Knowledge Management – The Road Ahead

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For additional information, see:

R. G. Smith and A. Farquhar. The Road Ahead for Knowledge Management: An AI Perspective. AI Magazine, 21(4):17-40, Winter 2000.

Enabling organizations to capture, share and use the overall experience and know-how of their people is fundamental to competing in the knowledge economy. As a result, there has been a wave of enthusiasm and activity centered around Knowledge Management. To make progress in this area, an ensemble of interwoven technology, process and cultural issues must be addressed.

In this presentation, we start with an examination of the present state of knowledge management and the goals of organizations that pursue KM activities. Next, we look at what may lie ahead. Whereas the Winter 2000 AI Magazine article concentrated on future AI technology, in this presentation we take a broader perspective. We examine 4 possible future headlines that cover technology, business, learning and management.

Finally, we attempt to quantify the power of knowledge sharing, following the familiar Metcalfe's law (*If there are n people in a network, and the value of the network to each of them is proportional to the number of other users, then the total value of the network (to all users) is proportional to $n \times (n-1) = n^2 - n$, or n^2, for large n.*)

Oil & Gas Drilling
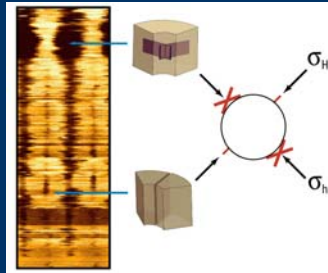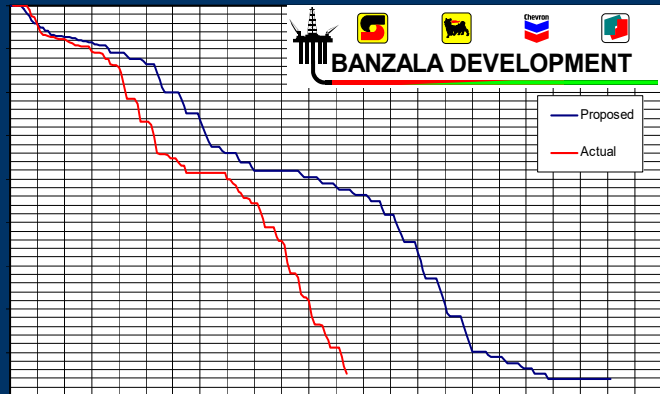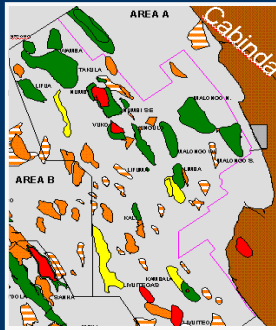
Apply everywhere what you learn anywhere

Knowledge Management

… Improve organizational capability

… Create a new working environment where knowledge and experience can easily be shared

… Enable individuals to apply their collective knowledge to make optimal decisions in real time

The focus of knowledge management is improving organizational capability.

To succeed, an organization must create a new working environment where knowledge and experience can easily be shared. In such an environment, individuals are able to apply their collective knowledge to make optimal decisions – in real time.

The biggest challenge is to create/nurture a knowledge-sharing culture – one in which people share their knowledge and learn from others as a matter of course – they see it as the right thing to do.

The key issues revolve around people, processes, technology and content.

Exploration & Production
- – Reduce unit cost of production ($/BOE)
- – Increase recovery factor: 30 - 40% → 60 - 70%
- – Reduce investment and operational risk
- – Maintain stable production with reduced investment
- – Reduce Drilling Cost

What do organizations try to achieve? An organization's senior management team is concerned with bottom line results like these:

Revenue

Earnings per share

Return on Average Capital Employed (ROACE)

Revenue per employee

Market capitalization to book value ratio

Employee turnover

Average age

Another topical concern is integrating the organization (e.g, after a series of acquisitions / mergers).

Each industry sector has its own business drivers. The following are representative for Petroleum Company Exploration and Production departments:
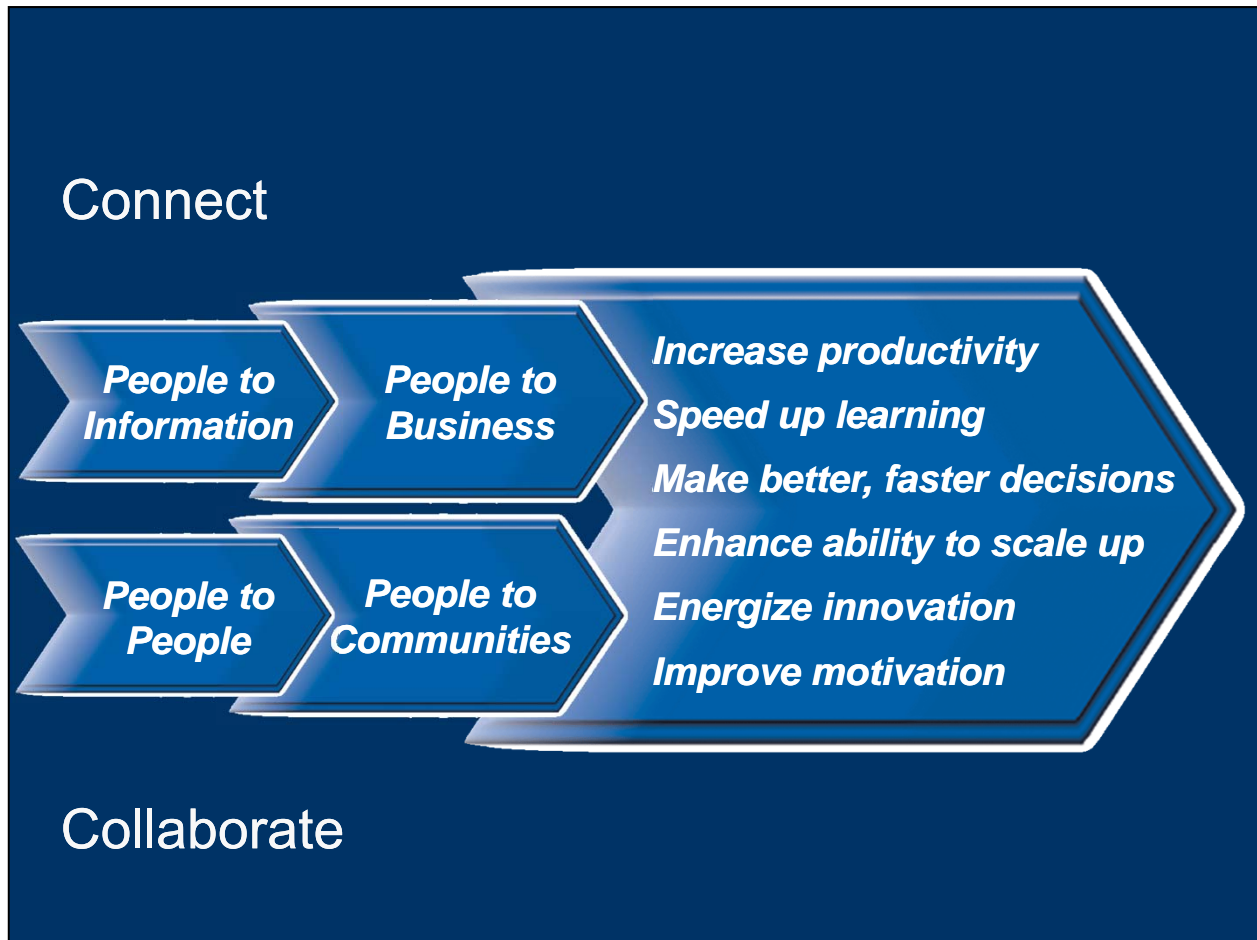
Reduce unit cost of production ($/BOE)

Increase recovery factor: 30-40% to 60-70%

Reduce investment and operational risk

Maintain stable production with reduced investment

Reduce Drilling Cost.

To achieve bottom line results, KM activities can help organizations to: increase employee and asset productivity; speed up organizational learning; make better, faster decisions – reduce cycle time; enhance the ability to scale up the organization; energize innovation – in product development, in business development, in customer relations, ...; improve employee motivation – remove the clutter from people's jobs and give them the confidence of knowing that they are riding on top of the best knowledge and experience held by the overall organization.

Anne Marie Cannon of Morgan Stanley Dean Witter estimates a revenue enhancement and cost savings potential of 5-10% per oil & gas company is possible via KM and Collaboration. Most of this bottom line impact is expected to come from cycle time reduction, using the following logic. Proper use of information systems allows best practices to be distributed efficiently, and standardization and best practices can lead to significant per barrel cost savings. The key is to focus KM activities on bottom line business drivers and not on peripheral activities: The key banners are: Connect and Collaborate.

Connect People To Business. Organization must align people to the business, making them feel that what they do every day contributes to the business goals, rather than being passive readers of annual or quarterly results. Each person must understand how what he or she does contributes to the overall goals.

Connect People to Information. It is essential that people have the information they need to do their jobs – finding data, best practices and lessons learned, news, help desks, business policies, process and procedures, e-learning, information in the extended enterprise of partners, suppliers, customers, universities, etc. The portal is the approach of choice – with personalization, search, real-time data feeds, publish and subscribe services, security and authentication, document management, and so on. But it is not just a question of technology. This connection also includes the processes and encouragement needed to cause the people to contribute information and to trust and use information they find.

Connect People to Communities. The fundamental organizational unit of KM is the Community of Practice (CoP). Strong and vital communities enable people to mentor each other, collaborate and work together on Distributed Virtual Teams, without necessarily being co-located. Processes are needed, plus technology and a culture that encourages people to form and link to interest groups, to have discussion forums, to assist each other and to influence the strategy of the organization. Technology includes chat, shared calendars, threaded discussions, whiteboards, collaboration workspaces, instant messaging, etc. People and process support involves community leaders – knowledge champions in Schlumberger.

Connect People to People. To form communities, people must first of all be able to find each other. It is widely accepted that a corporate "people finder" – perhaps based on an LDAP directory – is a must, with its basic contact information on the people in the organization – e-mail, phone, address, etc., but also job, expertise and interests. This connection includes processes and encouragement to make people feel comfortable with publishing their expertise, asking for and giving help, ...

InTouch

- **Goals**
  - Improve service delivery
  - Improve deployment & support of new technology
  - Improve workforce motivation
  - Position organization for cyclic business environment

- **Strategy**
  - Create a centralized knowledge-based organization
  - Easy access to information
    - Timely & direct information exchange
      technology centers ↔ field
      field ↔ field

InTouch Benefits

- **Cost Savings**
 - Over $30 million annually

- **Response Time**
  - 95% reduction in time to resolve technical queries
  - 75% reduction in time to update engineering modifications

- **Lessons Learned**
  - Devote sufficient human resources to ensure knowledge management initiatives ease (rather than add to) employees' daily workload
  - Incentivize and recognize desired behavior

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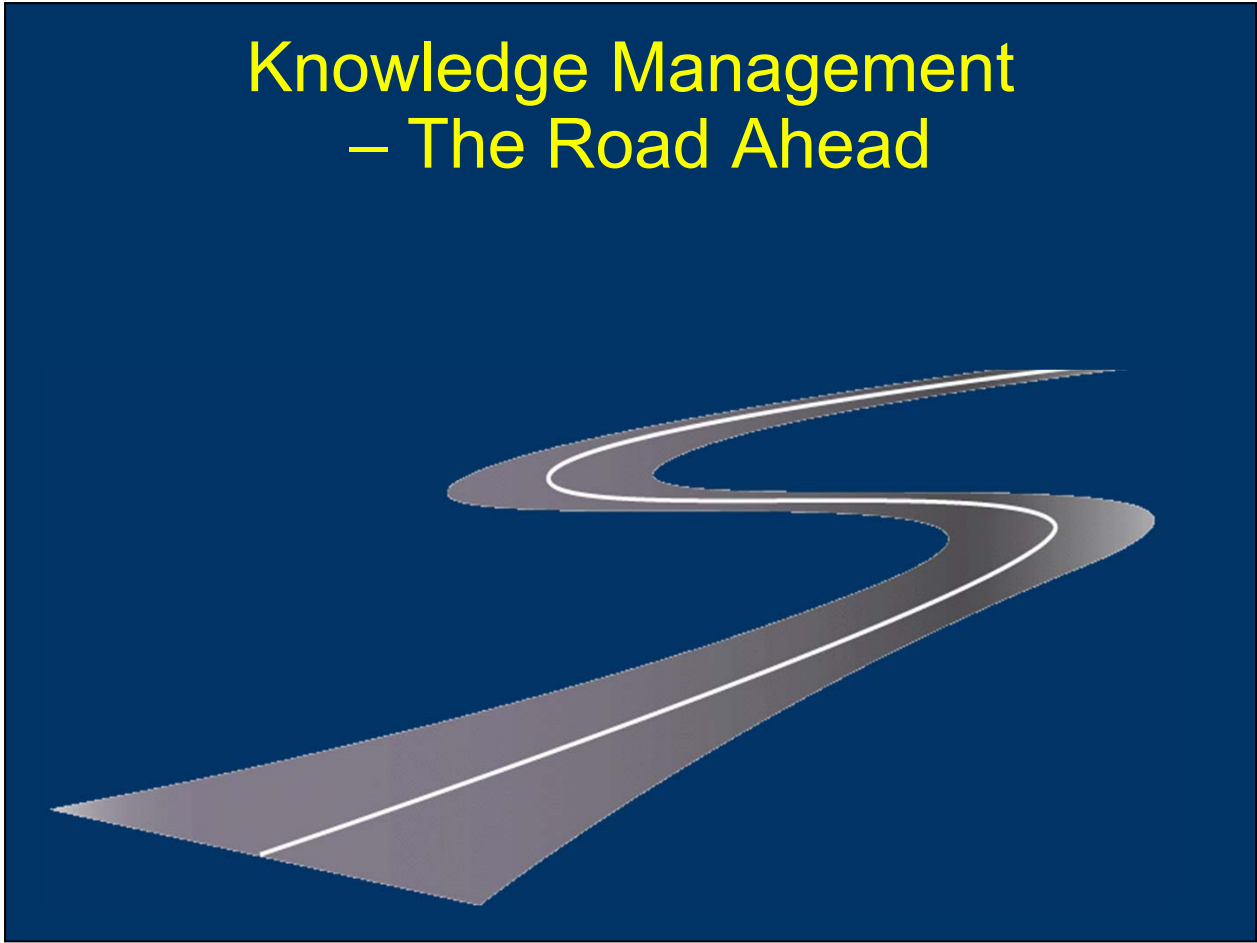
Headlines

Technology continues on the same curve

Knowledge Management ➔ e-Business

Just-In-Case Learning ➔ Just-In-Time Knowledge Delivery

Knowledge Management ➔ Management Competency

These are possible futures. I believe that the technology prediction is "risk-free." The others are easy to state, but many pitfalls lie between now and a future in which they could come true.

Technology continues on the same curve

Infrastructure, Portals, Search, Content Management, Simulation, Decision Support, Agents, AI, …

- Information → Services, Process Support, Collaboration

- Exactly what you need, when you need it, where you need it, how you need it
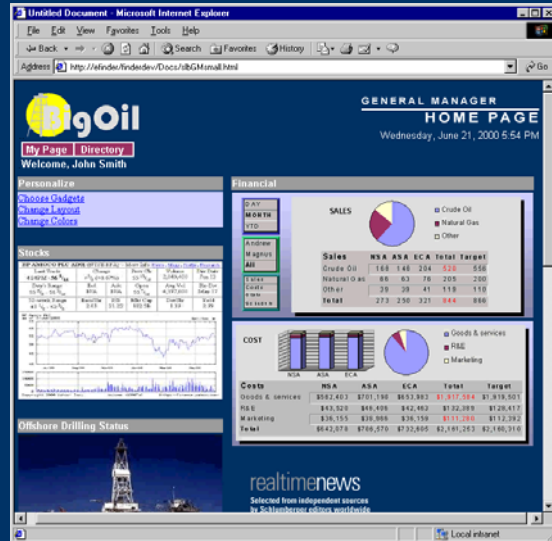
Control @ a Glance

See the *AI Magazine* article for additional detail.

DecisionPoint is an example of where Portals are going.

Knowledge Management ➔ e-Business

- Communities of Practice ➔ Extended Enterprise
  - Customers, partners, suppliers

- Knowledge Transactions
  - Best practices, access to experts, collaboration
  - Portals: Customer, Extranet, B2B, Industry
  - Knowledge Exchanges ➔ Knowledge Brokers

  e-Business ➔ Business

e-business is not just about selling products online, as e-commerce was originally defined. It covers all aspects of relationships with customers, suppliers, and partners (e.g., sales, marketing, technical support, news, tracking and reporting progress, linking customers and employees). It also includes service; infrastructure; and multiparty, multidirectional (business-to-business) transactions (Karlenzig 2000).

Knowledge management projects lead naturally to e-business projects over time. i) the benefits an organization reaps from knowledge management activities (e.g., improved practices, up-to-date technical information) are also beneficial to customers, suppliers, and partners. ii) the portals and other knowledge management systems that ensure employees have access to critical information can provide a similar service to customers, suppliers, and partners—requirements are almost identical. Portal technology, common to the Schlumberger public knowledge hub and its internal counterpart, is a step in this direction. Iii) much knowledge that companies reuse is generated beyond the bounds of the single enterprise by the "extended enterprise" (customers, suppliers, partners, and alliance members) and beyond (Dawson 2000). It is essential to have access to this external knowledge.

Some organizations use knowledge as a competitive differentiator, some sell it directly, others offer services and technology to enable their customers to improve their own KM. Three other possibilities for direct exploitation of knowledge management are customer-specific (extranet) portals, industry portals, and online industry product catalogs.

The customer-specific (extranet) portal provides direct information and support for products and services that are required to support an organization's relationship with a specific customer.

The industry portal draws traffic and revenue by providing a variety of things to see and do. Such portals exist to serve many industries (for example, plastics, metals, medical). We expect this trend to continue (along with consolidation in the number of portals that serve any particular industry). An example in the energy industry is IndigoPool.com. In addition to news and information, it provides an online oil and gas asset-trading service, complete with the data management and economic simulation tools necessary to evaluate the fit of the assets with a potential buyer's portfolio.

Knowledge Transactions will become standard. Different business models will be developed as companies seek to understand how to take advantage of their knowledge. Some will sell best practices, others will sell access to their experts, others will sell collaboration among community members. Questions about intellectual property and value assessment will become very important.

Knowledge Exchanges & Knowledge Brokers: The predicated Disintermediation actually leads to Infomediaries for filtering / quality control, aggregation.

The 'e' in e-business will become superfluous. As a colleague told me, "there's no business but e-business", … it's the only business I know … and you can add the music as desired. (to the tune of "there's no business like show business, …")

Just-In-Case Learning
➔ Just-In-Time Knowledge Delivery

- **Today**
  - Time to Competence
    - 16 weeks (1998) ➔ 8 weeks (2001)
    - Synchronous & asynchronous distance learning

- **Future**
  - Deliver knowledge needed to perform a task when it is needed … in context
  - Help Desk Plus

  … just in time, just enough, just for me

Future:

Teachable moments; i.e., those moments when you are in trouble and know that you need help.

Help Desk Plus. Suppose the help desk gave you not only the answer to a problem, but also the rationale behind the answer, together with the training you need to carry on and further develop your skills.

Knowledge Management
→ Management Competency

The ability to create and nurture a working environment where knowledge and experience can easily be shared.

The Right Conditions
– Performance-driven organization
– Common infrastructure

+

The Right Means
– Common tools, processes, skills, incentives, recognition
– Recruiting, training, acting

The Right Actions
– People instinctively seek, share, and leverage know-how and new ideas … they see it as the right thing to do

Over time, knowledge management will become an expected standard management competency, like financial management, project management, etc.

Competition vs. sharing; individual incentives vs. team incentives

Balanced Scorecard: Financial, Customer, Internal Business (Internal Process), Innovation and Learning (Learning and Growth) [Kaplan and Norton changed the words between the original 1992 article and the 2000 article.]

Another way to look at it:

Financial Focus

Customer Focus   Human Focus   Process Focus

Renewal and Development Focus

Operating Environment

Recruiting: hire knowledge sharers

Training: at every training opportunity, reinforce why we want knowledge sharing

Acting: demonstrate your personal commitment. Walk the talk, Ask questions; e.g., with whom have you shared your learnings, what have you learned from others?

Keeping track of skills & expertise (skills bank … a la SkillScape).

Right Conditions + Right Means -> Right Actions comes from BP.

Incentives & Recognition

- **Sharing and Using Knowledge**
  - Reduced Time / Effort for Job Preparation
  - Reduced Stress through Better Planning & Execution

  Knowledge Sharing - Shares own knowledge, learns from others and applies knowledge in daily work. Open to new ideas and continuous learning.

  - Recognition by Community
    - *Visibility: Name in the News, Leaving a Legacy*
  - Recognition by Management
    - *Objectives, Appraisal, Career Progression*

Note that in Schlumberger, as of 2000, knowledge sharing is part of the annual appraisal process: *Knowledge Sharing - Shares own knowledge, learns from others and applies knowledge in daily work. Open to new ideas and continuous learning.*

A few other points.

Hire people who have a history of knowledge/information sharing.

Promote people who exhibit this behavior.
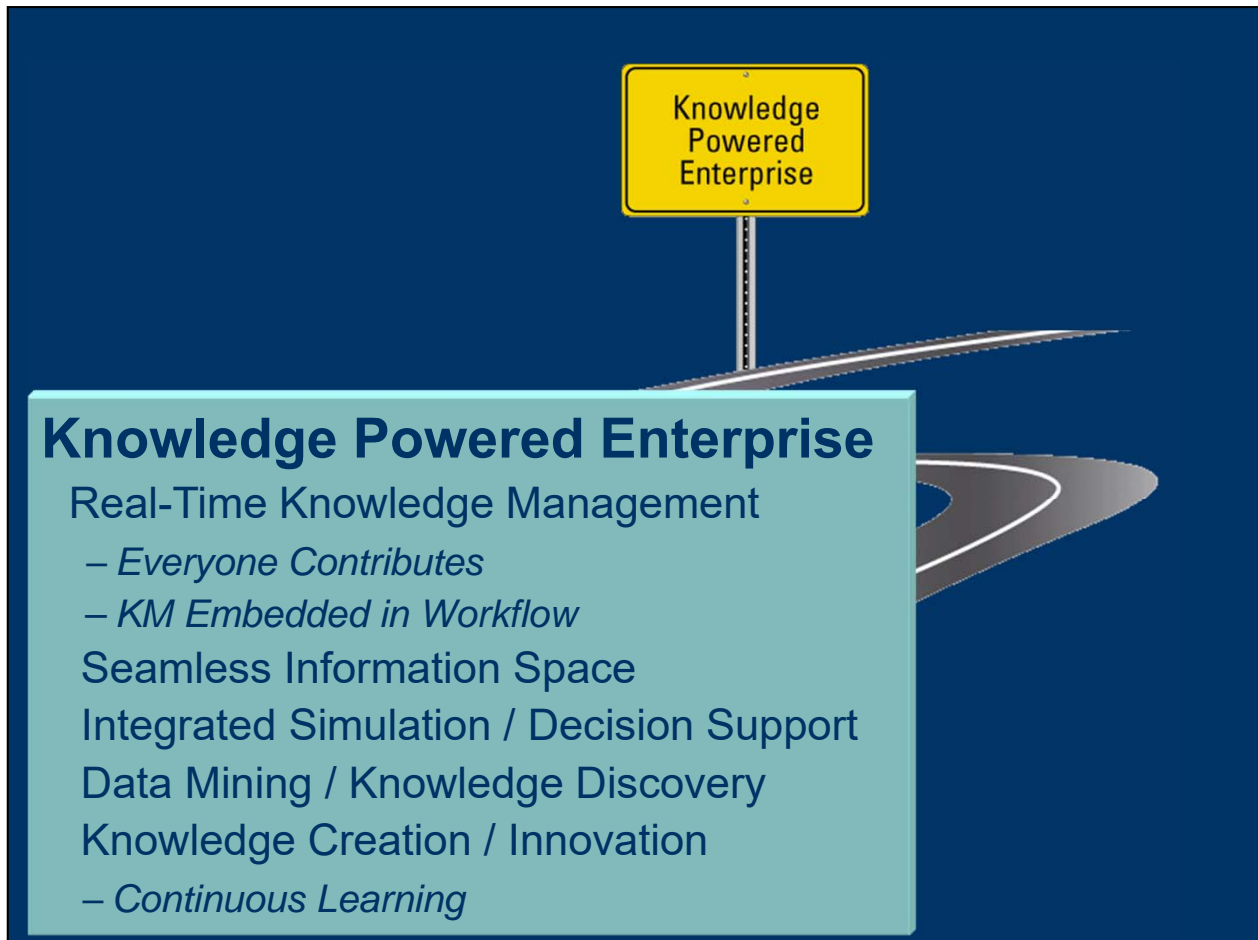
Enhanced Client Relationship

e.g., Customer letter of recognition coupled with a Case History (tied to Performed by Schlumberger)

Teamwork, Innovation, Value Creation

Friedrich Bock. The Intelligent Organization. Arthur D. Little PRISM, Second Quarter 1998.

"Research has shown culture to be the principal determinant of the success of knowledge management. Astonishingly, it is also the most neglected aspect. As a result of this neglect, cultural issues often take more than 50 percent of project time and create enormous complexity—with all-too-familiar results. Most organizations still endure costly "turf" battles and rely on local solutions, rather than seeking and emulating best practices within the company or outside. And individuals still hoard personal knowledge to justify their indispensability. In a recent ADL survey of senior managers, only 15 percent of the participants said that their companies reward the sharing of knowledge between functions, divisions, or sites. An outstanding exception is Holderbank—the world's largest cement manufacturer—which has as the motto for its worldwide learning program "Steal with pride—share with delight." Holderbank identifies its best practices at more than 50 international sites, assigns "taker" and "giver" roles to pairs of colleagues, and measures improvements. Importantly, the "taker" of information receives at least as much positive recognition in the corporation as the giver.

The importance of recognizing contributions, saying "thank you"

Knowledge Powered Enterprise

Real-Time Knowledge Management
– *Everyone Contributes*
– *KM Embedded in Workflow*
Seamless Information Space
Integrated Simulation / Decision Support
Data Mining / Knowledge Discovery
Knowledge Creation / Innovation
– *Continuous Learning*

This is the one-slide version of the end point of the AI Mag article road map. Beyond the first chicane, the last visible road sign is "knowledge powered enterprise". In such an organization, knowledge management is "organic" (Shevlin et al. 1997). It happens everywhere—in the background, in real time. Everyone contributes. Knowledge management process and behavior are embedded in the workflow as part of the normal day-to-day job. Knowledge management functions are embedded in core business applications and employee productivity tools. KM specialists may still be present to assist; e.g., as librarians. However, they will be part of a small team that operates across the company.

Seamless information space: Everyone has rapid access to the information needed for the job. The portal will be extended across the organization. CoP members will not need to know which information is stored in which application on which server. They will get the information they need when they want it, where they want it, and how they want it delivered.

Integrated simulation and decision support: Vignette 3 dealt with an oil company well engineer talking to a potential investor. The investor was able to compute the likely effect of a well operation, drilling a sidetrack, from a geoscience point of view. He then used the results to compute the rate of return and risk associated with the proposed investment. Combined geoscience, economics, and risk simulation can be done today, but it is neither commonplace, nor real time.

Data mining and knowledge discovery: Today, most enterprises are still at the stage of trying to capture the data in an organized fashion, let alone trying to mine it to influence business decisions. However, we expect three threads to come together: First there will be continued evolution of data management technology. Second, powerful new data-mining and knowledge-discovery technology will be developed. Third, these two types of technology will be coupled with portal technology to deliver the information needed to perform a task just in time for it to be of use (Mitchell 1999).

Developing integrated simulation and decision support tools is likely to consume substantial resources. It represents a major challenge in and of itself. For Schlumberger, a sizable fraction of the entire R&D budget is devoted to building tools that can be used by clients to solve problems like that in the vignette. However, from a KM perspective ii is important to ensure that the tools can be coupled in useful ways to the seamless information space via the intranet portal (including its case bases, best practices, and other information) and with the data-mining and knowledge discovery systems.

In the knowledge powered enterprise, knowledge sharing and application are standard. The new focus is the KM end game—fostering knowledge creation and innovation by continuous learning to replenish and renew its stocks of knowledge. Data-mining and knowledge-discovery tools play an important supporting role. The new challenge for KM will be reinventing the organization as a provider of products and services that are only possible because it is able to leverage the collective knowledge of its people. This depends on a new working environment where knowledge and experience are easily shared.

Let's remember – it is not a leisurely drive down the road ahead. It is a race, and the competitors are lined up on the grid.

Q&A Material

The Power of Knowledge Sharing

$$p \approx n^2$$

p – network power   *Metcalfe's*

n – network size   *Law*

$$p \approx k$$

k – knowledge

~~… Knowledge is power~~

$$p \approx nk^s$$

s – sharing network size

… Power is knowledge^{shared}

Let's examine the power of knowledge sharing.

Start with Metcalfe's Law If there are n people in a network, and the value of the network to each of them is proportional to the number of other users, then the total value of the network (to all users) is proportional to n x (n-1) = n^2 - n (Shapiro and Varian, 184).

For large n, this is approximately equivalent to $v \approx n^2$

Moving on, another familiar equation is $p \approx k$

Which will be even more familiar if written out as … knowledge is power.

However, this is only true for networks of size 1.

Instead, a useful restatement that captures the effect of knowledge management is $p \approx nk^s$
where s = the number of network members among whom the knowledge is shared.

Or, to restate. Click. power = knowledge^{shared}

See: http://www.reidgsmith.com/Power.htm

The Power of Knowledge Sharing
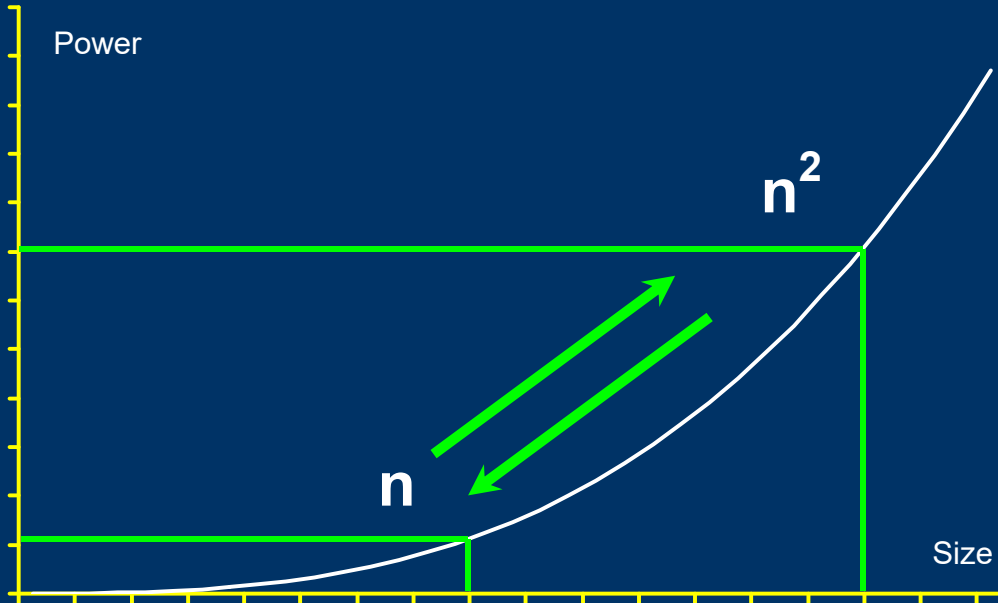
… Power is knowledge^shared

Let's look at this graphically for two organizations, one of size n and the other of size n^2.

The graph shows the power of the two organizations plotted against their size.

Note that if the n organization shares it knowledge to the maximum; that is across all n members, and the n^2 organization does not share information at all, then the power of the small organization will be equivalent to that of the large organization (derivation below).

Hence, with effective knowledge sharing, a small organization can be as powerful as a much larger organization.

On the other hand, if an organization does not share effectively, then the power of a large organization can effectively be reduced to that of a much smaller organization.

So … you can make your small organization look much larger by sharing … or you can make your large organization look much smaller by not sharing. The choice is yours.

Derivation: Compare two organizations, one of size n1 that shares its knowledge k across all nodes, and the other of size n2 that does not share its knowledge.

n1*kn1 = n2*k

n2 = n1*kn1-1 approx = $k*n1^2$ for large n1.

n2 = $k*n1^2$

If k = 1 unit, then the non-sharing organization must be the square of the size of the sharing organization to exhibit the same power.