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Applying Knowledge Management to Oil and Gas Industry Challenges

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The oil and gas industry has taken advantage of knowledge management (KM) developments for more than a decade. In that time, the industry has experienced rapid changes and so many mergers that a one-worded petroleum company name now seems like an oddity. Throughout the rapid advance of technology, an extension of offshore drilling, numerous acquisitions, the growing reliance on foreign oil sources, and a focus on environmental issues, KM initiatives have played a part in making operations more efficient and effective.

For instance, when oil and gas companies have been faced with new technology, outsourcing, new partnerships, and government regulation, their KM teams have provided support through technology and knowledge transfer, as well as asset management. When business issues involved capacity management, cost reduction, and the environment, KM played a part through forecasting/scheduling and process and technique innovation. And to improve speed and convenience, KM initiatives have expanded to address point-of-sale technology adoption and procedure effectiveness.

Undeniably, KM has been proven to increase stock market valuation, assist in growth through acquisition, lead to better-developed products, and encourage intelligent leadership for tenacious early adopters. Chevron's (now ChevronTexaco's) definition of KM is apt for much of the industry: processes, tools, and behaviors that deliver the right content to the right people at the right time, and in the right context so they can make the best decisions, exploit business opportunities, and promote innovative ideas.

Industry leaders, many of now merged companies, have embraced KM:

- "We learned that we could use knowledge to drive learning and improvement in our company. We emphasize shopping for knowledge outside our organization rather than trying to invent everything ourselves. Every day that a better idea goes unused is a lost opportunity. We have to share more, and we have to share faster." - *Ken Derr, Chevron*
- "All companies face a common challenge: using knowledge more effectively than their competitors do." - *John Browne, BP Amoco*
- "Knowledge management is the framework for innovation to succeed in the new business while adapting employees to the rapidly changing operating environment." - *Brendan O'Neill, Imperial Chemicals Industries*
- "We got into KM because we had so many projects going on that it was difficult to standardize without limiting creativity. … Through KM, different leaders not only share experience and knowledge, but go forward to create what I call 'contamination centers' where people infect each other with ideas." - *Rudulfo Prieto, PDVSA*
- "We must become experts in capturing knowledge, integrating and preserving it, and then making what has been learned quickly and easily available to anyone who will be involved in the next business decision." - *D.E. Baird, Schlumberger*

After so many years of experience, knowledge management may not be a novel concept. But an existing KM infrastructure can be a cost-effective means of addressing new and/or increasingly pertinent operational issues in the oil and gas industry, including retaining valuable knowledge during a period of

work force aging/diminishing and increasing efficiency through communities of practice. Furthermore, many companies are fine-tuning their best practices transfer process using content management systems and communities of practice to further minimize downtime at field sites across the globe.

Shifting Work Force and Preventing Corporate Amnesia
In addition to numerous mergers and acquisitions, the industry has recently undergone significant turnover, internal redeployments, and growth-then-contraction fluctuations. All of this occurring in an industry in which an aging work force poses a threat to knowledge retention.

The Society for Petroleum Engineers (SPE) estimates that between 1980 and 1998 the number of people working in the oil and gas industry fell from about 700,000 to 300,000 people. The median age of today's SPE members is 47. The industry will experience a 44 percent attrition rate among petroleum engineers by 2010, and 231,000 years of cumulative experience and knowledge will be lost to the industry in the next 10 years due to retirement. Almost half of the work force will be new. Collectively, upstream oil and gas companies will likely lose more than 60 percent of all employees-along with their experience and knowledge-by 2010 (Sapient Corporation. *Brain Drain: Retaining Intellectual Capital in the Energy Industry*. 2001).

Through its recent KM consortium benchmarking study, APQC found that the best way to retain valuable knowledge in the face of attrition or downsizing is to build and sustain systemic KM approaches. Many best-practice organizations embed their knowledge retention efforts in their overall KM strategy through: identifying and mapping the at-risk knowledge loss, evaluating the risk, interviewing executives, employees or subject matter experts, conducting project reviews and After-Action Reviews, and establishing communities of practice. The most effective way to combat tomorrow's knowledge loss is to capture, retain, and transfer valuable knowledge in today's process and work flow, according to APQC's 2002 Best-Practice Report *Retaining Valuable Knowledge: Proactive Strategies to Deal with a Shifting Work Force*. This not only retains the context, but also links the sources and co-creators of knowledge while they are still present to learn from each other.

Best-practice organizations often work closely with HR to design and implement knowledge retention strategies, including hiring employees who will work effectively in a knowledge-sharing environment. PanCanadian Petroleum Limited, a best-practice partner in APQC's 2001 study *Succession Management: Identifying and Cultivating Tomorrow's Leaders*, prepared to retain knowledge using its HR programs. The general managers of business units or centers of excellence were responsible for their respective units and identified trends and future directions, development requirements and follow-up to make sure they occur, and continuity in succession planning and work force management (forecasting). IT also had a risk mitigation plan that managed talent discontinuity. Consequently, leaders knew where needs would arise before knowledge retention became a problem.

Minimizing Downtime
The cornerstone of knowledge management is sharing best practices and lessons learned. Companies like Chevron Texaco, Schlumberger, and ExxonMobil have improved their efficiency by institutionalizing a knowledge-sharing culture. But as these organizations collect large amounts of data, content accessibility and organization become pressing issues. The magnitude of content has increased dramatically, but the time to find and understand it has not. The next step in KM library management is creating content management systems to further minimize the time between having a problem/issue and finding a solution/effective approach.

Knowledge management provides context for content management.

Content management systems of people, processes, and technology provide meaningful and timely information to end users by creating processes that identify, collect, categorize, and refresh content using a common taxonomy across the organization. Content can include databases, audio clips, competitive data, presentations, publications, e-mail virtually any artifact of transactions or dialogue or creative work,

inside or outside the organization. Users can access internal and external content from the same system and with the same queries, yet still know the source of the content.

The adoption of content management systems reflects a growing strategic importance of online services and delivery systems within the oil and gas industry.

Knowledge management provides context for content management by enabling the successful application of the content to today's issues. Schlumberger, a best-practice partner in APQC's 2001 study *Managing Content and Knowledge*, is a leading example. Knowledge management and content management are interrelated at Schlumberger. The company formed the Schlumberger KM group in 1998 to "develop and deploy processes and technology to improve organizational performance and reduce cost for Schlumberger and its customers by enabling individuals to capture, share, and apply their overall knowledge in real time."

The primary impetus for Schlumberger's content management business case was that employees needed access to online information in order to more effectively perform their jobs. The company was hosting numerous Web sites, which was confusing to both employees and customers and resulted in redundant and obsolete information, as well as substantial operational overhead.

The initial content management systems were deployed across the enterprise, with approximately 50,000 employees (that number has since increased by more than 25,000) and 600,000 external customers. Schlumberger began the content management initiative with a small team consisting of five staff members devoted to KM. Schlumberger spent about four years developing its current content management systems.

The initial investment required for the content management systems at Schlumberger was more than $1 million. Schlumberger factored in the time savings of its employees and the cost savings based on server and other information technology consolidation as part of the business case. Beyond the hard numbers, the investment in content management was justified because of its substantial increase in service quality to customers, which indirectly leads to revenue enhancement and cost savings in the field.

Schlumberger currently has three primary content management initiatives in place

1. **The Schlumberger Knowledge Hub** ("The Hub") is an intranet and Internet enterprise information portal that provides employees and customers uniform access to information. The initial goal of the Hub was to centralize the many Schlumberger Web sites and provide access to:
   - knowledge repositories,
   - project management and collaboration spaces,
   - real-time stock and industry activity,
   - a help desk, and
   - support for multiple internal and external audiences through threaded discussions, community repositories, and collaboration technology.

   A key feature of the Hub is the seamless view it provides to the end user, whether it is an employee or a customer. All information is stored in one repository, and the portal posts only the appropriate information for each customer type.

2. **Realtime News** is a news-based corporate portal, hosted on the Hub, which is updated every hour with the most current industry and corporate news. Customers and employees can search, categorize, and customize the information. Realtime news allows Schlumberger employees to be in close touch with their customers in real time; the goal is also to align the perspective of the employees with that of their customers. More importantly, customers might return to the Schlumberger home page for more information.

3. **The InTouch Knowledge Hub** provides a single electronic interface for information exchange on products and services between the field (Schlumberger engineers located at customers' locations) and its technology centers (help desks that handle incoming calls and questions from the field organization). Through the InTouch application, the field has easy user-friendly interchange capabilities with these technology experts and access to validated information, electronic documentation, knowledge repositories, and training aids.

Some of the operational challenges that Schlumberger had to address during the implementation of its content management system involved ensuring connectivity worldwide in a geographically dispersed organization, technology maturity, technology project cycle time, and finding skilled programming resources. Schlumberger also had to handle a number of cultural issues to make the content management evolution a success. One issue the company had to consider was that it was changing the work environment of its employees. People are typically resistant to change and its resulting uncertainty, which must be addressed and managed. Another issue for Schlumberger was the fact that it is a decentralized organization, where local managers have the tendency to build their own silos. Also, Schlumberger is a transnational organization and had to handle multiple languages for both employees and customers. Finally, the company's content management system was built to be a sustainable system, which is much more difficult than building a one-off system.

Some lessons learned at Schlumberger follow:

- It is important to realize that knowledge management and content management are the tools to help companies reach their business goals, and they are not the solutions in and of themselves.
- Craft a solution that is applicable across the enterprise, and adopt an evolutionary approach as business needs require, rather than assume it will be a one-time technology that can be implemented.
- Putting aside technology and process, fundamentally the people involved in the knowledge and content management effort will really make the difference.
- The cost of initial content migration is substantial. Not only will the company have to migrate existing content, but also much of that content will need to be revisited and revised before it is made available to the company population.
- Time and money will inevitably be wasted due to failed technologies or technologies that don't live up to their promises. The tools to publish content should be very easy to use.

Schlumberger KM employees envision an ever-increasing range of commercial technology in the future of content management. This will include more automated support for the classification of knowledge objects, for the assembly and reuse of content, and for multiple touch points (e.g., personal digital assistants and phones). Extensible markup language will be standardized across the company as a basis for content creation and publishing, and content editors will have increased control over the publishing process (e.g., defined work flows for specific tasks). Finally, there will be better technology available to provide more support for distributed authorship, editing, and publishing. In its next iteration of content management, Schlumberger is planning to introduce open architectures, which will enable the use of best-of-breed commercial technology.

Through consortium benchmarking studies, APQC has found numerous best practices in content management. For instance, the business case for the content management system investment is often strategic, mission-oriented, and positioned as a cost of doing business, not as an investment requiring a clearly measured ROI. Best-practice organizations offset their initial request for funding on the basis of cost reduction and productivity improvement, even though they have a more strategic rationale for the system. The primary cost driver is labor for design, development, and implementation, not for software and systems. Many early adopters developed their own content management applications and are now moving to commercial applications, which will require further investment.

APQC also has found that there is no single technology solution to content management. The key is to understand all the components of the content management process and then look for the technologies that will best fit those needs. APQC KM experts advise to design the processes around the user and add technology as an enabler. While purchasing technology, assess the costs required to acquire, customize, support, and implement an application. To get an estimate of overall costs, however, don't forget to include the people costs involved in gathering the data, auditing the data, and supporting the users.

Communities of Practice Impact Growth and Customer Satisfaction
The final industry imperative to address is not new; oil and gas companies join organizations across all industries in seeking ways to improve overall efficiency. Communities of practice (CoPs) are the next step in the evolution of the modern, knowledge-based approach to process and productivity improvement.

Communities of practice create a channel for knowledge to cross boundaries created by workflow, functions, geography, and time. And CoPs promote the development and rapid standardization of practices across operations and regions. People share a common interest, legitimized by business intent, and form relationships that provide support and validation. Members collaborate, use one another as sounding boards, teach each other, and strike out together to explore new subject matter. They are held together by a common interest in a body of knowledge and are driven by a desire and need to share problems, experiences, insights, templates, tools, and best practices.

A significant percentage of the oilfield services business requires complex, context-specific solutions rather than standard best-practice solutions that come "off the shelf." Halliburton Energy Services is using communities of practice to leverage the knowledge and experience of experts around the world to develop solutions that precisely meet the needs of customers for complex well designs and difficult well conditions.

"By helping to build these communities, we are not only realizing huge improvements in business processes and performance, but also providing employees with greater access to one of the most valuable learning resources: interaction with peers," said Michael Behounek, director of knowledge management at Halliburton.

An example of how KM is providing value to Halliburton and its customers was captured by an electric wireline perforating business development representative in Houston. One of his customers was concerned about which perforating system would be best for a well design on the drawing board. Of particular concern was whether or not there would be problems retrieving the perforating equipment from the well. The customer wanted a response that same day. The Halliburton BD representative is an active member of a perforating CoP and, upon hearing the customer's questions and concerns, immediately spoke with the community's full-time knowledge broker. In turn, the knowledge broker presented the question to the community. Almost immediately, an experienced engineer in New Iberia, La. replied that he had spoken with several field people in his location; they perform this service, using the system in question on a regular basis and could not recall any problems. Consequently, the BD representative in Houston provided the customer with a screenshot of the collaboration around his request. The customer awarded Halliburton the work. Furthermore, a couple of days later, another field engineer in Laurel, Miss. added to the collaboration and cited that his crews had performed many similar jobs in even more difficult situations. Halliburton representatives believe that being able to share this kind of information with a customer results in more than winning a single job; the customer is confident that the company brings not just the right crew and equipment to the job, but also the power of an entire community of experts.

Drilling teams at BP Amoco act as CoPs by replacing a bias toward action with a bias toward learning. A drilling team at the Schiehallion oil field in the North Sea, for instance, embedded drilling lessons learned after each successive well it drilled. The result was a savings of $50 million in drilling costs and a record time to drill wells in that region. Overall, the number of days spent drilling deep-water wells at BP Amoco has been reduced by more than half.

At Chevron, a best-practice partner in APQC's 1996 groundbreaking study [Knowledge Management](#), CoPs were just one component of a KM portfolio that included its intranet, skills/expert directory, project-focused best practices database, organizational learning tools, collaborative tools, data mining tools, consulting, online FAQs, and customer-driven knowledge-sharing applications.

Its Refining Best Practices Network represented a group of operations and technical experts and management sponsors. This group developed, shared, and tracked implementation of best practices for refinery and laboratory operations and safety. A network of experts in Chevron's U.S. oil refineries supported best practices teams covering the major, high-cost functions common to all six plants ranging from catalytic cracking to plant maintenance. This program distinguished its U.S. refining operations for the systematic sharing of both internal and external best practices. Other examples of Chevron CoPs, created in the 1990s, include: energy efficiency, chemical plan managers, planners forum, customer satisfaction network, diversity forum, competitor intelligence network, and the machinery specialists conference.

Results and Using Past Successes for a Business Case Rationale
Another advantage of using an existing KM infrastructure to address new challenges is that a company believes its own KM success stories; senior management and the work force have seen the benefits of a KM initiative firsthand. Gaining support may be easier, and the KM approach can be refined based on initial lessons learned.

AAt Schlumberger, the InTouch system created a centralized knowledge-based organization, with easy access to information. The results were $150 million cost savings a year, a 95 percent reduction in time to resolve technical queries, and a 75 percent reduction in time to update engineering modifications.

To create a single, global company and reduce cycle time, Shell established global CoPs, broke down the "old boys" network, transferred best practices, and shared stories "from the edge." These efforts led to $200 million per year costs savings, a reduced number of wells, increased facility uptime, and reduced design and planning errors.

In 1998 BP Amoco documented $700 million in savings from knowledge sharing.

At Chevron, savings from 1991 to 1999 were $650 million from just one community effort. Chevron's energy-use network generated an initial $150 million in savings in its first year with a total over time of $650 million. Across Chevron, from 1992 to 1999, productivity increased 30 percent and employee safety improved 50 percent. "Of all the initiatives we've undertaken at Chevron during the 1990s, few have been as important or as rewarding as our efforts to build a learning organization by sharing and managing knowledge throughout our company. In fact, I believe this priority was one of the keys to reducing our operating costs by more than $2 billion per year from about $9.4 billion to $7.4 billion over the last seven years," said Kenneth Derr, recently retired chairman of Chevron.

The oil and gas industry has been a clear leader of the quality movement and in knowledge management. Those who have found success with KM principles can now take advantage of an established infrastructure and a more knowledgeable work force and KM team to address pertinent challenges, be they acquisitions, globalization issues, reducing downtime, organizing content, or organizing people. Derr made an important point for oil and gas companies that aren't broken but are still pursuing continuous improvement. "Decentralized companies, especially global companies, will always be challenged to achieve uniform performance in sharing knowledge just as they are in other areas," he said. "But the key is to view the differences as opportunities rather than deficiencies."