Important to the organization as a whole? Important to others in the CoP? Important to other experts or also to novices? Or important in a way that can be used for instructional design? Additionally, is it most important to improve the performance of everyone (including other experts) or mainly the more novice members of the CoP?

These questions get at the importance of design and planning at the level of the individual and the CoP. In this case, XYZ decides to focus on the capture of both explicit and tacit expert knowledge that can be shared with other supervisors and managers who are involved in the laboratory CoP. They feel that novices are receiving adequate classroom training and as long as the supervisors are writing the policies and procedures, they will build in the needed experiential knowledge. So that the contributor understands the schema of others in the CoP who do not work in the lab, he is instructed to spend time with supervisors in the field at various locations, talking to others and witnessing how research projects are executed. Additionally, in order to enhance the relevance of contributions, the director is instructed to create a diagram describing how research projects are conducted both inside and outside of the lab -- including the roles of other managers and supervisors in the CoP. His diagram, once circulated to others in the CoP for comment and changes, will become his guide for his knowledge contributions. In this way, he will incorporate the schemas of the others in the CoP who will be using his knowledge. As a result, some of the director’s past experience will become irrelevant because it doesn’t apply in the current organizational context.

Finally, XYZ realizes that all contributions to the knowledge-base must be filtered somehow to make sure they are consistent with current company policy and practice. Two other managers in the CoP are given the task of excluding any contributed knowledge that appears to conflict with the organization’s current policies. If they are not sure about a given chunk of information, they can forward it to a division manager for an opinion. Once the contributions have been vetted, access to the acquired knowledge is granted to the remainder of the CoP, instructional designers working on training for the CoP, and selected information relevant to the organization as a whole is released to other supervisors and managers. Follow-up monitoring of how often this new knowledge is used for performance-improving activities can provide feedback on the success of the effort.

This example is a highly simplified snapshot intended to demonstrate how the issues presented in this paper might be applied to real-life situations. There are many more considerations and aspects of a knowledge management project required to maximize its success but the principles remain the same.

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The Selection of Supporting Technologies

Regarding the selection of supporting technologies, once the design and planning have succeeded in characterizing the project at the individual, CoP, and organizational levels, someone can be appointed the task of writing a requirements
document for distribution to technology vendors. There are many providers of these technologies who specialize in various aspects of knowledge management. The committee responsible for the knowledge capture initiative should evaluate technology proposals based on their ability to support the business solutions already developed.

Organizational capabilities for evaluating, testing, and implementing enterprise applications are well-established in most medium to large organizations. It is beyond the scope of this white paper to explore the current field of knowledge management solutions, particularly without a definition of specific business needs to be fulfilled. In some cases, organizations are choosing to adopt SharePoint, and applications designed to work with SharePoint, as the platform for this type of business community-based solution. That said, there are many other proven applications that accomplish specific tasks within the knowledge management domain. The key message in this paper is that selecting the most appropriate applications will be a much more mechanical, informed process after completing the worker-centric design and planning process. Since this is a very significant, long-term investment with implications for the future operational, competitive, financial success of the organization, taking a shortcut to technology adoption before the identification and characterization of the information needs of individuals and CoPs, has proven to introduce very significant risks of failure.

► Conclusions

In conclusion, knowledge management techniques, including the subset of activities related to knowledge capture and retention, are derived from a very broad set of disciplines but at the root there are simple, guiding, worker-centric principles that have great influence over the utility and results of efforts to become a learning organization. In oil and gas, a high priority is the prevention of knowledge destruction due to a high employee attrition rate, primarily due to retirement. Instead of searching for a technology solution to this problem, the successful design and planning for a knowledge management system begins with defining relevant organizational objectives and then within that context, focusing on the knowledge needs of individuals and communities of practice. Given a proper design and a focus on the utility of the solution for each CoP, workers will demonstrate essential behaviors that feed the knowledge-base and lead to a culture of participation. In order to keep the focus on relevant knowledge, contributors use the schema of the other knowledge users in their CoP to guide their contributions. In this way, knowledge directly related to performance improvement is collected and shared while minimizing sources of user frustration, such as searching through volumes of irrelevant information, which can lead to low utilization. Finally, once the business solution has been designed, supporting technologies are evaluated and implemented as needed. These technologies support knowledge acquisition, cataloging (indexing), storing, searching, and user analytics. Given active
monitoring, refinements are made over time to keep enhancing the utility of the knowledge-base for individuals in each CoP which further enhances utilization. Oil and gas organizations that recognize the importance of individual human cognition and its effects within communities of practice will be more successful in designing successful knowledge retention initiatives and maximizing the return on this significant investment.

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