

The Vision of the Integrated Enterprise

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The time is the mid-1990s. After a long business dinner with your field service managers, you are crawling down the interstate highway (traffic hasn't improved over the past five years!). Your car phone rings and its display shows that one of your company's most important customers in Japan is on the line. Your office communications system has prescreened the call, found it to be one you are willing to accept at any time, and automatically forwarded it to your car phone.

You answer the call – it is the president himself, whom you met on your visit to Tokyo last year when you signed the deal to be his firm's primary supplier. He tells you that fire has struck his largest plant, knocking it out of commission. He needs all the parts that were scheduled to be shipped to that facility diverted to another. He also needs an emergency shipment sent to the working plant.

Pulling over to the side of the road, you open your briefcase and use the computer inside to access your corporate database through a cellular radio link. You identify yourself to the system with your key-card and personal identification number. The system then knows exactly what information you may access and what changes you are permitted to make.

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You order the system to redirect the scheduled shipments (even the ones already en route) and to send out the needed emergency parts to the customer's plant by the fastest means possible. Within seconds the system replies with the expected shipment and delivery times. It informs you that some of the needed parts are stocked in Europe and asks if you want them shipped by international courier. It quotes the extra cost for this service.

You pass on the information to your customer and ask if he wants to pay the costs for next-day delivery. He agrees and at the same time expresses admiration for the speed with which you are able to help him. He asks for a fax confirmation of the new delivery quantities, destinations, and times, which you immediately transmit from your briefcase-computer.

On the road home again, you feel good about the help that you have been able to give to a valued customer. You feel even better a few weeks later when this customer increases his business with your company by more than 10 percent because of your excellent service.

Science fiction? No. The technology exists today to allow you to do everything described above. But most companies have not sufficiently integrated their internal systems – nor established external links to their suppliers and other business partners – to permit field personnel or executives to access information anywhere and take immediate, responsible action to meet customers' needs.

The Coming Integrated Information Systems

By the mid-1990s, Integrated Information Systems (IISs) will turn into reality what is now just technologically feasible. IIS is the name that we give to the integration of all of a company's computing and communications resources into a unified structure. This single system will allow all the information and computing resources of a company to be accessed and used by every employee to the extent that he or she is authorized to do so. In most cases, a company's IIS will be linked to its counterparts belonging to principal customers, suppliers, and other business partners.

An IIS is characterized by a single data architecture and transparently connected networks of hardware that support the competitive thrust of the company. Mainframes, workstations, departmental computers, personal computers, and wide- and local-area networks can form an almost seamless infrastructure that will enhance the operation of all parts of the company. This IIS is already a practical, achievable goal.

IISs will allow busy executives and knowledge workers access to the information they need and the computing resources they require as a normal part of doing their jobs. And they will not need to learn mystic incantations or even to become computer-literate – as they often must now – to tap the enormous power at their fingertips.

Downward-spiraling prices and enhanced capabilities will make such systems practical – indeed necessary – for growing numbers of businesses during the 1990s. The challenge for most companies in the information systems arena will be to decide which technologies to invest in and how to integrate them smoothly into the normal work flow of their businesses without skipping a beat.

Of course, the even-more-fundamental challenge will be to decide which business objectives to pursue and how. We have now reached the point where the business „dog“ can wag the technology „tail.“ That is, the technology

can be adapted to support the objectives and operational demands of the business. The business no longer need be overhauled – or re-engineered – just to match the technology. One of the most valuable consequences of a heightened attention to the roles and benefits of information technology may indeed be a new understanding of an organization's real requirements for success, which may sometimes include, but will always go well beyond, the technological underpinnings of information and communication systems.

The very power of information systems makes it critical that those people who are ultimately accountable for the successes and failures of an organization clearly and completely understand what that organization is doing, how it is doing it, and why. Because of the potentially vast coverage and immediate responsiveness of information systems, immense rewards can flow from their effective application – and severe, perhaps even fatal, damage from their deliberate or accidental abuse. Should top management therefore apply the brakes – or damn the torpedoes and go full speed ahead?

The View From the Top

Paradoxically, yet understandably, just as the Integrated Information System is becoming achievable, top management is beginning to question the bill for information technology and to express doubts about its payoff.

Visible information processing and communications budgets are jumping by an average of 10 percent or more per year, with no obvious connection in many cases to increases in revenues or profits. The actual increases in the budgets are much greater because personal computer hardware, software, and related personnel costs are often camouflaged in burgeoning support budgets.

The lack of commensurate benefits is rooted in the history of every incompatible application that has been developed, patched, and enhanced during the past two decades and is still in use today. Over the years, companies have purchased masses of incompatible third-party applications. These individual applications, each implemented on a different manufacturer's hardware, were originally intended to work independently. In the age of integration, however, these inharmonious applications are required to work together. They do so grudgingly, often frustrating users.

At the same time, users perceive that new applications take unreasonable amounts of time and money to implement. That is not surprising, since IS staffs spend most of their time maintaining systems rather than developing new ones. At Mellon Bank in Pittsburgh, Management Information Systems (MIS) Director George DiNardo has said that he assigns 60 percent of his staff time to the upkeep of the old systems and only 40 percent to developing new ones. Avco Financial Services in Los Angeles has reported a backlog of new application requests measuring 19 person-years.

New projects take a long time to implement because each one requires major changes in existing systems due to data incompatibility or other problems. Even simple management reports are often difficult to obtain. In short, while everything in the world of information systems is changing, little seems to be improving.

This Gordian knot – the need for new applications entangled with the indispensability of old ones – cannot be suddenly severed without great risk to the organization concerned. Rather, it must be progressively unravelled and reknitted into an integrated infrastructure that is developed with the help of care-fill planning and the judicious use of standards and new technologies.

Yet the questions now being asked in the boardrooms of America rightly chill the skin of the chief information officer, whose responsibility it is to define and defend investments in information systems. „Where is the promised increase in productivity from past expenditures?“ „Where are the expected strategic advantages?“ „Why is there still a three-year applications backlog?“ Often, the CIO cannot provide satisfactory answers.

So what is the right way to develop an IIS, and what benefits can realistically be expected from it?

Evolution Rather Than Revolution

Building a new information infrastructure within an existing company is similar to redesigning a shopping mall. Computers and their databases are the steel, concrete, bricks, and mortar out of which the foundation and walls are built. Networks are the electrical and telephone lines – invisible but indispensable. In a mall, key department stores, like crucial applications, anchor the whole development. Specialty shops – like niche applications – come and go according to how well they appeal to customers, their users.

An aging mall can be repainted only so often to make it appear modern. Yet the developers cannot disrupt the various units of business to reconfigure the underlying structure. Rather than closing up shop to tear down and build again, they must renovate gradually. So it must be with information systems.

Yet some observers suggest that companies should „jackhammer“ and „detonate“ old systems. Others advise using the „information weapon“ to launch a revolution in American business, with the CIO as the spear carrier. Old organizational structures must be destroyed, they say, to make way for the information-based enterprise.

And old systems must be tossed onto the technological scrap heap to make way for the new.

These voices of apocalyptic change fail to see that the course of business history is much more the story of evolution than of revolution. Individuals and companies are limited in both the scale and the rate of change they can accommodate. Sweeping organizational changes cannot easily be implemented on the back of information technology. An Index Group study of 35 companies that attempted to do so turned up only 7 that reported succeeding. In the other 28, the fundamental transformation of processes and people failed to materialize into any quantifiable gain, such as market share, earnings increase, cost savings, or stock value. The lesson is clear: The development of increasingly complex information technology should be viewed as the growth of flexible, evolving organisms rather than the sudden introduction of new systems.

To ensure a sound technology foundation for the company in the long term, the Integrated Information System must be built block by block over the next five years. Until the structure is fully built, there may be few dramatic benefits to point to. Nevertheless, the CIO will need to maintain the credibility of the long-term vision by seizing every opportunity along the way to implement „quick-hit“ systems that deliver immediate, visible impact.

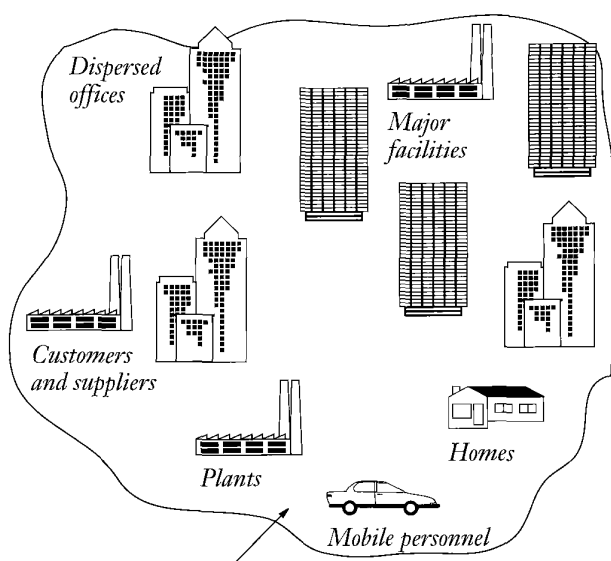
For instance, a tool such as Easel, from Interactive Images, Inc., can give the appearance of integrated systems even though that reality may be years away. (Easel is one example of an „intelligent front end“ that enables people to use existing applications and databases in new and more effective ways; it is cited here for illustrative purposes only.) With Easel, a user can search and retrieve information from multiple existing applications and databases from a single screen. He or she makes only one request for information through a simple graphical user interface. Any service representative handling a complex business account can be made more productive through Easel’s ability to bring information quickly to the screen from any of hundreds of databases, while the representative talks with the customer. Workers who get a taste of what integrated systems can do for them become active supporters of the long-term effort, which may eventually require the complete replacement or overhauling of the databases and applications involved.

By the mid-1990s, large companies following this kind of evolutionary path will implement IISs embodying the overall architecture shown in Exhibit 1. This configuration is network- rather than mainframe-centered. Because communications networks are ubiquitous, there are no „islands of automation.“

Although the central systems located in major computer complexes retain more importance than other computer systems, application programs run at all locations. For those authorized to obtain the information, up-to-date data are simply a button press away, rather than buried in mounds of computer printouts that would take weeks to review. In other words, the timeliness, relevance, and accuracy of the information that is available for all employees of an organization to do their jobs, from field service to development staff and from manufacturing to sales personnel, should be substantially improved. What benefits may be expected as a result?

Exhibit 1

The Integrated Enterprise of the Mid-1990s



**Seamlessly integrated wide-area
voice/data communications networks**

Advantages of an IIS

The most visible benefits of an IIS can be measured in terms of time and improved responsiveness to customers and markets – and therefore, ultimately, in terms of money. As one example, faster decision-making contributes to a quicker introduction of new products, which is one of the surest ways to increase profits. (See an elucidation of this relationship in „Managing Rapid Technological Development,“ by P. Ranganath Nayak, in this issue of *Prism*.)

Information is a basis of all decisions. At some companies, such as Du Pont Co., the flow of raw data out of which information is built increases at a phenomenal 30 percent annually. Du Pont spends about \$1 billion annually on systems to access, control, and use data. An IIS can facilitate the movement of important information, whatever its form or amount, to executives by significantly cutting the delay of review and handling.

In the 1980s, computers primarily processed text and numbers. In the 1990s, image and voice will become common on networks, allowing human communication to take the form most natural to the message and most comfortable to the user. According to IBM estimates, 95 percent of information used by the average business today is not yet coded and, therefore, not manipulated by computers. Image processing and multimedia applications are aimed at this huge, hard-to-handle mass of paper-based information.

In a typical company today, it may take three weeks of moving paper to effect a price cut to match a competitor and five weeks to propagate an engineering design change to correct a defect. To aggressive companies in the mid-1990s, such time scales will seem glacial.

Even mundane administrative matters, such as travel authorizations, hiring requests, and expense reports, can cut into the productivity of an organization when paper is the medium. At Hughes Aircraft, „The cycle time for documents is horrendous,“ admits Peter Donaghy, designer of a new forms-routing system. The prototype electronic system aims to automate the document review and approval process, then eventually extend to all 15,000 electronic mail users spread over 275 buildings in Southern California. „We believe that the increased efficiency will be so shockingly large that we won't have to cost-justify it document by document,“ Donaghy says.

In many companies, a simple purchase order can take a week to process. Most of that time is consumed by the paper's traveling in a mail cart from one office to another. In an electronic purchase order (PO) system, as soon as one individual approves the PO, it can be moved into the next approver's electronic „in box.“ This set-up allows all sign-offs to be obtained within a few hours, even when the approvers work miles, or even states, apart. Although this time saving can be justification enough, the system also can reduce the number of local personnel whose major function is to approve routine requests.

The equivalent of paper in the office is people in a warehouse. Ford Motor Company found that 70 percent of the work done in its huge parts distribution centers involved people walking to various bins and picking out items. In 1987, the company applied information technology, such as bar-code scanning, automated carousels, and central mainframe databases, not just to simplify the process, but to transform it. Conveyor belts move the parts from stock shelves to traveling carousels, which in turn take the items to the shipping area. The system virtually eliminates the time workers formerly spent walking, keeping paper records, and keyboarding information. Ford also eliminated 600 jobs and 1.5 million square feet of inventory space while increasing shipping volume at its eight distribution centers by 45 percent – and cutting rush-order delivery from 72 to 48 hours.

In the communications arena, the standard business card can no longer accommodate all the executive's „addresses“ – his or her postal address, voice telephone number, voice mail number, fax number, electronic mail identifier, telex number, car phone number, and perhaps internal corporate phone extension. Each locator allows a person to receive and send communications under different conditions in the particular format that suits the message.

The IIS will help to coordinate these forms of communications so that an individual will be notified of and be able to receive all forms of communication at his or her „desk,“ wherever it may be – at a company location, on the road, or at home. The system will determine the appropriate form of communication and automatically make the necessary connection.

On a broader scale, international companies such as General Electric and Du Pont are extending integrated networks around the world. In December 1989, General Electric switched to a private network designed to provide voice, data, and video services to offices in 25 countries. Du Pont considers its global network „the nervous system for the whole corporation.“ General Motors announced in 1990 that by 1992 it would link its 9,700 American dealers into what it called the world's largest private satellite network.

As information spreads throughout the enterprise in distributed databases, electronic mail, and universal file sharing, each part of the corporation more easily sees the inner workings of the others. In this way, each worker becomes more reachable and better able to work with others. Each person's role and contribution become more

comprehensible to others.

Instant communication allows professionals to go beyond their specific departmental functions and feel more a part of a single corporate entity. Work teams can form and dissolve, reform and dissolve again, in combinations of members spanning functions, buildings, and even countries. These teams, rather than being collections of specialists, are dynamic groups of pragmatists. Their members think of themselves more as bankers, automakers, or retailers than as financial analysts, design engineers, or marketers. The pragmatists bring their special expertise to the mix, but their understanding of the broader context is what enables the company to act as a whole, i.e., as an integrated enterprise.

Information technology alone, no matter how brilliantly planned and executed, cannot make an integrated enterprise. Human beings must define the objectives and criteria of success for such an undertaking, and human beings must supply the essential ingredients of judgment, commitment, discipline, and initiative. But the effectiveness of these human beings – and their ability to shape their own destiny and anticipate and respond to changes in their circumstances – will increasingly depend on the quality and capabilities of the information and computing resources to which they have access.

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