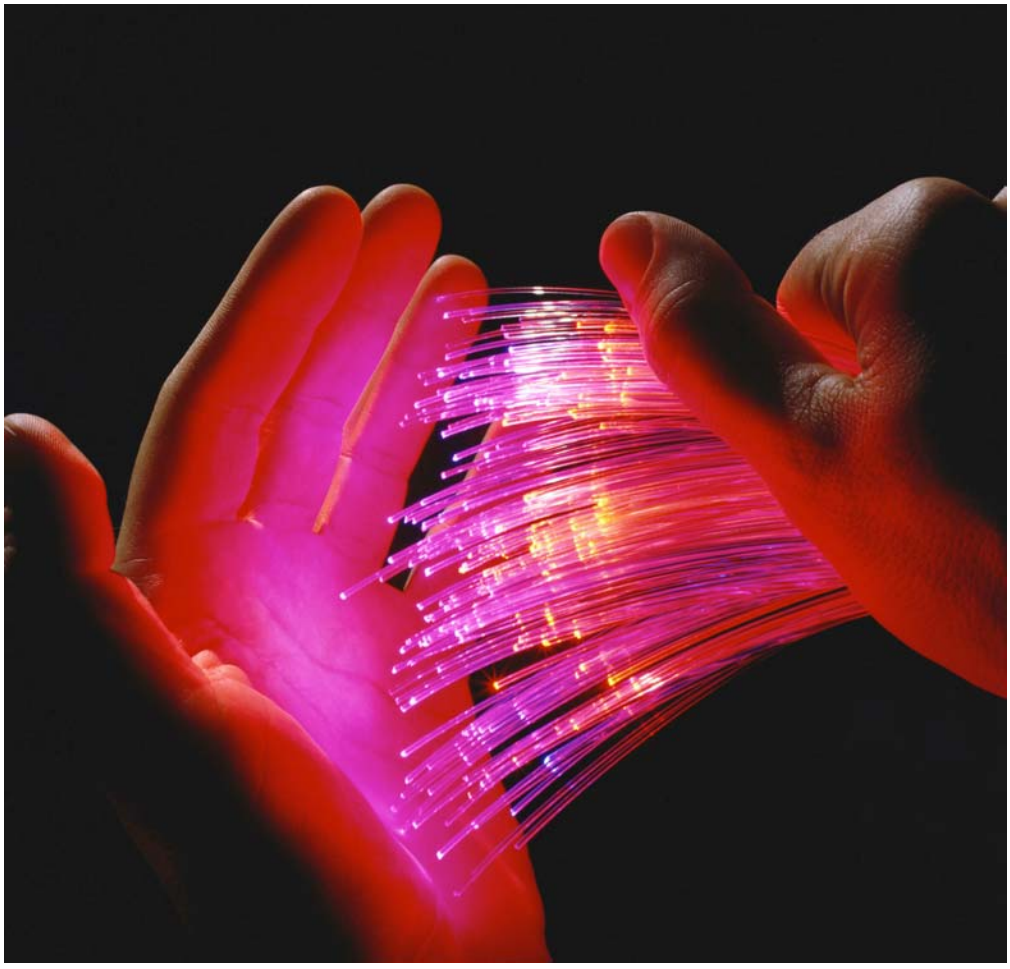
Economist Intelligence Unit

The Economist

# Leveraging knowledge

## Business intelligence in the global corporation

A white paper from the Economist Intelligence Unit



Written in co-operation with

**Oracle**

## The Economist Intelligence Unit

The Economist Intelligence Unit is a specialist publisher serving companies establishing and managing operations across national borders. For over 50 years it has been a source of information on business developments, economic and political trends, government regulations and corporate practice worldwide.

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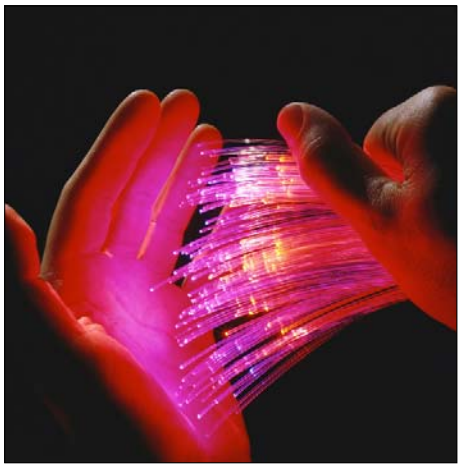
*Leveraging knowledge: Business intelligence in the global corporation* is the third in a series of three white papers that the Economist Intelligence Unit wrote in co-operation with Oracle. *The new business imperative: Using the Internet to boost your bottom line* was published in September 2001, the second report in the series, *Simplicity reigns: Building the connected enterprise,* on the role of technology in business, was published earlier this year.

The Economist Intelligence Unit bears sole responsibility for the content of this white paper. Its editorial team conducted the interviews, managed the online survey and wrote the report. John Edwards was the main author.

Oracle, the report's sponsor, worked together with the Economist Intelligence Unit to determine the line of enquiry for this report.

Our appreciation is due to the dozens of executives quoted in this white paper, who kindly shared their insights during in-depth interviews, and to all those who responded to our online survey in July 2002.



# Leveraging knowledge

## Business intelligence in the global corporation

### Executive summary

Knowledge is a key corporate asset—as hard to define as it is crucial to business success. CEOs struggling to manage operations in volatile conditions need swift access to data on financial performance. Mobilising pockets of expertise around the globe is essential to avoid the trap of continuously reinventing best practice. Effective communication among employees is key to putting innovative ideas into practice.

Fortunately, thanks to Internet-based technologies, companies can now capture, network and leverage data and knowledge throughout an organisation. By allowing more agile and focused decision-making, such online knowledge management and real-time business intelligence offer clear bottom-line advantages.

There's nothing new about knowledge, of course. Skills and expertise were at a premium centuries before the term "learning company" was coined; capitalising on great ideas has always led to profitability. What is new now are technologies that, by using the Internet and related IT systems, give companies the ability to capture and disseminate knowledge with both global reach and instantaneous effect. Putting knowledge at the fingertips of every employee promises unprecedented gains in efficiency, agility and cohesion.

Knowledge is a slippery concept, however, and is easily confused with data or information. Executives have learned the hard way that systems set up purely to amass data—on customer preferences, say, or on productivity—can do more harm than good by swamping corporate leaders with an excess of numbers that don't lend themselves to clear decisions, or by submerging employees in a flood of spreadsheets.

With information overload a real

threat, the pressing challenge—and the topic explored in this white paper, written by the Economist Intelligence Unit in co-operation with Oracle—is to ensure that the right people have the right information at their disposal at the right time and in the right format, and that good ideas make a swift transition from the insights of talented individuals into new and profitable products and services. This also means, importantly, that the same people are not overwhelmed by information that, while undoubtedly important to someone, somewhere, is not directly relevant to their jobs.

Knowledge is fundamentally a human creation; no technology or IT system, however sophisticated, can generate it. What technology can do, however, is facilitate a flow of information to enable people to be as creative as they can, and to simplify human choices by giving structure to overwhelming quantities of data. Building a company that makes outstanding use of knowledge—or intellectual assets—will always depend on hiring and inspiring a talented and skilled staff, and the degree to which employees work well together.

But the technological answer, this white paper argues, is to be found in the Internet. The Internet provides an ideal conduit both to process and to disseminate knowledge throughout corporations, no matter how sprawling and far flung their operations. Internet-based knowledge tools, such as web conferencing, collaboration and e-training technologies, span the globe to bring employees closer together, put information at their fingertips and create a more unified, productive enterprise. They help create what D T Ogilvie, associate professor of management at Rutgers University, calls a "boundary-less" organisation.

But if technology holds promise, its use is fraught with difficulties and dilemmas. How can companies ensure that they are collecting the right information, and delivering it in the right format, to the right people? What costs are justified in capturing business intelligence? How can companies ensure that different technologies work together seamlessly? And how can they win the employee buy-in that is crucial to the success of any intelligence system? This report provides answers to these questions, building on the experience of pioneering firms already leveraging business intelligence profitably across global networks.

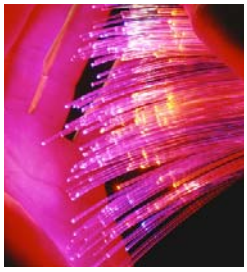
Drawing on dozens of in-depth interviews with corporate leaders and an online survey of 95 global executives conducted in July 2002, this white paper explores five main areas:

- The business benefits
- The tools available
- Survey results on how companies are using these tools

- Case examples of leading-edge knowledge organisations:
  - Xerox
  - Schlumberger
  - Dow Chemical
  - Ford
  - Newport News Shipbuilding
  - Buell Motorcycle
- Key lessons on leveraging knowledge and business intelligence

## Knowledge and its business benefits

In today's information-driven economy, companies uncover the most exciting opportunities—and ultimately derive the most value—from intellectual rather than physical assets. To get the most value from a company's intellectual assets, knowledge-management practitioners maintain that knowledge must be shared and serve as the foundation for collaboration. Yet better collaboration is not an end in itself; without an overarching business context, knowledge management is meaningless at best and harmful at worst.



An effective knowledge-management programme can help achieve several aims. It can facilitate innovation by providing the global communication links that enable employees in different locations to brainstorm effectively and efficiently. A smoother flow of information can also enhance corporate cohesion by building a greater sense of awareness of the company's aims and practices.

Knowledge systems can speed decision-making by putting needed information at the fingertips of all employees. They can improve productivity, reduce errors and boost morale by giving employees in similar functions a chance to record and share their "tricks of the trade". Fuelled by the collected wisdom of in-house and external experts, learning-oriented knowledge tools can expedite the training of new hires and give current employees valuable new skills. All of these benefits mean lower costs and greater efficiency.

Perhaps most important, knowledge management—and its cousin, business intelligence—can help companies monitor and react quickly to the changes thrown up by a volatile business environment. Tools that provide the ability to monitor sales, distribution and financial performance in real time enable companies to spot trends as they take shape, giving them a huge competitive advantage over firms with poorer reflexes.

## Technology provides the tools

Little wonder, then, that corporate spending on knowledge management is expected to balloon to $12bn by 2003,

and 80% of major firms are developing knowledge-sharing programmes. The Internet and related technologies have provided the corporate world with a wide range of versatile new tools to help collect, organise, distribute and process data, information and entire business practices. These run the gamut from off-the-shelf e-mail packages to sophisticated collaboration tools designed to support community building.

• **Corporate intranets** and portals give employees round-the-clock access to trusted information sources, and also keep staff up-to-date on the latest company policies and milestones. Enterprise **portals** also provide employees with the ability to amend, update and rank resources as they use them, looping their learning and new information back to a database. This helps give global staff guidance on the most relevant and useful information sources.

• Online **knowledge-oriented databases** offer employees around the globe round-the-clock access to an entire store of data and documents, and link staff to the colleagues who created them. A data warehouse can be structured to support a variety of analyses, including elaborate queries on large amounts of data that can require extensive searching.

• **Document management software** provides streamlined access to key information, in a variety of forms, helping employees plough through records to find needed answers.

• Powerful **search engines**, by providing text matching and analytical capabilities, help users pinpoint and access specific snippets of information, whether on an intranet or the Internet.

• **Virtual conferencing** allows employees located anywhere in the world to interact with other colleagues on a real-time basis, particularly inexpensive web cameras spread to each PC.

• **Online collaboration** permits professionals separated by physical distance to work together on projects in a virtual workspace, eliminating the need for people or documents to travel.

• **Online communities** bring together employees sharing a common professional interest, using message-board services to allow participants to share (and rate) the latest tips and advice.

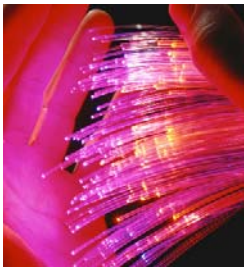
• **Web-based learning**, ranging from electronic books to fully structured computer-assisted instruction (CAI) courses, can help employees at all levels acquire new skills—at their desks.

• **Business intelligence tools**, such as budgeting, forecasting and data-mining applications, provide the reporting tools to give employees a better understanding of business operations—and management a near

real-time understanding of corporate performance. Data mining, in particular, underpins customer relationship management (CRM), helping staff wade through huge amounts of information to help find insights into customer behaviour and preferences.

The technology supporting knowledge management and business intelligence is developing at a breathtaking pace, giving organisations the ability to process and distribute information in increasingly sophisticated ways. Vastly powerful database search engines are making knowledge searches faster and more accurate, while portable devices are making knowledge accessible anytime, anywhere.

Web conferencing is making particular strides in overcoming physical distance. Researchers at the University of North Carolina at Chapel Hill, the University of Pennsylvania in Philadelphia and Advanced Network & Services in Armonk, NY, have already taken part in experimental "tele-immersion" conferences, in which users view life-size, three-dimensional images of each other and their surroundings. Also on the drawing board, says Greg Welch, an assistant professor of computer science at the University of North Carolina, is a "haptic" interface that will allow users to touch and feel objects as well as to see them—all but eliminating the difference between virtual and live conferencing.

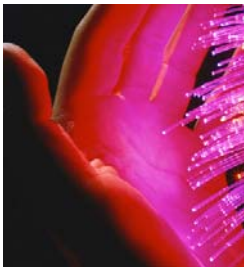


This range of tools has generated huge excitement, given their potential to enhance creativity, reduce development cycle times and cut costs. "Companies have an entire menu of Internet technologies they can choose from," says Uday Karmarkar, professor of management strategy at UCLA's Anderson School of Management. "For most companies, it's a matter of finding the right tool to accomplish each specific task."

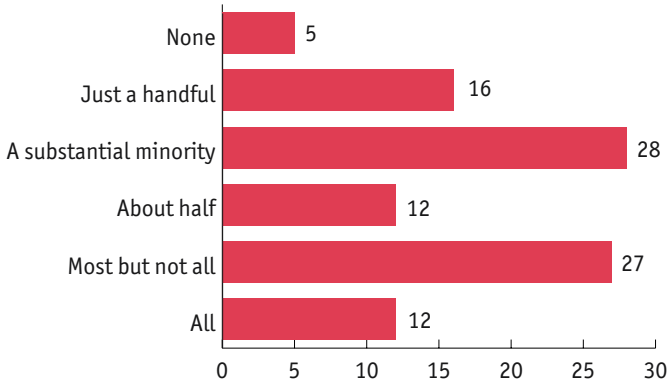
Chosen carefully, the right tools can indeed produce bottom-line benefits. "Giving employees, such as service technicians and customer support specialists, the ability to extract and apply key snippets of knowledge can pay big dividends in terms of increased productivity and lowered costs," affirms Shyam Sunder, a professor of accounting, economics and finance at the Yale University School of Management.

## Survey results: Unrealised potential

Companies are making use of many of these tools, particularly corporate intranets, according to an online survey of 85 global executives conducted in July 2002 by the Economist Intelligence Unit as part of



**How many employees make regular use of the system?**
% of respondents




**Source:** Economist Intelligence Unit online survey, July 2002.

the research for this white paper. But cost concerns, design flaws and employee apathy all constrain the corporate potential of knowledge-management and business intelligence, the survey suggests.

Only 46% of the survey respondents said their companies had an organised system to leverage intellectual capital by capturing and disseminating information and best practices. But use of specific knowledge-management and business intelligence tools is more widespread than this figure would suggest. Corporate intranets are by far the most popular of these, with 81% of respondents reporting their use. Other tools are less widespread: 43% use knowledge-oriented databases, 41% employ document-management software and 39% offer web-based training. Only 27% provide virtual conferencing facilities.

Survey responses suggest that companies are having a mixed experience with knowledge-management tools. Usage ranges widely from company to company (see chart).

Not surprisingly, given the prevalence of corporate intranets, respondents see the main benefits of company knowledge-management efforts as "better internal communication", chosen by 69%, and "time savings", selected by 67%. "Cost savings" was also cited frequently (42%), along with "faster decision-making" (40%). Other benefits recognised by a significant number of respondents included "improved employee performance" (33%) and

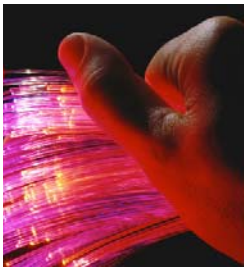
"better understanding of business performance" (32%).

Knowledge-management efforts have their drawbacks, however. The most commonly cited problem was that the tools provided were "used too little", a choice selected by 49% of respondents. A related failure was also chosen by a large number of respondents: companies provided "no incentive to use" the tools (38%). Another main drawback was that business "benefits were not apparent", chosen by 31% of respondents.

When asked about the greatest barrier to developing a knowledge-management or business-intelligence system, the most common response by far was a perception that costs were too high and funding too low—and that top management was unaware of the bottom-line benefits of knowledge management.

## Knowledge in action

Such caution is well taken. As with any technology investment, the potential of knowledge management and business intelligence tools needs to be balanced carefully against the costs, and a clear understanding of the specific business benefits to be derived from them needs to precede any purchase.



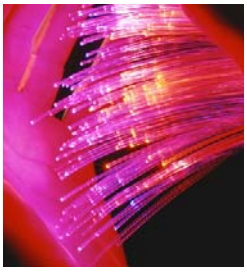
Fortunately, companies looking to apply technology to the pursuit of knowledge can benefit from the experience of pioneering firms, ranging from Xerox to Buell Motorcycle. The case studies that follow (pages 10-18) offer examples of the business benefits of knowledge management and business intelligence.

These case studies provide helpful lessons for other companies to follow:

- **Build the business case.** Companies have been most successful in tackling knowledge management when they've adapted new technologies to solve specific business problems—in fact, the more specific, the better. A business focus helps avoid well-intentioned attempts to capture a company's entire store of knowledge, and provide ready benchmarks for use in assessing the return on investment of new systems.
- **Design carefully.** Heed human nature. Knowledge starts and ends with people, so any system that aims to change the way people work is doomed from the start. Do your IT homework too, to ensure that separate parts of the system function smoothly together. Even if the system is built piece by piece, it needs to be viewed as a cohesive programme. "It's like the way separate parts come together to form a complete car or truck," says Ed Sketch, Ford's director of education training. "It's the parts that create the system."
- **Make life easier.** Successful knowledge-management initiatives work because they make employees' jobs easier. This may seem obvious, but many

companies—by focusing on the system rather than the process it is meant to facilitate—have erred by setting up static document repositories or labour-intensive databases that increase the workload for the employees they are meant to help.

- **Provide incentives.** Users need both the time and motivation to make use of knowledge-management tools. Incentives are a big part of the answer. "Reward people for sharing information by tracking contributors and rewarding them in some way as exemplars of the behaviour you want to encourage," says D T Ogilvie, associate professor of management at Rutgers University. She points to General Electric as a company that knows how to nourish the flow of information: "GE, at every meeting, honours people for sharing ideas with or 'stealing' ideas from others." Similarly, The World Bank treats knowledge sharing as a core component of annual performance reviews.
- **Build in feedback.** Knowledge-management systems work best if they incorporate a user-friendly way for employees using the system to rate the information provided, in the style of Amazon.com's reader book reviews. Such ratings not only keep systems relevant to the end-users; they also provide much-needed recognition for the authors of particularly useful suggestions, innovations or process pointers.



- **Find evangelists.** Even the best-designed, most user-friendly system will require some getting used to, so identifying in-house "evangelists" who can explain the system and set an example for less eager colleagues is a good way to set it in motion. "You need to find some active users to start the process," notes Ms Ogilvie. "Find those who can lead discussions, or have a lot of experience and are willing to share it."
- **Encourage sharing.** Appealing to individual users must be part of a corporate-wide initiative to encourage and nurture the gathering and sharing of intelligence. Some companies unwittingly inhibit the flow of information by creating a competitive rather than collaborative atmosphere. The key, say practitioners, is to orient the corporate culture towards collaboration and the sharing, not hoarding, of expertise.
- **Get management engaged.** Knowledge-sharing projects need backing from the top to succeed, says Ms Ogilvie. "Have the CEO, president and other top people contribute to, and use, the system," she says. To overcome inertia, the system must be seen as having both staying power and the intellectual engagement of the highest echelons; the line managers tasked with implementing the system should report to a powerful boss. Putting knowledge in the hands of the IT department risks downplaying its significance.
- **Measure usage.** Nearly all

knowledge-management tools offer some method of tracking user participation. Statistics generated by these products should be collected and compared over time to measure whether employee interest in specific tools is rising or falling. Diminishing interest can indicate that a tool isn't providing enough benefits, is too hard to use or hasn't been properly promoted to employees.

- **Track success.** A knowledge-management system is never an end in itself. Measuring its success is difficult, but finding a method is crucial if knowledge is to be recognised as a core corporate asset. The yardsticks used will differ from company to company, with some preferring a more impressionistic definition of success and others opting for a more rigorous financial accounting of usage rates, cost savings and return on investment. Such direct financial benefits go hand in hand with less quantifiable gains in terms of heightened creativity, improved productivity, and better teamwork and communication.

## Conclusion: A new frontier

As executives struggle to deliver results in a volatile global economy, corporate agility—the ability to react quickly to change—is at a premium. The faster companies that can sense changing consumer needs and adapt their products and services in response, the better their competitive position. The faster corporate leaders can assess cost and revenue trends, the better their ability to deliver profitable growth—and to detect abuses. And the more easily information travels around a company, the more cohesive its staff.

As this report has argued, Internet technologies cannot in and of themselves create knowledge. But they can provide the conduits through which knowledge can travel to the people who need it most, speeding innovation; they can help bring clarity and order to huge quantities of data, helping executives make difficult business decisions; and they can provide a real-time window into disparate business operations, giving corporate leaders timely insight into threats and opportunities that are only just taking shape.

As our case examples have shown, Internet-driven knowledge management and business intelligence systems can deliver a bottom-line pay-off—provided companies keep a clear focus on the business benefits and tailor their systems to serve their employees, who are, after all, the true source of knowledge.

**Xerox: Build in incentives**

For Xerox, which bills itself as "The Document Company", knowledge is as important as the photocopiers, printers and other office-equipment products it manufactures. "What we know and how we use information are critical to our success," says Dan Holtshouse, Xerox's director of knowledge-management strategy.

When the company first considered the potential of knowledge sharing in 1994, it zeroed in on its most important asset—its service engineers, who now number about 25,000. Xerox wanted to help them become more effective by capturing and sharing the knowledge they gather in their field experience.

Xerox turned to its own software designers at the legendary Xerox Palo Alto Research Centre (PARC) to develop a knowledge-sharing system that would allow its service engineers to retrieve key snippets of information quickly and easily. The result was the Eureka Knowledge Base, an online community that gives users access to knowledge not contained in the company's standard service manuals.

The system was designed to help engineers solve very difficult, complex or rare problems by capturing knowledge that is often passed along informally through the "war stories" shared among the tight-knit community of customer-service engineers. Explains Mr Holtshouse: "Eureka was designed to convert the power of these war stories and the strength of the community into work practices and tools that would help Xerox better serve our customers and provide service with greater efficiency and lower cost."

Xerox employs a rating system driven by the users themselves to ensure that the information they are collecting is useful. The company's Eureka system, for instance, is maintained by the engineers themselves, who evaluate each tip from the system they use in trying to solve a customer's particular problem. "They click 'thumbs up' if it worked, 'thumbs down' if it didn't," explains Mr Holtshouse. This helps both engineers and managers track which solutions work best for what problems and under what circumstances.

In addition to tracking the relevance of information collected, Xerox also measures the cost savings delivered by the system. It chose to launch Eureka in France, in fact, because it was home to one of Xerox's lowest-performing service groups. The system's impact was almost immediate. Comparing the performance of service engineers with and without Eureka access, the company discovered that the knowledge-sharing technology allowed it to shave about 10% from the cost of parts and labour. "Once we discovered this fact, we were anxious to roll out the technology as quickly as possible," says Mr Holtshouse.

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"A knowledge system won't work unless it's designed to fit real-world human behaviour," cautions Mr Holtshouse. The Eureka system succeeded, he says, because its design was 90% sociology and 10% technology; engineers use it and keep it up to date because it helps them solve problems and save time.

Recognition is another important motivating factor, particularly where professionals take pride in their specialist knowledge. In Xerox's Eureka system for service engineers, for instance, each tip prominently displays the name of its originator as well as those of employees who have validated it. "The importance of peer recognition in this [online] community was something our anthropologists at PARC identified during their research, and it's what's given much of the credit for Eureka's success," notes Mr Holtshouse.

Today Eureka is available to all Xerox service engineers worldwide. The system provides information in eight languages and contains more than 50,000 service solutions. Eighty per cent of Xerox's service engineers visit Eureka at least once a week to access information. Careful system design was the key to Eureka's success, argues Mr Holtshouse. "A lot of knowledge solutions lack either high participation or high utilisation," he says. "The bottom line is: people must want to use it. We feel we achieved that goal."

Eureka's success has inspired Xerox's management to develop similar systems for use in other areas. One project, under development since late 2000, is a knowledge-sharing system for sales staff who manage the company's major global accounts. Xerox is also mulling a public version of Eureka for customer self-help. "This is a solution that can meet knowledge needs in many different areas," says Mr Holtshouse.

**Schlumberger: Three pillars of wisdom**

With thousands of employees scattered around the world, Schlumberger, the world's second-largest oilfield services company after Halliburton, realised several years ago that Internet technology is a perfect medium for information distribution. The result: a three-pronged system comprising an information distribution portal, online knowledge communities and Internet-accessible knowledge databases. "We call them our three pillars of wisdom," says Reid Smith, Schlumberger's vice-president of knowledge management.

The company's information distribution portal, the Schlumberger Knowledge Hub, serves more than 50,000 users each day. The portal offers employees a daily digest of impartial news about the industries in which they work, as well as easy access to information on Schlumberger products and services.

A team of Schlumberger editors on four continents chooses industry news from independent sources, posting updates around the clock, seven days a week. The selection is careful; the portal aims to provide only the news that matters most to the company and the industry. The site carries the latest headlines for each business segment, providing users with a quick, high-quality overview of major developments. Stories are stored in a searchable archive for seven days.

"Eureka", an array of 20 online communities covering a range of businesses and technologies, is the second key component in Schlumberger's knowledge infrastructure. In addition to spurring knowledge creation, these communities are designed to promote improved motivation through more cohesive teamwork and improved business relevance through more efficient team building. The largest of the online communities, Information Technology and Software, has over 2,000 members.

The third part of Schlumberger's equation is a web-based database called "In Touch", which gives field engineers access to the latest solutions and generalised knowledge from peers working in 20 corporate technology centres worldwide. The InTouch communities, managed by 180 field engineers staffing 75 service desks, focus on service delivery to clients.

Schlumberger's combined knowledge-sharing technologies have helped the company save an estimated $50m a year. "We measure the results by the number of people needed to deliver a service," Mr Smith says. "You may find there are more efficient ways to do what you're doing if you start thinking about global knowledge sharing."

Most Schlumberger employees have no problem sharing information with

colleagues, recognising that information sharing is a two-way street, says Mr Smith. "We use the phrase, 'Power Equals Power Shared.'" Still, some employees require more coaxing than others. "You will find that some people, no matter what you do, will share information and lead communities just because they're that sort," he says. "The challenge is to motivate the people who aren't natural information sharers."

Knowledge responsibilities need to be integrated into employees' daily work routines, concurs Reid Smith, vice-president of knowledge management at Schlumberger. Many people are stingy with their time and will tend to resist any effort to make knowledge distribution an added work responsibility. "If you try this, I can guarantee that over time you will fail," warns Mr Smith.

**Dow Chemical: Enhancing business objectives**

At Dow Chemical intellectual capital is viewed as a tactical business asset. "Knowledge management at Dow is not an end in itself—it's a tool that we use to help generate more value for business-specific objectives," explains Tracy Teich, Dow's business information systems director.

The secret to using knowledge effectively is to apply it to areas where it can provide the greatest benefits, says Mr Teich. "We focus our efforts on key functional and business activities that are 'knowledge-centric'. Strong discipline around managing our knowledge content enables us to convert knowledge into tangible assets like patents and processes. This is one of the ways a good knowledge practice creates value."

Good systems ensure that the knowledge being gathered is relevant to the end-users. At Dow subject matter experts—what it calls "information stewards"—help manage the firm's intellectual resources. They decide "what information is important and how it should be captured, delivered, stored and shared", explains Mr Teich. Each information steward leads a work group that focuses on a specific business area, providing guidance and training.

Based on input provided by the information stewards, each Dow business unit selects and further prioritises the information it wishes to share with employees and business partners. The business units are also careful to determine which information should not be shared, particularly when dealing with external entities. "While technology enables us to do more sharing, we are very mindful of the need to protect the integrity of our information," says Mr Teich.

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To distribute its accumulated knowledge, Dow relies on an array of technologies, including Internet- and intranet-enabled desktop and notebook computers, mobile phones and PDAs. These systems can be used to access e-mail, databases, conferencing, collaboration and a variety of other web-driven services. Web search and text mining software help Dow employees locate specific snippets of information. "Text mining allows Dow employees to more fully explore complex relationships among documents in textual databases," says Mr Teich.

The combined Internet technologies provide a virtual work environment that allows employees to access knowledge from almost anywhere. But continuous information access also has a dark side. "These tools have enabled significant collaboration and productivity improvements across the company, but they've also put an unexpected strain on our employees, who now have the ability to work 24/7," says Mr Teich.

As a result, Dow managers watch employees for signs of "information overload". "Encouraging communication isn't the issue," says Mr Teich. "The issue is finding the right balance and encouraging better communication practices and processes to enhance business objectives."

Dow measures the return on investment for its knowledge-based initiatives on a business-unit and project basis. Benefits are measured on several levels: financial cost savings, acceptance and utilisation by employees. The return on investment is often impressive. Dow's knowledge-fed training programme—learn@dow.now—provided cost savings of $3.5m in 1999, climbing to $30m in 2000. "Knowledge isn't an abstract concept when it can be used to provide positive bottom-line results," concludes Mr Teich.

**Newport News Shipbuilding: Reducing cycle times**

The second-largest shipbuilder in the US, Newport News Shipbuilding (NNS) builds, maintains, refuels and repairs nuclear aircraft carriers and submarines, and for the past 40 years has been the only builder of the US Navy's aircraft carriers. It has a strong commitment to information technology (Bill Gates owns 8% of the company), and knowledge sharing plays a key role.

Like Xerox, NNS tailors its knowledge-sharing system to address specific business issues. "Once the functional requirements have been identified, we then look for an appropriate technical solution to the business problem," says Stephen Hassell, NNS's chief information officer.

NNS's largest knowledge-orientated initiative, the Shared Data Environment (SDE), was created as part of a programme designed to reduce the cycle time of selected shipyard operations by up to one-half. "During the project, it became apparent that providing a consistent knowledge store that could be accessed seamlessly across the organisation would be one key to cycle-time reduction," explains Mr Hassell. The SDE is an intranet-based knowledge-retrieval system, based on database and networking technologies supplied by SAP, i2 and other vendors. Employees use it to tap a wide range of information generated by co-workers.

A second NNS project, the Knowledge Delivery Architecture (KDA), aims to reduce the time employees spend compiling and distributing corporate documents. Powered by Cypress document-management software, the system gives more than 2,000 employees electronic access to custom-tailored information.

Before KDA was launched, NSS employees had to monitor, print and hand-deliver reports to designated individuals throughout the company—a laborious and inefficient process. Now the web-based system automatically captures, indexes and archives business-critical documents, allowing employees easily to search, retrieve, bundle and distribute them. KDA is expected to cut printer output by 6m pages per month.

Supplementing the SDE and KDA, NNS embeds best-practices information and rules directly within applications, particularly computer-assisted design (CAD) and enterprise resource planning (ERP) tools.

Knowledge sharing is taking NNS into a new era. "NNS employees are beginning to operate from a common context, in a sense getting on the 'same page'," says Mr Hassell. "As we get better at analysing trends and making decisions from those trends, we should be able to drive bottom-line benefits."

**Ford: Knowledge without borders**

Ford Motor is working hard to extend knowledge resources to all of its 350,000 global employees, not just a few selected executives. The company disperses knowledge via several routes, including web-based learning, portal, conferencing and collaboration technologies. "We're helped by the fact that we've got one of the largest and most sophisticated intranets in the world," says Ed Sketch, Ford's director of education training. "It's a common global infrastructure, so you can basically link up anywhere in the Ford world."

Company portals, for example, are designed to give employees easy access to an array of business and engineering knowledge databases. Ford has all of its sales, warranty, technical and learning data online. The Internet gives the company the opportunity to distribute rapidly both internal and external knowledge. "We're probably one of the most web-enabled companies in terms of databases," says Mr Sketch. Ford is able to access not only the company's own databases, but it also has many links with universities and major research institutes, including MIT and its technological research databases.

Ford views training as the bedrock of its knowledge-sharing strategy. "Just as knowledge management is a way to support people's performance—getting them the data they need to do their job—we see learning as the way to get people the skills they need to do their job," says Mr Sketch. The company's major training initiative is the Ford Learning Network. This intranet-delivered instruction system encompasses over 1,800 web courses, utilising knowledge drawn from a variety of corporate and external sources. The online instruction includes study programmes focusing on information technology, automotive engineering and an array of other topics. "We're teaching people the skills they need to do their jobs," says Mr Sketch.

Based on information search and retrieval software developed by Autonomy, the Ford Learning Network allows users to access knowledge through both structured and unstructured searches. "It's like someone's filing cabinet when you don't know where the thing you need is," says Mr Sketch. "Autonomy is very good at teasing out stuff that isn't necessarily identified in the right way."

Another way Ford moves knowledge between employees is with web-collaboration software. "Our whole computer-aided design set-up is designed to allow collaborative work," says Mr Sketch. Ford was one of the pioneers of web-based collaboration technology. As long ago as the early 1990s, company engineers, designers and other employees were able to work together on a virtual basis. Today Ford employees can share information and collaborate over great distances and across international borders. "In Europe, for example, our vehicles are

designed half in Britain and half in Germany," says Mr Sketch.

User input is vital for the acceptance of knowledge systems, continues Mr Sketch. At the carmaker, knowledge system designs and functions are fine-tuned with the help of employee teams: "The vision might be managerial, but the detail deployment is very much driven by working with users." The company tests out new systems through "soft launches", with a limited number of users. "We don't just throw things out to 350,000 people. We launch with maybe 50 or 60 employees, then build up to hundreds and eventually maybe thousands," he says. Focus groups are then used to ensure that users are satisfied.

Knowledge, learning and job performance are highly interconnected, says Mr Sketch. "Success is when people can't tell whether they're doing their job or learning," he says. "When they're solving a problem, they're being helped to solve the problem in a systematic way that's teaching them—and when they're learning something, they're learning it in a way that applies it to a real-life problem," he observes.

**Buell Motorcycle: Collaboration in 3-D**

At Buell Motorcycle, a manufacturer of high-end motorcycles, web-based knowledge sharing is speeding up and improving product development. Web collaboration technology has given Buell's engineers the ability to collaborate closely on component designs with parts manufacturers worldwide.

Before the advent of the Internet, Buell's engineers had a choice of meeting suppliers' engineers in an office or swapping ideas and documents by phone and fax. "The result was a bunch of engineers crowded around a conference table or standing on either end of a fax line," says Greg Jankowski, the company's senior information systems analyst. "Either way, you waste a lot of time."

After pondering the situation, the Harley Davidson subsidiary decided that the Internet could be an ideal joint brainstorming medium. Yet the technology was still at a primitive stage, and an initial effort using two-dimensional Adobe PDF files proved less than successful. "It was rather static," says Mr Jankowski. Engineers could view images and talk about them, but they couldn't make real-time changes. As a universally accepted file format, PDF was appealing. "But as a knowledge exchange tool, it has its limitations."

About a year ago, Buell discovered eDrawings, a web-collaboration program from

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software developer SolidWorks. The program converts standard computer-aided design (CAD) files into 3-D documents that can be sent across the Internet.

Visualisation tools allow users to measure models, rotate objects and see shaded views. Mark-up features let users suggest changes and add comments.

The technology has allowed Buell engineers to work more productively and efficiently. "It's better, in some ways, than working with a partner on-site," says Mr Jankowski. "You can work in your own environment, you avoid mistakes by always having access to the latest version and you're not wasting time travelling or swapping fax documents."

Getting Buell's engineers to use collaboration software wasn't a problem. "It's made life much easier for them, so there have been no complaints," he says. The company's suppliers have also embraced the technology. As with Adobe's PDF software, the eDrawing viewer, including the mark-up features, is free. "The suppliers view it as a perk that we're providing them," says Mr Jankowski.

Considering the software's modest cost and critical benefits, Buell didn't bother to work up a formal business case for the project. "The convenience alone justified the purchase," says Mr Jankowski. "It's something that we knew we wanted to do."

Given the success of its web-collaboration initiative, Buell is now considering other knowledge-based projects. An in-house document exchange system is currently in the planning stages. "We want to give everyone within our organisation the ability to access drawings and other types of information," says Mr Jankowski. "We want to bring everybody into the loop and spread the knowledge around."

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