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Harvard Business Review on the Business Value of IT

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Harvard Business Review on the Business Value of IT

A HARVARD BUSINESS REVIEW PAPERBACK

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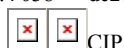
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Saving IT's Soul: Human-Centered Information Management

Thomas H. Davenport

Executive Summary

It specialists often promise that technology will serve as a catalyst for change. They agree that shared databases will allow employees to interact with other departments, creating heretofore unheard of synergies. But, as Thomas Davenport points out, it is a promise that usually goes unfulfilled. IT managers put too much emphasis on hardware and not enough emphasis on the soft science of how people actually share information. Too many managers still believe that, once the right technology is in place, appropriate information sharing will follow.

By contrast, Davenport, who is director of research at Ernst & Young, argues that to achieve its promise IT needs to take a human-centered approach. But implementing such an approach is far more difficult than figuring out which computers work together and how to

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construct a new network. It means building flexibility and disorder into information systems. It means accepting that different departments frequently can't come up with a shared definition for things that might seem obvious, such as what constitutes a drug, an airport, or a sale. And it means changing corporate behaviors that discourage information sharing.

Looking at companies that have successfully addressed this problem—like Symantec Corporation, Chemical Bank, Hallmark Cards, and Rank Xerox, U.K.—Davenport directly addresses how to rebuild an organization's information culture and how to get beyond the technologies to changing people's behaviors.

People handle information in myriad ways—from data processing to exchanging E-mail worldwide.

Information Technology has a polarizing effect on managers; it either bedazzles or frightens. Those who are afraid of it shun it, while bedazzled IT departments frequently become prisoners of their own fascination, constructing elaborate technology architectures and enterprise information models to guide systems development. Senior executives who buy into this view promote technology as the key catalyst of business change. But such technocratic solutions often specify the minutiae of machinery while disregarding how people in organizations actually go about acquiring, sharing, and making use of information. In short, they glorify information technology and ignore human psychology.

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Information managers must begin by thinking about how people use information, not how people use machines.

It shouldn't surprise anyone that human nature, good and bad, can throw a wrench into the best-laid IT plans, yet technocrats are constantly caught off guard by the "irrational" behavior of "end users." In fact, people who are afraid of information technology may have good reason to feel that way. Companies that ballyhoo their latest management information systems or groupware usually spend little time training employees to use them. Even those who like computers can find themselves hobbled by the rigid structure and rules of many IT shops.

Too many managers still believe that once the right technology is in place, appropriate informationsharing will follow.

Obviously, people handle information in any number of ways, from basic data processing to generating sophisticated accounting documents to exchanging informal E-mail messages around the world. For the many diverse information users in large organizations, only one thing is certain: effective information management must begin by thinking about how people use information—not with how people use machines. While it's impossible to account for all the unforeseen consequences of information expansion and use in today's companies, the following three observations exemplify how a human-centered approach to information management contrasts with the standard IT view:

- *Information evolves in many directions, taking on multiple meanings.* While IT specialists are drawn to

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common definitions of terms like customer or product, most information doesn't conform to such strict boundaries. Forcing employees to come to one common definition, as some technologies require, only truncates the very conversations and sharing of perspectives that the technology is supposed to ensure. Rather than forcing employees to simplify information so that it will fit into a computer, a human-centered approach to information calls for preserving the rich complexity we prefer in our information diets.

- *People don't share information easily.* Assuming that different departments, professionals, or line workers will want to use technology to share information is one of the biggest mistakes executives make. Yet it is one of the fundamental assumptions made in planning any IT system. That is, if you build it, people will use it.

- *Changing an IT system won't change a company's information culture.* The presence of technology, in and of itself, cannot wholly transform a corporation. Changing a company's information culture requires altering the basic behaviors, attitudes, values, management expectations, and incentives that relate to information. Changing the technology only reinforces the behaviors that already exist. Yet in most companies, many managers still believe that once the right technology is in place, the appropriate information-sharing behavior will inevitably follow.

At one large pharmaceutical company, for example, IT managers tried to implement shared databases and other new technologies to speed up R&D, only to have their efforts foiled by significant cultural barriers. In this

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case, managers assumed that researchers involved in the development of a drug would pass along all information about it to the people conducting its clinical trial; if researchers had found early on that, say, the drug's effect diminished when taken with certain foods, then patients in the clinical trial could be instructed not to take the drug at meals. Such early release of data, however, rarely happens at this pharmaceutical company. Clinical studies therefore often have to be redone, delaying the drugapproval process sometimes for years.

In this company, management pushed the new databases and software, but researchers were either hostile or apathetic. The IT department was so focused on the technology that they had failed to understand the rigid rules of scientific exploration that govern how scientists think about information. Different departments couldn't agree on what constituted a "drug" or a "clinical trial"—or even what font they should use for research reports. In this case, the rate of technological change far outstripped the pace of change in the culture as a whole. Instead of instituting new technologies, executives should have instituted a program of cultural change to convince highly competitive scientists that they wouldn't be penalized for sharing early and perhaps incomplete results.

Technology, after all, is neither the savior nor archdemon of the information age. At its worst, it distracts and misleads us. But at its best, new systems can support the kind of information use that results in real business change.

What's Wrong with the View from IT?

Since the first business applications of computers in the mid-1950s, planning and control have dominated

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systems development in large companies. In particular, the concept of "information architecture" has overshadowed a human-centered view of information. IBM created the first structured approach in the 1960s and has defined the field ever since. Originally named "business systems planning" (BSP), later versions came to be called "strategic data planning" and "information architecture."

The analogy to an architectural blueprint, in which the location and uses of different rooms are specified, works as far as it goes. But information architecture was invented to specify computer systems and databases unambiguously. Systems planners believed that information environments could be designed for the entire organization, without reference to particular individuals. Many planners still assume that organizations have a core of invariant pieces of information—such as customers, products, and business transactions—around which key systems can be developed.

Most managers don't rely on computer-based information to make decisions.

This approach has several potential strengths. Such blueprints attempt to structure the sharing of data across multiple computer applications. In addition, since information storage has been a scarce resource until recently, executives hoped that information architecture would help minimize redundant data. And one nontechnical benefit has been widely touted: after a successful planning exercise, executives can supposedly make decisions based on common information.

But information architecture has never achieved its promise. Enterprise models of information types, uses, and responsibilities are too broad and arcane for nontechnical people to comprehend—and they can take

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years to build. One study of enterprisewide BSP efforts found that few of the systems projects identified in the plans were ever implemented; another concluded that most strategic data plans were shelved without implementation.¹ Given today's rate of business change, even if an enterprise model is finished in a year or two, it's likely to be outdated.

The primary reason for information architecture's failure, however, is that few companies have undertaken such planning with any concern for how people actually use information. (See the insert, "The Information Facts of Life," on page 29.) For one thing, most approaches have addressed only a small fraction of organizations' information—that found on computers. Yet evidence from research conducted since the mid-1960s shows that most managers don't rely on computer-based information to make decisions. The results of these studies are remarkably consistent: managers get two-thirds of their information from face-to-face or telephone conversations; they acquire the remaining third from documents, most of which come from outside the organization and aren't on the computer system.²

When technical approaches to information planning are applied broadly, not only do they fail to encompass all of a company's information, they also undercut business change. Rank Xerox U.K., for instance, began a major effort in the late 1980s to redesign its business processes with the help of information architectural techniques and computer-based modeling tools. The idea behind this was that once the new business processes were designed, then the very same models could be used to generate code automatically for a new set of supporting information systems and databases.

After several years, however, a new managing director asked for a simple model that could describe the old and

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redesigned processes. Not one could be found; all that existed were very detailed data models that reflected the status quo. The technicians had lost the objective of business change in the details of modeling. Now Rank Xerox uses simpler approaches to do process modeling, such as flow charts and cost buildup charts, and has made some successful changes; for example, it has saved \$11 million annually in sales-order processing by eliminating approval steps and better integrating the sales force with the entire order-management process. Now the company uses information architecture only to design specific systems.

As at Rank Xerox and other large companies, information architects have assumed that common information is created through the development of a computer model instead of through the long and often arduous process of reaching a shared understanding. They haven't identified, trained, or monitored the desired behaviors for information users and providers, both of whom must cooperate if common information is to be developed. Most important, they make the unrealistic assumption that most of a company's information can be organized according to a few common terms.

A Natural Mess: Multiple Information Meanings

While information architecture can't capture the reality of human behavior, the alternative is hard for traditional managers to grasp. That's because a human-centered approach assumes information is complex, ever-expanding, and impossible to control completely. The natural world is a more apt metaphor for the information age than architecture. From this holistic perspective, all

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information doesn't have to be common; some disorder and even redundancy may be desirable. (See the chart, "Human-Centered IT Managers Focus on How People Use Information Rather than Machines.")

No matter how simple or basic a unit of information may seem, there can be valid disagreements about its meaning. At Digital Equipment Corporation, for example, a "sale" to the indirect marketing organization happened when a distributor or reseller ordered a computer; but to direct marketing, the sale occurred only when the end customer took delivery. Even within direct marketing, there were differences of opinion: salespeople recorded a sale when the order was placed, manufacturing and logistics when the product was delivered, and finance when it was paid for.

Human-Centered IT Managers Focus on How People Use Information Rather than Machines

Information architectures:	Human-centered approaches:
Focus on computerized data	Focus on broad information types
Emphasize information provision	Emphasize information use and sharing
Assume permanence of solutions	Assume transience of solutions
Assume single meaning of terms	Assume multiple meanings of terms
Stop when design is done or when system is built	Continue until desired behavior is achieved enterprisewide
Build enterprisewide structures	Build point-specific structures
Assume compliance with policies	Assume compliance is gained over time through influence
Control users' information environments	Let individuals design their own information environments

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No unit of information is too basic to prevent disagreement about its meaning: USDA officials can't even agree on what a farm is.

At American Airlines, there are several perspectives on what an "airport" is. Some managers argue that an airport is any location to which American has scheduled service; others count any airport granted that status by the international standards body. At Union Pacific Railroad, there's little consensus on what a "train" is. Is it a locomotive, all cars actually pulled from an origin to a destination, or an abstract scheduling entity? Even U.S. Department of Agriculture officials can't agree on the meaning of "farm."

These multiple meanings make the job of information management treacherous at best. At one oil exploration company, for example, information architects worked for years on ineffective models because people assigned different meanings to "oil location." Some users defined it as the original geographic coordinates in the ground; others thought it was the well from which oil sprang; still others used the term to refer to the oil's current location in a tank farm or pipeline. Each definition found its way into computer databases. As a result, it was difficult to share even the most basic information on the production of different sites. Among many other problems, the company couldn't accurately monitor the performance of specific wells or figure the taxes it owed states and counties where the oil was pumped.

In this case, the CEO finally dictated to the entire management team what "oil location" would henceforth mean: an official corporate algorithm that reflected drilling location, well angle, and drill depth. Those man-

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agers or other employees who used alternative meanings would lose their jobs. Although this solution is extreme, it did achieve the desired result: consensus on the meaning of oil location and better information on production that could be shared.

But while multiple meanings can create problems for organizational integration and information sharing, they shouldn't always be eliminated, especially in large companies with diverse businesses. In fact, given the importance of information to the success of individuals and groups within organizations, managers should expect pressures to define information in ways that are useful to these smaller units. There will always be a healthy tension between *information globalism*, which seeks to create meanings that apply to an entire organization, and *information particularism*, in which individuals and small groups define information in ways that make sense to them.

Another large computer company exemplifies the natural tension between particularism and globalism. This company is renowned for granting autonomy to product and geographical units. That autonomy extends to information; when it comes to financial information, for example, there are 103 general ledgers. Divisional, geographical, and product executives can therefore count costs, revenues, and profits in ways that are most meaningful for their particular products or businesses. To deal with aggregation, this company maintains a corporate-level ledger to consolidate results across common financial categories.

Undoubtedly, such particularism turns aggregation and information sharing into a challenge. Even though there is a corporate-level information stream, managers are often evaluated by comparing their financial results

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against that corporate stream. Much effort goes into reconciling and explaining how the local stream relates to the corporate stream. Finance managers keep trying to remove as many entries from ledgers as possible and coaxing local executives into using corporate-level information when they can. Some top managers are actively trying to get rid of the local ledgers altogether. But while dual information streams are messy and hard to control, they seem realistic for this diverse company.

A larger managerial barrier, however, remains: operating with multiple meanings also requires basic changes in behavior—not only for information providers, who categorize and collect the information, but also for users. The CEO who is annoyed when told there's no quick answer to how many customers (or employees or products) the company has is just as guilty of oversimplifying information as the database designer who insists on one definition of customer.

And when it is necessary to define common meanings, the process requires much more management participation and time than many assume or want to allot. For instance, Xerox did data modeling and administration for 20 years, but in the words of the director of information management, "We got nowhere." These initiatives were driven by IT rather than by senior business managers; they were always abandoned in favor of specific development projects like the new order-processing or billing system, which yielded obvious benefits.

Finally, Xerox's IT department asked senior executives to identify the key pieces of information on which the entire business should be run. The executives debated the issue on several occasions but weren't able to reach a consensus. They did agree, however, that their main priorities were customer, financial, and product information—in that order.

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Xerox's IT department then took another tack. From around the world, 15 marketing and sales managers, accompanied by their IT counterparts, met to agree on the set of common customer information the company would use. As usual, people disagreed about what "customer" meant. But these managers eventually agreed to define customers as corporations that had already purchased products or services from Xerox and to refer to them with a common worldwide number; they also reached consensus on 11 other customer-oriented terms, including customer-satisfaction measures. This coordinated approach allowed country managers to then create customer information that the IT department has now combined into a global data warehouse.

The Trouble with Information Sharing

Paranoia about dissemination has its roots in practical information issues.

In today's competitive business environment, it makes sense to give information particularism its due; but as Xerox's experience with customer information illustrates, executives must also decide which aspects of a company's information are global. More to the point, executives must determine how such information is to be shared effectively— one of the trickiest management issues for today's companies. While information architecture can specify who controls information, such rigid models don't account for the unpredictable growth of information or human nature.

Some managers are quick to point out the obvious difficulties with information sharing, especially when it's driven by new technologies like electronic mail. If

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sharing makes it easier for a company's employees to get at critical information, it also opens the way for any interested external parties—competitors, attorneys, even computer hackers. Given the many recent and highly visible cases of departing employees allegedly taking with them reams (or diskettes) of proprietary information, many executives wonder whether or not such information should be widely disseminated in the first place.

When Chemical Bank and Manufacturers Hanover merged, two information cultures clashed.

Paranoia about external opportunists has its roots in practical information issues. For information to be shared, it must first be structured and compiled, which makes it easier to steal or subpoena. For example, when Otis Elevator began to compile information on elevator reliability and performance—which would enable sharing among managers, service personnel, and new product designers—the company's internal counsel feared having to produce this information if the company were sued for an elevator-related accident. This hasn't happened so far, but it's all too easy to understand this attorney's concerns. Ironically, his response exposes some of the old-line corporate attitudes about controlling information through secrecy and ambiguity.

Indeed, the internal problems that arise with information sharing have the most impact on companies and are much less obvious than external thieves and ex-employees with a grudge. Mergers produce some of the most visible clashes, since managers from companies with sometimes very different attitudes toward information use often find themselves thrown together. For example, a number of contentious issues surfaced at

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Chemical Bank shortly after it merged with Manufacturers Hanover.

The two banks had very different information cultures. Chemical Bank favored sharing information across departments and product groups. Manufacturers Hanover believed that each group owned its information and could choose not to share it. To help integrate banking operations, senior executives decided to create a basic set of information management principles, a process that allowed managers of both banks to discuss which policy should prevail.

One draft principle stated that if a business area had a legitimate need for information, it should get it. But managers from the different banks first disagreed about access to sensitive information—would they be breaching both customer security and trust? And what was a "legitimate need," anyway? For instance, should the private banking group furnish information on wealthy customers to the capital markets division, which could then promote a bond offering to them? If so, which of the groups were responsible for identifying likely prospects, notifying the appropriate managers, and outputting the customer information in the correct format for the capital markets division?

Other Chemical Bank principles addressed the need for a clear owner for each major piece of information and clarified responsibilities and priorities for supplying information to other parts of the bank. These information management principles aren't magic, but they've hastened the integration of the two banks and limited disagreements about important information issues. As with so many human-centered information management techniques, the process of developing principles—of hammering out how information is defined and distributed—was more important than any fixed result.

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In this case, bank executives were well aware of what made information sharing such a touchy subject. But consider a less successful example: the IT managers of a large telecommunications company generated an admirable set of their own information management principles. They addressed the need to establish "enterprise information" and the ways such corporate information should be managed and shared. But while corporate senior managers reviewed these principles, divisional heads weren't consulted. As a result, several divisions decided they were separate "enterprises" and could therefore define their own information.

Such natural power plays, malicious or not, are legion. The will to power—whether that applies to CEOs, separate divisions, line supervisors, or individual professionals—is the main reason why new information technologies don't inevitably lead to flattened hierarchies and empowered employees. Working out information issues in a company with a monolithic culture—instead of wrestling with two competing information cultures that result from a merger—often involves digging out entrenched attitudes toward organizational control.

In such companies, technologies that promote information sharing can end up controlling employees rather than empowering them. When lower level workers are ordered to "share" information with those higher up the corporate ladder, a cutthroat information culture of meddling micro-management can result. At the refining and marketing division of a large oil company, for example, the division president delighted in being able to use his computer to peer electronically over the shoulders of oil traders—and occasionally to override or initiate a deal.

On the other hand, Xerox's executive support system has been limited to accessing data two levels below the

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user—precisely to avoid this type of excessive control. Such human-centered technology implementations are still rare, but they indicate the way managers must think about the issues that information sharing brings to the surface.

Many people suffer from far too much noninformation rather than the "information overload" they complain about.

Populist exhortations to the contrary, unlimited information sharing doesn't work. In fact, increased information sharing can either improve or actively harm company morale. Sharing information about actual corporate performance is usually good for morale—even when performance is poor, since uninformed employees often assume that it's worse than it really is. Sharing rumors, however, can be demoralizing.

An information systems manager at a New York bank, for example, created a Lotus Notes bulletin board that he called the "Rumor Mill." The system allowed employees in his department to share rumors easily; the manager could then quash false ones on-line. This experiment worked just fine—until rumors were posted about the manager's own departure from the bank. When he refused to comment, employees correctly surmised it was true. They became cynical about this attempt to share information through technology, since the manager hadn't communicated with them on this particular piece of information. Needless to say, Rumor Mill was not continued by his successor.

Sharing rumors in this fashion underscores the distinction between information and *noninformation*. Many people suffer from far too much noninformation—which companies seem to generate with ease and at the

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expense of useful information—rather than the "information overload" they complain about. Any heavy E-mail user can testify to the junk mail problem. Right now I have more than 160 messages in my electronic mailbox, some of which inform me that one colleague lost his appointment book or that another wanted to be included in last Thursday's pizza run. I should never have received them, and now I don't have the time to delete them.

Technologists are working on personalized filters or "agents" that can separate real information from junk. But it's likely that good marketers of electronic information will find ways to circumvent filters—just as direct mail now looks like a tax refund or personal check. In fact, some communication technologies just exacerbate this problem.

At Tandem Computers, for example, a combination E-mail/bulletin board allows field-service personnel to send a "has anyone seen this problem?" message to all technical people in the company. The service technician may get an answer, but is it really necessary for everyone to read this message? As in so many other cases, simply implementing an electronic-mail system—without any guidelines for how to use it—won't resolve the complicated issues of information sharing and management.

If some companies generate noninformation through E-mail, others rely on it too much to communicate real information. Although such technologies can improve organizational communications, they have their limits. Several researchers have argued persuasively that the organizational trust and interpersonal context necessary to achieve a true network organization aren't based solely on electronic networks.³ Rather, relationships must be initially constructed through face-to-face meetings.

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Symantec Corporation, for instance, found that electronic mail is not all it's cracked up to be. At Symantec, a California software company that grew rapidly through acquisition and ended up with relatively autonomous product groups, there was substantial use of electronic mail. Indeed, senior executives believed E-mail was the fastest way to forge connections in this virtual corporation. But senior managers soon realized their diverse organization still didn't communicate very well. They concluded that people in geographically far-flung product groups just didn't see each other enough.

To address the problem, executives organized the first companywide meeting. Managers began communicating about important issues through several different routes: letters to employees' homes, face-to-face conversations, as well as E-mail memos. In some cases, they made the same announcement across all media to make sure all employees heard essential news. The company's executives noticed substantial improvement in the problem thereafter; employees complained less about communication problems, and those in the field talked about Symantec's overall strategic directions with greater understanding.

Changing the company's information culture is the best way to implement IT, but it's also the hardest to carry out.

New communication technologies will certainly support information sharing when physical proximity isn't a possibility. But as Symantec's story shows, the proliferation of these technologies has created a new problem: how to choose among all the alternatives. A sales rep who wants to communicate with a customer can use first-class mail, express mail, voice mail, electronic mail,

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a fax, an electronic bulletin board, videoconferencing, or the telephone—not to mention a face-to-face meeting.

Few of us have a clear sense of which alternative is most appropriate for a given communication. But while using a suboptimal medium is not yet a corporate crime, managers should at least acknowledge the confusion. And regardless of the technical form of communication, managers must bear in mind that employees who work together still need regular personal contact.

Preparing the Cultural Ground for IT

If companies as diverse as Symantec, Chemical Bank, Xerox—even the oil company with the controlling division president—are all struggling with information-sharing problems, it's because such issues are unavoidable in today's global economy. What many have discovered, however, is that their solutions do not turn out to be particularly "scientific." Indeed, the solution that most reliably leads to successful IT implementation is also the hardest one to carry out: changing an organization's information culture.

Nonetheless, preparing the cultural ground is essential. Two professional services companies, which I'll call Company A and Company B, illustrate the impact information culture has on technology implementation. Both companies implemented the same new technology for the same purpose. But while one had an existing information culture that fit the management's objectives for the technology, the other did not.

Company A ⁴ hadn't had a successful information orientation in the past, and now managers decided it was time to lead with technology. They acquired both a large number of workstations and an organizationwide

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license for a new software program that combined electronic mail, conferencing, and document distribution. But the company's professionals received little training on how to use the new system. They also had no incentives to share information—only disincentives, especially the fear of giving away their best ideas to others, who would then use them to get promoted in this company's up-or-out culture.

The average professional at Company A worked with few other employees outside his or her office and had little knowledge of anyone else's information requirements. The company recruited new employees based on their willingness to work hard and their training in specific disciplines rather than any demonstrated ability to generate new ideas and package them for use by others. As a result, Company A's fancy new software program was ignored and misunderstood. Even the company's IT sponsor for the program now admits that professionals use the new system mostly for E-mail, a limited application that hasn't solved the main information issues.

Valuable tools are still just tools; new technologies alone won't change anyone's behavior.

Company B, on the other hand, had a long history of hiring people who were good at generating ideas and expressing them in written and verbal form. Managers showed an interest in sharing information long before technology was invented to support this task; the company published regular journals and summaries of press mentions and encouraged its professionals to publish books and articles externally. Company B also had an up-or-out culture, but a key criterion for promotion was whether or not an individual had created and

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disseminated new ideas in the form of practice bulletins, articles, or books. Most important, information managers at Company B are just that: in addition to software and hardware, they focus on incentives, organizational structures, human support, and presentation formats as facilitators of good information behavior in the company.

As for information technology, Company B only recently invested in a new system comparable to Company A's. Before that, however, Company B had set up a simple database for key practice and client documents; it had also created a system for measuring the documents that were most commonly accessed, which then counted toward the promotions of individual authors. I never heard anyone at Company B utter the words "information culture"; but by the time an IT platform had been implemented, this company could build on and support a program of information sharing that was already in place. Now its professionals use the expanded software capabilities to facilitate electronic discussions and have created new databases at a rapid clip.

As Company A and Company B reveal, valuable tools are still tools; new technologies, no matter how advanced, won't change anyone's behavior without human intervention. In fact, we have yet to address fully the role of people in information management work, though some research has focused on how information itself affects humans at work.⁵ It's not even a matter of "implementing" the right information culture at the right time. The specific solutions to information problems described below demonstrate how information cultures can evolve to match new organizational needs, becoming more human-centered, flexible, and cost-effective in the process.

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Information Maps

Most large companies now have plenty of databases. But precisely because of the vast amounts of information circulating around organizations, few employees know where to find what they really need. As obvious as it may seem, few companies have an information map that describes the location and availability of the most widely used information. Even at IBM, founder of business systems planning and steeped in the rhetoric of information architecture, executives only recently realized the need for information maps.

Pointers to information in a computer or on a library shelf alone are useful; but pointers to the people who own or oversee particular information are especially valuable. These people can interpret the information, describe its intended uses and limitations, and direct information seekers to other sources. At IBM, a task force studied the use of market-oriented information throughout the entire company. This task force found that market information in regular computerized reports was sometimes ignored by managers—something that other non-IBM research has also suggested. What these managers really wanted was fast answers to their ad hoc questions.

As a result, IBM's task force created the "Guide to Market Information," an internal catalog. The insert "IBM's Catalog of Information" displays a sample page (see page 30). This guide not only lists available marketing information at IBM, but also the people or organizations responsible for that information and how to contact them. It includes proprietary market research, internal and external databases to which IBM has

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access, electronic bulletin boards, libraries, and internally and externally produced reports. In 1992, IBM printed 5,000 copies, charged internal buyers at cost, and sold out.

Even so, the task force and managers still had to whittle away at old attitudes about information sharing. Some information "owners" were initially reluctant to have their names listed, since they were afraid that answering questions about information would be too time-consuming. In practice, however, the extra time involved hasn't really interfered with anyone's job. Many of these information owners now say they learn from the questions and comments of others. More important, IBM has saved millions by avoiding duplication in the purchase of external market information.

Information Guides

Hallmark has established "information guides"—translators between information users and the IT staff.

Along with maps, information users need people to guide them to the right kind of information in the first place. Librarians have often performed this role in the past. But while information owners at IBM can answer specific questions, few companies have general guides to the vast information resources available throughout an organization. Once again, including new kinds of human support for technology can help change a company's information culture.

In 1991, Hallmark Cards's MIS managers realized that the company's information users were confused about how to access necessary data. The problem was both

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technical and behavioral. Financial, customer, supplier, product, and other data were buried in many different databases. In addition, existing applications were hard to use and provided no information about how the data were created.

Hallmark's MIS managers therefore established in each business unit a new full-time position: the "information guide." These individuals are the primary point of contact for anyone at Hallmark seeking computer-based information. They translate between user information requests and the IT staff who can query databases and get the computerized information that users need. Hallmark's information guides have helped improve data access so much that there are now 10 guides around the company. They have substantially reduced the time it takes for employees to find the right information and to compare information across business units.

Business Documents

The form in which information is presented is also critical to its understanding and use. After all, raw data is not information; and accumulating data is not the same as interpreting it and putting it in a usable form. Company B's emphasis on documentation and presentation demonstrates how such an attitude shapes the overall information culture. In that case, promotions and other financial incentives were tied to the kinds of documents professionals produced

In general, business documents provide organization and context, and they exclude enough information so that what remains is digestible. Focusing on which documents an organization needs often leads to a more

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fruitful discussion than looking at broad information requirements or trying to pin down a term like "customer."

Several companies have begun to identify critical information needs in the form of documents. At Dean Witter, for instance, information managers, particularly those in the central library, were frustrated by their inability to address brokers' information needs efficiently. They advocated hiring more librarians, but financial executives were reluctant to take on additional workers.

With the help of a consultant, finance managers talked to brokers about what information they needed. Instead of phrasing their questions in terms of information and systems, they asked which key documents brokers required. As it turned out, almost all used the same documents over and over. Their needs were categorized into a set of "core documents," most of which were regulatory and reporting documents from U.S. companies.

By separating the documents into three or four industry groups, 90% of the information needed by a typical broker fit on one CD-ROM disk. Dean Witter then created a "perfect information platter," which was updated monthly and kept on a local area network server. By defining common informational needs and implementing technology to support what brokers were already doing, Dean Witter was able to reduce its library staff—rather than increasing it as originally suggested— while greatly facilitating information use.

Groupware

Groupware like Lotus Notes, NCR's Cooperation, and Digital Equipment's TeamLinks are excellent examples

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of less structured information-sharing technologies. This new technology allows teams in different locations to share documents electronically, to discuss issues on-line, and to capture and distribute key information easily.

Even so, companies will fail to take advantage of groupware if they don't also provide adequate training and human support. Indeed, groupware implementation stands or falls on a company's information culture. For one thing, groupware increases the appetite for information rather than controlling it; therefore, companies must provide both the time and training for employees to get used to handling more information. For another, groupware requires people to manage the technology on a regular basis, not just a one-time implementation of the system.

Consider this investment bank, where Lotus Notes has been installed to improve communications and access to external information. The Notes system was linked to several different external databases of information on companies and markets. Individual bankers could specify in general terms the types of information they wanted, and intelligent software (aptly named "Hoover") would then search all these databases and send news items and financial reports on particular companies or deals to the individual desktop automatically. Any banker who later sought information about a topic would also find the results of all previous searches.

Information managers expected this facility would increase information demands and external expenses initially, but demands would taper off since the information could be reused and shared within the organization. They were wrong; demands and costs are still increasing. Yet it also appears that this investment in information now supports the bank's overall business goal: more and

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better deals. In this case, an unexpected result—increasing information use—led to a clear business benefit that a limited focus on the technology couldn't predict.

Grand IT schemes that don't match what rank-and-file users want simply won't work.

In addition, since the database searching and basic communications features of Lotus Notes require little human attention after initial setup—and the system itself is easy to use—the bank's information managers planned a low level of human support. But they didn't anticipate two labor-intensive activities critical to the successful use of groupware. One is training, or more accurately, education: that is, the need to show bankers how the new technology can be used to create better deals and working relationships with colleagues and clients.

The other important task is the ongoing pruning and restructuring of the system's document databases. Bank managers have found that this task requires judgment and knowledge; if the system made decisions about, say, which documents to delete based on their age, some of the bank's most widely used documents might disappear.

As this use of Lotus Notes shows, even the best new technologies depend on a strong information culture—one that is open, flexible, and expansive. When executives introduce such potentially valuable new technologies, they must be prepared to support an increasing appetite for information. Large appetites may mean further information expenditures. But that's the reality of today's information economy—a reality that can provide better deals, investments, or product planning, as well as new costs, technical requirements, and all-too-human complications.

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Some managers have always been distrustful of the information systems approaches of their companies, largely because they didn't understand them. In many cases, they were right to feel uneasy. As the diverse company experiences suggest, grand IT schemes that don't match what rank-and-file users want simply won't work.

It certainly doesn't hurt for executives to understand communications networks, complicated databases, and the latest groupware. But precisely because of the enormous financial resources involved, we must abandon the idea that technology in and of itself can solve a company's information problems. No matter how sophisticated an IT system, information is inherently hard to control. It's only when executives stop being "technologically correct"—when they start viewing information as ever expanding and unpredictable—that they realize how little the latest computer application has to do with effective information use.

The Information Facts of Life

- 1. Most of the information in organizations—and most of the information people really care about—isn't on computers.**
- 2. Managers prefer to get information from people rather than computers; people add value to raw information by interpreting it and adding context.**
- 3. The more complex and detailed an information management approach, the less likely it is to change anyone's behavior.**
- 4. All information doesn't have to be common; an element of flexibility and disorder is desirable.**

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5. The more a company knows and cares about its core business area, the less likely employees will be to agree on a common definition of it.
6. If information is power and money, people won't share it easily.
7. The willingness of individuals to use a specified information format is directly proportional to how much they have participated in defining it or trust others who did.
8. To make the most of electronic communications, employees must first learn to communicate face-to-face.
9. Since people are important sources and integrators of information, any maps or models of information should include people.
10. There's no such thing as information overload; if information is really useful, our appetite for it is insatiable.

IBM's Catalog of Information

Hands On Network Environment (HONE)

Overview

HONE is an on-line system that provides access to a variety of applications, tools, and information databases designed to increase the productivity of the field. These applications are organized into the following categories:

IBM product information

IBM services information

marketing information and tools

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technical information

configurators and tools

financial topics

performance information and tools

administrative information and tools

publications

education topics

customer registration/support tools

about HONE information

Seven components of HONE represent major sources of market information and are described in detail later in this section:

1. Competitive On-Line Marketing Perspective (COMP)

2. EXPERTMENU

3. Market Studies Document Database (MDOC)

4. National Solution Center (NSC)

5. Published Document Database (PDOC)

6. Selected International Account Support (SIASUPP)

7. SERVICES

For further information on any HONE application while using HONE, enter on the command line:

WHATIS application name

Key Contact

HONE Customer Support

External 800-555-6789

Hours 6 a.m.-6 p.m. Mountain Time

Contact the electronic delivery specialist or

HONE coordinator at a local site.

Availability

5 a.m.–1 a.m. Monday–Friday Eastern Time

5 a.m.–3 a.m. Saturday

8 a.m.–1 a.m. Sunday

Responsible Organization

IBM US Services—Electronic Delivery

User Interface/Query

Menu-Driven and/or STAIRS Query Tools

Educational Offerings

For HONE productivity tips and news, subscribe to HONEINFO Bulletin Board on NATBOARD.

The following educational tools are available on HONE:

- **HONE Reference Card—Key HONEREF.**
- **HONE User Guide—Key GUIDE from the HONE main menu.**
- **HONEDEMO—On-line demonstrations of selected applications or functions.**
- **HONE News—On the HONE main menu.**
- **Application Guides—A number of applications contain User Guides, which may be viewed by keying GUIDE on the application menu.**

Notes

1. Albert L. Lederer and Vijay Sethi, "The Implementation of Strategic Systems Planning Methodologies," *MIS Quarterly*, September 1988, pp. 445–461; also Dale L. Goodhue, Laurie J. Kirsch, Judith A. Quillard, Michael D. Wybo,

"Strategic Data Planning: Lessons from the Field," *MIS Quarterly*, March 1992, pp. 11–34.

2. Sharon M. McKinnon and William J. Bruns, *The Information Mosaic* (Boston: Harvard Business School Press, 1992), pp. 162–164.

3. Nitin Nohria and Robert G. Eccles, "Face to Face: Making Network Organizations Work," in *Networks and Organizations*, Nohria and Eccles, eds. (Boston: Harvard Business School Press, 1992). The authors also collaborated on a Harvard case study about Symantec Corporation that illustrates the problem.

4. This company's situation was first described by Wanda J. Orlikowski in "Learning from Notes: Organizational Issues in Groupware Implementation" (Center for Information Systems Research Working Paper, No. 241, MIT Sloan School of Management, May 1992).

5. See Shoshana Zuboff's work on "informating" jobs in *In the Age of the Smart Machine* (New York: Basic Books, 1988).

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The End of Delegation? Information Technology and the CEO

Perspectives from the Editors

Executive Summary

Information technology now permeates every aspect of a business, requiring CEOs today to involve themselves in IT planning and decision making. Which IT investment responsibilities should the CEO delegate and to whom? When senior executives consider IT investment options, what should they look for? How do they learn what they need to know to ask the right questions? What role should other managers play in the decision?

Six experts—Bob L. Martin, Gene Batchelder, Jonathan Newcomb, John F. Rockart, Wayne P. Yetter, and Jerome H. Grossman—share their views.

"Information technology risks are becoming increasingly entangled with business risks, and it is therefore the CEO's responsibility to distinguish between them."

BOB L. MARTIN, WAL-MART STORES

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"The rules of the IT game have shifted, and [the] function now requires strong general management leadership."

GENE BATCHELDER, GPM GAS CORPORATION

"We do not consider technology investments in isolation. We look at capabilities. . . . If technology is necessary to make a capability work, then [IT] investments are part of the package."

WAYNE P. YETTER, ASTRA MERCK

"I expect my CIO to have a rock-solid business view of technology and my line managers to demonstrate that they understand technology and are using it."

JONATHAN NEWCOMB, SIMON & SCHUSTER

CEOs routinely face questions about investment trade-offs. In the case of information technology investments, however, the context for making decisions has changed in the past few years. Once, senior executives could expect their information systems managers to oversee the core processing applications of the business and to help the CEO and line managers make decisions about new IT investments—big ones (American Airlines' SABRE reservation system) and small ones (imaging technology).

Today IT plays a role in most aspects of a company's business, from the development of new products to the support of sales and service, from providing market intelligence to supplying tools for decision analysis. For a global company, the ability to take information from multiple systems and make it broadly accessible to managers and employees is critical. Many observers believe

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that this fact, along with the increased opportunities for using IT to achieve strategic advantage, requires that CEOs reexamine what they need to know about this resource to manage it effectively.

Which IT investment responsibilities should CEOs delegate and to whom? When they consider IT investment options, what should they look for? How do they learn what they need to know in order to ask the tough questions? What roles should other managers, such as chief information officers and business line executives, play in the decision?

Six experts who have been grappling with these questions share their views.

BOB L. MARTIN *before becoming president and CEO of Wal-Mart Stores' International Division in 1992, was chief information officer of Wal-Mart for ten years. He is based in Bentonville, Arkansas.*

Information technology risks are becoming increasingly entangled with business risks, and it is the CEO's responsibility to distinguish between them. The CEO can no longer afford to delegate these decisions to information systems managers alone. At Wal-Mart and at many other companies, technology has become integrated with almost every aspect of the business. Once, we used technology to run core applications, such as general ledger, or to process key business information, such as sales and inventory. Those were applications that ran on big systems and stood alongside our business. Today technology plays a role in almost everything we do, from every aspect of customer service to customizing our store formats or matching our merchandising strategies to individual markets in order to meet varied customer preferences.

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As technology has become pervasive in the business, it has changed the way we work at Wal-Mart. We are placing in the hands of our associates more information than ever in order for them to make decisions closer to the customer and respond quickly to competitive situations. Every company that has, like Wal-Mart, empowered a broader number of employees to make a greater number of decisions knows that this process entails changes in how, when, and where decisions get made as well as challenges in managing the associated risk. I think that CEOs increasingly recognize the impact that technology decisions have on their business and their corporate culture. As a result, they are becoming less comfortable delegating technology decisions to others.

When I'm presented with a proposal to invest in new technology, I look beyond the financial commitment I'm asked to make today and try to understand what my follow-on commitments will be. Technology changes quickly and continually provides capabilities that we may want to take advantage of in our business. We have to know how we will get from the investment we make in today's generation of technology to the next generation.

I also push to understand how well the technology will fit the needs of the people for whom it is intended. As a general rule, a new technology is always a few steps ahead of our ability to use it, and therefore it is critical for executives to manage its impact on those people. If, a decade ago, we had had a greater understanding of the business and organizational dynamics of technology, I think we would now have an even greater payback from our investment in it. In my experience, the new systems that work best are those that are aligned not only with the business but also with the way people think and work.

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Finally, we expect any proposed technology investment to reduce the complexity of our business, our processes, or our organization—not to add complexity. I want to see clearly how the capability that the technology supplies will simplify the way we make decisions or the way we accomplish activities and processes, such as moving goods, stocking shelves, or communicating with our suppliers.

For all those reasons, I see fewer investments ahead for us in computing and more—a lot more—in communications. By this I mean that we are shifting our emphasis away from processing systems that give us weekly or biweekly reports (which we have used to manage the business during the following week) and toward technologies that help us move more information out to our associates faster. We're moving away from systems that stand beside our business to technologies that are more integrated with the work of our associates.

Where do CEOs go for help in understanding how technology impacts business today? I find that technology suppliers have become much better at communicating with general managers. In the past, vendors used to send marketers to us. All they wanted to do was sell technology. Today at most of the industry-leading technology companies, the hard-nosed marketers are gone, replaced by engineers and account managers who want to solve business problems for us and are willing to be held accountable for whether or not the solutions deliver as promised. They are more business oriented than their predecessors. Executives can sound them out.

Chief information officers are in a critical role. CIOs who share the language and the vision of the CEO and have a strong link with the business will help the CEO

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understand the business and organizational risks of new communications technologies.

GENE BATCHELDER is senior vice president and chief financial officer of GPM Gas Corporation, a Phillips Petroleum Company subsidiary that is located in Houston, Texas.

My advice to CEOs is this: Your IT function should be run by a great general manager, not by the traditional technology manager. No company can afford to overlook the role information technology can play in spurring organizational change and shaping core business processes. You can no longer delegate the IT function to the back office. Rather, you need to see it as a vital business within your business, run by people with commercial backgrounds who know how to make decisions that are based on ever changing competitive imperatives.

An accountant by education, I have had the opportunity to hold both IT and general management positions during my 25 years in industry. As an MIS manager, I delivered a sizable IT application (an executive information system) and later ran a major corporate data center and worldwide network. More recently, I managed a manufacturing and distribution subsidiary; and now, as CFO of GPM Gas, I'm guiding the reengineering of the corporation's business and commercial processes. These roles have provided me with the unique opportunity to understand the frustrations on both sides of the IT divide. I can see the concerns of IT professionals who must deliver products and services in a strategic vacuum — with a myopic focus on cost reduction—and those of business line managers who question IT's ever escalating costs and seeming inability to focus clearly on critical business needs.

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These are old frustrations. It has been six years since I was closely associated with the IT function. But I heard those complaints then, and I hear them now, from managers in my industry and from managers I talk with at other companies. For CEOs to manage information technology effectively in their organizations, they need to address those frustrations head-on—and that means understanding that the rules of the IT game have shifted and that the function now requires strong general management leadership.

Most large companies organized their IT departments to manage an infrastructure built around mainframe computer systems. IT managers and their staffs learned how to run data centers and deliver centralized processing. Today's pace of business requires on-site, on-line information, placing a premium on communications and distributed computing networks. Managers also need this information to be accessible across the business. The new imperative requires companies to integrate systems that have long been isolated from one another; to connect purchasing and manufacturing information with logistics, sales, and customer service; and to connect integrated business systems directly to customers and suppliers. It is difficult, if not impossible, to integrate today's new distributed technologies with the legacy systems that IT organizations have developed and maintained over the years. IT professionals generally don't have the technical and managerial skills necessary to help the company move from these older technologies to new ones.

Worse, they don't have the skills to integrate technology with the business. More and more, business considerations rather than technical ones drive investments in IT. Our businesses are asking, "Why not buy solutions

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rather than build them?" and "How can IT serve the critical needs of the business rather than those narrowly defined by accounting and human resources?" Far too many IT professionals don't know how to frame questions like these, much less answer them.

I find, in my company and elsewhere today, that it's the general manager who really is leading the changes that new approaches to IT call for. Most line managers are already running full-line businesses these days. Companies transferred bottom-line responsibilities to them in the 1970s and human resource management in the 1980s. They are now ready to take on IT. The CEO needs to help drive this next phase of organizational growth.

We are beginning to move in this direction at GPM. We have established a cross-functional team that is, in a sense, providing general management leadership for our IT function. We refer to this group as our Business Integration Council. It's composed of plant and field operations managers, and accounting and IT staff professionals. The CEO sponsors and fully supports the council. Currently, the group is establishing an approach to systems development that will help us steer our IT in a new direction. We no longer talk about separate systems for accounting, decision support, or technical functions but about integrated business systems.

I believe that teams like ours can help companies solve complex information technology problems. Perhaps they could even manage the entire IT function. Technology and staff managers, working alongside line managers, can solve problems together that require an integrated understanding of both business and technology. The opportunity is there. Today's technology makes it possible. And teams are a tried and true management

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principle executives have used successfully in many different business situations.

JONATHAN NEWCOMB is president and CEO of Simon & Schuster, the publishing operation of Viacom in New York City.

As CEO of Simon & Schuster, I need to understand how information technology is changing our business, and I must ensure that our organization uses technology effectively. Consequently, I spend a lot of my time trying to understand the implications of new technologies, such as the electronic distribution of information products or software programs bundled with books. I also expect my CIO to have a rock-solid business view of technology and my line managers to demonstrate that they understand technology and are using it.

At Simon & Schuster, information technology is not a back-office operation. It is not systems. It is not telecommunications. It is a valuable source of business solutions, touching virtually every aspect of our company. We ship more than 300 million books a year from more than 4 million square feet of warehouses. The books are created from our portfolio of 350,000 active copyrights, each of which has its own complex intellectual property characteristics, such as royalties, rights, and permissions. We simply could not run our business effectively without robust systems to process orders, manage inventories, track royalties and returns, and perform all the other transaction-oriented tasks involved in publishing.

Like many companies today, we use technology to help us streamline business processes, cut costs, and manage independent work activities better. For instance, in creating a publishing product, authors,

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editors, and layout designers work in parallel with one another. We are installing an electronic manuscript management system that links their activities in a network and that will, among other benefits, help us control these multiple activities better and get products to market faster.

Unlike many other companies, our company is undergoing, because of information technology, a transformation — beyond just the transaction aspects of our business — in the products we create and the core economics of our business. In fact, today more than a fifth of Simon & Schuster's revenues come from technology-based products such as CD-ROMs and interactive television. To succeed in our business for the rest of the decade and beyond, we must be able to package and sell ideas, information, and entertainment in whatever format the customer desires—be it a book, a video, a stream of information and graphics over a computer network, or a combination of all three. We must be able to deliver it to customers when they want it, where they want it, and for a competitive price.

It is for this reason that I need to understand technology and what it is capable of doing. That is not to say that I view myself as a technologist. Rather, I focus on the business needs that the technology supports. I don't need to know about the latest video compression tools. But I want to understand the opportunities video compression may offer Simon & Schuster's Educational Management Group, which delivers live, interactive television to 3,500 classrooms nationwide. What impact might the technology have on the Educational Management Group's operations or on the development of new products? How will electronic manuscript management help us carry content produced for one market cost-

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effectively into other markets? How will we take, for example, software and curriculum material developed for an educational market into consumer markets? With words and pictures in digital form, can we leverage our creative investments across a greater number of new formats and new markets?

To ensure that I am actively involved in the give-and-take of how technology is used in our businesses, the chief information officer at Simon & Schuster reports directly to me. He has a substantial central staff and has dotted-line relationships with chief technology officers in each of our line units. (The chief technology officers report to their business unit leaders.) The CIO attends the operating reviews for all our businesses and works in partnership with line managers and their technology staffs to design and implement systems that best serve Simon & Schuster's needs and, more important, the needs of our customers. My CIO helps me understand technological advances outside and inside the company and aids me in formulating priorities for technology investments.

I also hold my line managers accountable for technology and make that accountability a part of our regular reporting processes and operating reviews. Line managers must demonstrate a clear understanding of how their own technology programs and products compare with those of their competitors. Technology must figure into their visions for their business: They incorporate technology initiatives into their annual and five-year plans, and those initiatives become part of the management milestones by which they are judged. In other words, technology plays a key role in their strategic thinking, their planning, and, most important, the way they accomplish their goals.

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My technology discussions with business unit leaders aren't always formal. I may have an informal discussion with a business unit leader about a product that could have an impact on his or her business. It may be a competitor's product or a product that another Simon & Schuster unit is making. (One of my roles is to help cross-pollinate ideas.) For instance, I might tell the head of my interactive television unit about something our school publishing operation is doing and ask if she sees any way to leverage the technology or the concept in her area.

In fact, we discuss technology actively throughout the company. Chief technology officers meet regularly to trade notes on their operations or to talk about new technology products and ideas. Employees and managers from a number of units and from functions within units come together regularly at informal forums to share information about technology they have explored and to discuss how it might be used in other units. For instance, Simon & Schuster has interactive sites on the World Wide Web. We recently drew together employees from across the company in a one-day forum to brainstorm about ways we could market, sell, promote, and deliver products in this new medium. The point is that we want the majority of our employees to be comfortable talking about technology—and to use it.

New ideas for using technology may originate in the business units and flow up to the company's senior management team or vice versa. In either case, I expect managers to use business criteria to assess technology. The CIO develops multiyear plans with quantifiable objectives for his unit. For instance, he is responsible for setting and reaching rates of return for those systems that are designed to yield cost reductions. Chief technology officers and business leaders also must look at tech-

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nology investments—whether for systems to help their units be more efficient or for new product initiatives— and treat them as business decisions subject to the same investment thresholds as any other business investment.

JOHN F. ROCKART is the director of the Center for Information Systems Research at the Massachusetts Institute of Technology's Sloan School of Management in Cambridge, Massachusetts.

More important than what the CEO knows about information technology is how he and key members of the organization think about it and about their respective roles in ensuring that the organization uses it effectively. The CEO of 1995 must incorporate the capabilities of IT into his "theory of the business," to use Peter F. Drucker's term ("The Theory of the Business," *Harvard Business Review*, 72 No. 5, 1994). Equally important, the CEO must see to it that key managers envision their roles appropriately.

Organizations fail because their theory of the business is outdated, Drucker argues. As he puts it, the "assumptions on which the organization has been run no longer fit reality." Among the key assumptions are those on "markets, customers, competitors, core competencies, mission, *and technology*" (my emphasis). When the reality underlying the assumptions change, Drucker notes, the organization must incorporate those changes into its theory of the business. In no area are things changing faster today than in information technology. It is a primary job of the CEO to test continually and perhaps change his theory of the business in light of these changes.

In the 1990s, IT has become the fourth major resource available to executives to shape and operate an

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organization. Companies have managed the other three major resources for years: people, money, and machines. But today IT accounts for more than 50% of the capital-goods dollars spent in the United States. It is time to see IT for what it is: a major resource that—unlike single-purpose machines such as lathes, typewriters, and automobiles — can radically affect the structure of the organization, the way it serves customers, and the way it communicates both internally and externally.

Understanding the importance of the fourth resource and building it into the theory of the business (as well as into strategies and plans) are more important today than ever for the CEO.

First, the capabilities and potential of the technology are increasing more rapidly than ever before. During the past three decades, consumers have received about 30% more computer power each year for the same price. Competition among microprocessor companies and new advances in the technology are accelerating that rate. In communications, the story is similar, if not more striking, as worldwide deregulation, optical fiber, digitization of networks, and the opening up of more of the wireless spectrum are generating even greater increases in cost-effectiveness and capability.

Second, in an increasingly competitive world, IT is critical to the development of more effective operational and management processes. To serve customers well in 1995, companies need to be proficient in a half dozen key areas: reduced cycle times, reduced asset levels (for example, in inventories and people), faster development of new products, improved customer service, increasing empowerment of employees, and increased knowledge sharing and learning. Information technology is a critical resource for accomplishing all those goals.

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Third—and perhaps most important with the advent of the "networked age" typified by the Internet, America Online, Prodigy, and the soon-to-debut Microsoft Network — there is now a whole new ball game for ordering and delivering products and services.

The CEO's own vision is the key. It sets a tone. But CEOs cannot do it all. Our ongoing research of IT management suggests that certain key managers determine how effectively IT will be used within the organization. They are line managers who recognize their responsibility for the success or failure of how the IT resource is used and business-oriented chief information officers.

Only line managers are close enough to their business to see the most effective ways to utilize IT. Only they possess the clout to embed IT into their strategies and to commit the necessary financial resources. The CEO's vision can be a catalyst, but it can be multiplied manyfold by line managers who see IT as an essential strategic resource. Thus the CEO, in reviewing strategies and plans, should look for and insist on a relevant and robust IT component.

CEOs also should hold line managers responsible for effective implementation of information technology. Although building good information systems is seldom easy, it is far easier than revolutionizing the process by which people work, their roles, reward systems, accounting systems, or the organizational structure—all of which need to be altered to install today's process-based systems. The heads of IT cannot make such changes. Changes like those are outside of the scope of their responsibility.

The companies that use IT most effectively boast, in addition to good line managers, chief information officers who have a deep understanding of the business and

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who are therefore capable of building strong working relationships with line management. The CIO's understanding of technology is a given. But it is through a deep knowledge of the business that the CIO can not only understand what is necessary but also build credibility with line managers—and thus build the ability to influence them to move in appropriate technical directions. The CEO's choice of a business-savvy, relation-ship-building CIO is critical.

WAYNE P. YETTER *a member of the Merck organization since 1977, is president and CEO of Astra Merck in Wayne, Pennsylvania.*

I don't make decisions unilaterally about information technology. On the contrary, I rely on my people and the processes we have in place at Astra Merck to help me understand the opportunities that technology presents and the challenges it can pose. Together, we make decisions about technology investments based on the value of the business capabilities they enable.

To explain what I mean, I must first explain my organization because we are, admittedly, somewhat unusual. In 1992, we began life as a unit of Merck that took to market selected drugs from the pipeline of Astra AB. But the terms of the original licensing agreement between the two companies required that Merck would make us a stand-alone operation (eventually owned jointly by both Merck and Astra) if we reached a specific revenue trigger. By 1993, it was apparent that we soon would reach that revenue level, and we began to plan for life on our own. Astra Merck became a reality in November 1994, when Astra purchased a 50% interest in us from Merck.

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Our business is to take products from Astra's research or those discoveries of other companies that are licensed to us, guide them through clinical development studies and the U.S. Food and Drug Administration regulatory process, and then market them in the United States. We had the luxury of building our organization from the ground up. We therefore were able to think clearly about the processes and capabilities we needed. So, for instance, we did not organize our business by product lines or functions but by business processes such as licensing, business development, and management of our unique package of products, services, information, and education for health care professionals, which we call pharmaceutical solutions. We arranged to have the leaders of each of our process areas sit on my executive team.

Because we were able to start fresh, we could plan our information technology strategy at the same time that we planned our overall strategy, our organizational structure, our business processes, and our culture. For instance, we looked at the steps involved in drug development and put into place a process, enabled by technology, that we think will allow us to be faster to market than our competitors. In our industry, investigators traditionally have collected data about drug studies at sites where clinical trials are performed—hospitals and universities, for instance—and have shipped the information to the drug company. It arrives as an assortment of separate manually prepared forms, reports, or files. The company must organize it, manage it, and analyze it, and eventually incorporate it in documents submitted to the government. The process has often required keying information one or more times—and it's prone to error.

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We took a new approach. Investigators using personal computers and new pen-based electronic devices collect and ship data electronically from sites directly to Astra Merck on an ongoing basis. We have programmed our computers to confirm with the investigators the accuracy of their entries on the spot. In other words, we wanted to capture the critical information faster and less expensively than competitors. We also wanted to build quality assurance into our collection procedures, not let it be a backstop activity at the end of the process. With these data in digital form, we find that we can store and manage the information more efficiently and can more quickly and easily incorporate it into required documents.

The point is that we do not consider technology investments in isolation. We look at capabilities, such as developing drugs faster or providing customers with services they can shape themselves; and if technology is necessary to make a capability work, then technology investments are part of the package. Starting the business from zero, we didn't have existing processes to reengineer, nor did we have legacy computer systems that are expensive to change and that don't integrate well with new technologies.

Our organization reflects our belief that information technology must be integrated with the business. Our IT people—we refer to them as solution integrators—live and work in the process areas that make up our business. They are not isolated in a support department. They participate in business meetings and help identify ways in which technology can make the business more efficient or more effective. They report both to business managers in the process areas and to the chief information officer. Our CIO is a full member of my executive

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team, but he is by no means the only technology champion in the group. Every one of my process leaders views technology as a core asset of the business to be leveraged in almost every activity.

To return to my initial point, I don't make IT decisions unilaterally. We were able from the start to put processes into place that would allow the organization to make decisions about initiatives largely by consensus. Every organization has to choose among initiatives. As we began to build Astra Merck, we, too, had to weigh our desires against our resources. First, we had to have the core applications we would need to run the business, such as payroll and telecommunications. We also had to build the capabilities—such as drug development—that would distinguish us from our competitors. We had to decide in what order we would develop our systems and what investments we would make in each.

A program management team made up of managers who reported directly to process-area leaders looked at all the various desired projects and, keeping our resource constraints in mind, established criteria to prioritize them. We expected them to be more than ambassadors from their respective areas and to bring an enterprise-wide perspective to the table. The team also reviewed the interrelatedness of the investments and developed an overall plan for implementing them.

My executive team approved nearly all of the recommendations. The program management team had made most of the really hard decisions about which capabilities to pursue and which trade-offs to accept. They clearly understood our company wide goals and objectives. Their proposed initiatives aligned with our vision and supported our model of the business. Within the executive team, I arbitrated disagreements among my

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managers. But in the end we, too, arrived at our decisions by consensus.

As CEO, I ask questions just to assure myself that, in the broadest sense, the technology under consideration is appropriate for a given activity. How will the technology differentiate Astra Merck in our ability to serve customers? Can we outsource a specific activity and thereby avoid the need to invest in it? I also use my executive team as a sounding board and to ensure that the investment is appropriate and necessary to support our business goals. In the final analysis, I trust my chief information officer, my management staff, and my organization to use the processes in place to make effective decisions about information technology.

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In today's changing health care industry, New England Medical Center must maintain research programs, teaching facilities, and high clinical-care standards, and yet also compete on price. New systems and applications are helping us balance these conflicting demands. It is my role as CEO to convey the message of change to my organization.

Historically, hospitals have not competed on price. In the past, government regulations and insurance reimbursement mechanisms created a climate in which we were paid to dispense service: The more we did, the more we earned. There was little incentive to manage costs or quality, and we fragmented our information systems to enable us to track and charge for individual units of hospital services.

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Now, however, in the competitive marketplace of managed health care, the rules of the game are different and the incentives dramatically reversed. Insurers predetermine and prepay for service. At the same time, we still must deliver high-quality service to the patient. Given such imperatives, our information systems must do more than account for provided services. They also must make certain that our quality-assurance systems (for monitoring the quality of patient care) and our cost-control systems provide us with the balanced data we need to manage our conflicting missions more effectively. If we can link together our formerly fragmented systems, we can get an integrated view of patient care that will transform the way we practice medicine, organize and manage care, and relate to each other as providers and patients.

To convey this message at my institution, I have to have answers to the questions that people continually ask: Why change? Where are we headed? How do we get there? What role do I play? Like managers in most companies today, I cannot answer such questions without also talking about the critical role that information technology will play. I work with outside consultants as well as with experts inside NEMC in addressing those questions.

I actively involve several members of my senior management team and other in-house experts in all decisions about IT development and investment. Within the past year, we created the Medical Center Information Services Advisory Committee from top administrators of information services, human resources, quality support services, laboratory, pharmacy, and nursing, plus physician leaders and individuals from a number of clinical

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