

IT-Enabled Business Transformation: From Automation to Business Scope Redefinition

N. Venkatraman

THE ROLE OF IT IN SHAPING TOMORROW'S BUSINESS OPERATIONS IS A DISTINCTIVE ONE. IT HAS BECOME A FUNDAMENTAL ENABLER IN creating and maintaining a flexible business network. Using a framework that breaks IT-enabled business transformation into five levels, the author describes each level's characteristics and offers guidelines for deriving maximal benefits. He suggests that each organization first determine the level at which the benefits are in line with the costs or efforts of the needed changes and then proceed to higher levels as the demands of competition and the need to deliver greater value to the customer increases. ☞

N. Venkatraman, who was on the faculty of the MIT Sloan School of Management from 1985 through 1993, joined the School of Management at Boston University in January 1994 to teach and conduct research in the areas of strategic management and information technology.

During the past decade, articles and books on the virtues and potential of information technology (IT) and information systems (IS) to provide new sources of advantage for business operations have besieged managers.¹ Indeed, the operative phrase today is "IT changes the way we do business." These publications either have developed intuitively appealing prescriptive frameworks that provide alternative approaches to leveraging IT competencies or have described cases of successful exploitation of IT as a way to encourage managers in other companies and industries to consider IT as a strategic weapon.

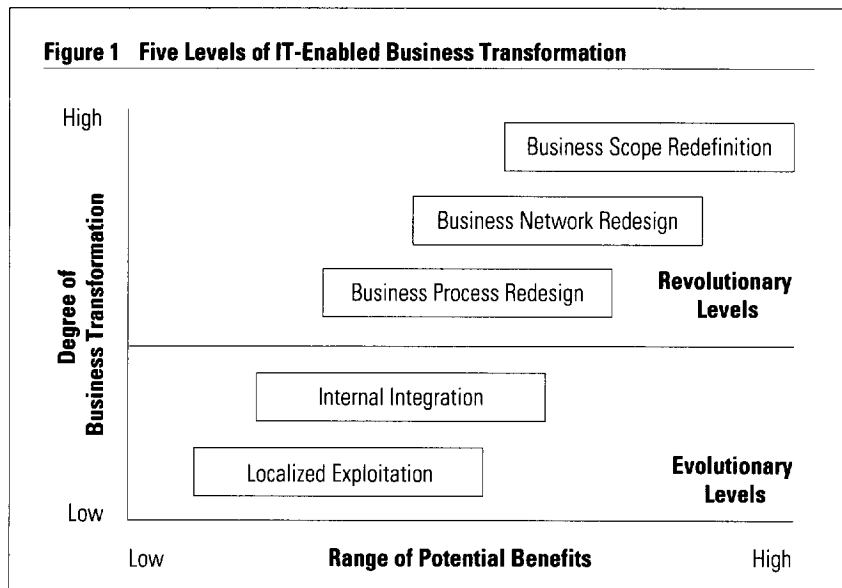
We entered the 1990s highly skeptical of IT's benefits. The productivity gains from IT investments have been disappointing. Loveman observed that "Despite years of impressive technological improvements and investment, there is not yet any evidence that information technology is improving productivity or other measures of business performance."² Max Hopper of American Airlines — whose SABRE Computer Reservation System (CRS) is often invoked to illustrate IT's competitive potential — remarked that the era of competitive benefits from pro-

prietary systems is over, since computers have become as ubiquitous as the telephone, and that any travel agency could replace its CRS within thirty days.³ Looking at the macroeconomy, Strassman observed essentially no correlation between levels of investments in information technology and such business performance indices as sales growth, profit per employee, or shareholder value.⁴ In a related development, many companies have handed over their IT and IS operations management to external vendors or systems integrators, such as EDS, IBM, Subsidiary-Issc, CSC, and Andersen Consulting, and the stock market seems to respond favorably to such moves.⁵

Against this backdrop, such questions as these confront senior managers:

- Is the logical requirement of aligning business and IT and IS strategies, so compelling just a few years back, now obsolete?
- Has IT (and IS) become a common utility that is best managed for efficiency alone?
- Is the role of IT in our business today fundamentally different from its role in the past decade?
- Does IT still play a role in shaping new business strate-

Figure 1 Five Levels of IT-Enabled Business Transformation



gies, or does it simply play a supporting role in executing our current business strategy?

- What is the source of IT competence, inside our organization or outside through partnerships and alliances?

These are valid questions because we are on the threshold of fundamentally reassessing the logic for organizing business activities and reevaluating IT's potential role. My aim in this article is to highlight the distinctive role of IT in shaping tomorrow's business operations. I have a growing feeling that the business logic of the 1970s and 1980s — exploiting experience curve effects for achieving low relative cost through vertical integration — may be inadequate for the 1990s and beyond because the emerging business environment calls for a strategy based on three intertwined elements: low cost, high quality, and fast and flexible response to customer needs. No one element is sufficient for competitive success. Correspondingly, IT's role within organizations has evolved from its predominant focus on efficiency enhancements (automation) to its role as a fundamental enabler in creating and maintaining a flexible business network of interorganizational arrangements — joint ventures, alliances and partnerships, long-term contracts, technology licensing, and marketing agreements. The functionality that computer and communication networks offer allows firms to learn from and exploit the capabilities of the extended business network.

Transformational Trajectory

In this article, I present a framework of IT-enabled business transformation, illustrate it with a wide array of examples, and derive implications and guidelines for man-

agement. I developed a preliminary version of this framework as part of MIT's Management in the 1990s research project.⁶ During the past five years, I have applied it at different businesses and learned from the experiences of senior managers who have used it in their organizations. This article represents my synthesis of these two streams of "action research" that enabled me to test and validate the framework. I discuss its refined logic and its implications for management.

The framework is based on two dimensions: the range of IT's potential benefits and the degree of organizational transformation. The central underlying thesis is that the benefits

from IT deployment are marginal if only superimposed on existing organizational conditions (especially strategies, structures, processes, and culture). Thus the benefits accrue in those cases where investments in IT functionality accompany corresponding changes in organizational characteristics. A related thesis is that the range of potential benefits increases from the first level — localized exploitation — to the final level — redesign of the business scope.

Figure 1 is a schematic representation of the framework, which proposes a hierarchy of five levels of IT-enabled business transformations. It is important to underscore that these levels are not conceptualized as stages of evolution because effective strategies do not (and should not) follow any one prescribed model of evolutionary stages. I will describe the distinctive characteristics for each level and offer a set of management guidelines for deriving maximal benefits. While the higher levels of transformation indicate potentially greater benefits, they also require a correspondingly higher degree of changes in organizational routines — logic of structuring, reporting relationships, performance assessment criteria, informational flow, etc. Thus, each organization should first identify the transformational level where the benefits are in line with the potential costs (efforts) of the needed organizational changes. Over time, however, higher levels may be necessary, depending on competitive pressures and the need to deliver greater value than competitors in the marketplace.

Level One: Localized Exploitation

The first level is the basic one for leveraging IT function-

ality within a business. I chose the term localized exploitation to indicate that, in many cases, decisions to deploy isolated systems (e.g., a customer order-entry system, toll-free customer service system, inventory control system, internal electronic mail system) are decentralized to the appropriate functional, operational managers. The result is minimal learning among the managers within the organization of benefits and limitations from such initiatives. Typically, managers initiate and deploy these systems to respond to operational problems or challenges: for example, a twenty-four-hour, toll-free customer service support system to enhance service; CAD/CAM capability to reduce the manufacturing cycle time; Hertz, Avis, and other systems to streamline car rentals at major airports; or decision support systems to help insurance underwriters evaluate the risk levels of new policies. Indeed, this level should be very familiar to managers, and many readers will be able to identify specific applications in their companies that fit this level.

My research indicates that this level is best viewed as the deployment of standard IT applications with *minimal* changes to the business processes. This underleverages IT's potential capabilities and fails to provide organizations with as many possible advantages if the company had attempted to change the business processes to leverage the technical functionality. The main weakness is that competitors can easily imitate standard technical applications with minimal changes to the underlying business processes to neutralize sources of strategic advantages. I suggest that each manager select a set of IT applications that are "successful" examples of localized exploitation and pose two questions:

1. By what criteria is this application considered a success?
2. What changes in performance criteria have been instituted since the deployment of this application?

During my five-year research, I found that some managers classified a set of their IT applications as "strategic information systems" and described them as success stories based on criteria that I would call "past practice." In such instances, these managers usually indicated that their chosen IT application either reduced the cost of a certain process (for example, use of barcodes or order-entry systems) or increased the speed of their response to customer requests (for example, twenty-four-hour, toll-free fax reply), measured against past performance levels. A manager's typical comment was, "The installation of a toll-free telephone system has allowed us to process twice the number of customer requests." When I evaluated such success stories (and corresponding improvements relative to past practice)

against the "best practice" in the marketplace, they were *no different* from standard business practice in the marketplace at that time. This is because most applications at this level use standard, off-the-shelf system functionality (with minimal changes in the organizational routines). Competitors are easily able to imitate such practices as vendors flock to sell similar applications to others in the same vertical market.

My argument here is not against IT applications within the level of localized exploitation. Even standard IT applications, when accompanied by corresponding changes in internal business processes, can result in significant advantages. Let us consider the case of a retail

Even standard IT applications, when accompanied by corresponding changes in internal business processes, can result in significant advantages.

establishment that decides to install a toll-free 800 number. Such a capability has become a basic necessity for doing business today, and this system per se does not confer any competitive benefits. However, when the standard application is enhanced with call-identification features to direct each call to the most appropriate service center, with corresponding support information displayed on the service representative's screen, the result is enhanced customer service rather than just an efficient call-answering system. Thus the decision to install a toll-free 800 number should be motivated by a focus on differentiation and strategic effectiveness (superior customer service) rather than efficiency alone.

Whirlpool Corporation, the consumer appliances manufacturer, designed a customer service center in Knoxville, Tennessee, that routes the customer's toll-free call to a service agent along with a call identification signal to an IBM host that downloads the relevant customer information to the agent's screen. The agent also has an image server on the local area network (LAN) to retrieve routine product and service information and an expert system that helps diagnose and solve more complex customer problems.

The second question — changes in performance criteria — highlights the importance of evaluating the appropriateness of the performance criteria before deploying the IT application (and the corresponding organizational

changes). The benefits from every IT application are considerably enhanced when the performance criteria are realigned to reflect the new IT-enabled business process. I found one company that had redesigned its tele-marketing activity into customer service support with appropriate telecommunication and database capability but had not changed its criteria for assessing the service center representatives. After one year, it was not surprising that the service quality measures (customer surveys) did not show any improvement; the company continued to evaluate the representatives on traditional criteria such as number of calls serviced and average length of calls. It made no attempt to learn from the *content* of the calls and improve the overall customer service process.

In contrast, Jones Truck Lines, Inc., which competes in the less-than-truckload (LTL) movement of cargo — installed an integrated database and freight handling application to increase operating efficiency and customer service. This was accompanied by a fundamental shift in the logic of performance assessment. The company now bases bonuses on improvements in customer satisfaction that are reflected in an annual survey of on-time performance, condition of freight, billing accuracy, and technical capabilities.⁷ The performance assessment system is the ultimate driver of managerial behavior.

Within the level of localized exploitation, it is important to recognize that no single IT application — however powerful — is *strategic* in its generic form. Instead of delineating a separate category of information sys-

Within the level of localized exploitation, it is important to recognize that no single IT application — however powerful — is *strategic* in its generic form.

tems as “strategic information systems” — a misnomer, in my view — a company should make the required business process changes that would maximize the benefits from the system functionality. Thus, my argument is that not all order-entry systems are strategic, although some could provide critical sources of competitive advantage if accompanied by appropriate business process changes. Similarly, not all airline reservation systems are strategic, although there are strong indications that

American Airlines and United Airlines have leveraged them more effectively than their competitors. The reasons lie in their ability to *use the information content* for more detailed analyses and insightful pricing and promotional decisions than their competitors.

Level Two: Internal Integration

The second level is a logical extension of the first, reflecting a more systematic attempt to leverage IT capabilities throughout the entire business process. This level involves two types of integration: *technical interconnectivity* (dealing with the interconnectivity and interoperability of the different systems and applications through a common IT platform) and *business process interdependence* (dealing with the interdependence of organizational roles and responsibilities across distinct functional lines). Neither type alone is sufficient.

During my research, I observed that firms allocated more attention and effort to technical interconnectivity than to business process interdependence. Efforts at technical interconnectivity have been enhanced by significant developments in connectivity capabilities during the past decade, such as increased availability of integrated technological solutions and favorable cost-performance trends. Nearly every firm that I studied had a technical committee (varying in degree of formality) responsible for ensuring technical interconnectivity, while, in only a few cases, did parallel, cross-functional teams address the challenge of business process interdependence. This is disappointing because external technical vendors and systems integrators can carry out the operating tasks for ensuring technical interoperability, but the responsibility for business process interdependence lies squarely within the firm. The important question that few managers ask is: “Even if we have achieved the objective of a seamless technical platform, will our managers operate as a coherent organization rather than as functional stovepipes?” My conclusion is that the lack of attention to creating interdependent business processes (with a supporting performance assessment system) weakens the organization’s ability to leverage a seamless and interoperable technical platform.

Merrill Lynch has succeeded with its Cash Management Account (CMA) not simply because of its technical sophistication but also because of its ability to create an interdependent business process that leverages information across different financial products to offer an “integrated” product in response to strong market needs. Similarly, Baxter’s success in the highly competitive pharmaceutical distribution marketplace is due not

merely to the deployment of its now-famous Analytic Systems Automated Purchasing (ASAP) system, but to its ability to leverage the IT infrastructure and deliver high-value products and services through ValueLink.⁸ USAA — an insurance company known for its customer service — has balanced business process interdependence with technical integration to achieve its business vision: “All customers calling the insurance company should be able to accomplish their task with a single call.” Similarly, Frito-Lay, a division of PepsiCo, has leveraged its integrated technical platform so that its marketing managers can respond effectively to the competition in various regional markets.

Max Hopper of American Airlines remarked that the age of owning proprietary systems (or “screen bias”) may be over, but he stressed the value of analyzing the distinct data elements for better decisions throughout the business operation. Benefits accrue not because of CRS alone but because of its link to the Revenue Management System (RMS) — which is based on a sophisticated internal database of disaggregated historical travel patterns — that allows increased flexibility in pricing perishable inventory, namely, airline seats.⁹

Ingersoll Mining Machine Company competes on its ability to offer customized products at competitive prices. Ingersoll executes this strategy through a computer integrated manufacturing (CIM) platform that delivers the required products at optimum speeds with minimal waste or inventory. The internal business process is driven by a Hitachi Data Systems (HDS) mainframe, which links more than 200 CAD/CAM terminals and diverse functions such as purchasing, billing, order handling, payroll, and shop floor — all supported by an integrated database. The key advantages of internal integration include the system’s ability to place purchase orders for necessary parts based on an engineer’s CAD/CAM drawings and a computerized “nesting” system that determines the most efficient way to carve raw plates of steel and reduce the manpower requirement by 90 percent while increasing reliability and quality. More important, this system is linked to the bill-of-material, routing, payroll, cost, and master scheduling functions, thus minimizing the finished goods inventory to one of the lowest levels in the industry.¹⁰

Similarly, Otis Elevator has leveraged its information system — Otisline — to streamline its internal operations and design and implement state-of-the-art elevators that provide the highest level of service operations. Otisline — primarily a centralized dispatching service that handles about 9,000 calls per day — is the central conduit for exchanging crucial information among field

service mechanics, salespeople, design and manufacturing engineers, and managers. Recent enhancements include remote elevator monitoring (using a microprocessor to report malfunctioning elevators to the central dispatching office via modem), direct communication with trapped passengers, and monthly reports on each elevator for subsequent analysis of performance patterns. Beyond dispatching service mechanics to rectify problems and obtaining feedback data on elevator performance for the consolidated database, Otisline’s internal integration characteristic is its sales support. Salespeople use Otisline to access NES (new equipment sales) — an integrated database management system that provides immediate quotes for prospective clients. Thus, the logic of internal integration is to support the business vision. According to George David, CEO of Otis, “Any salesperson in the organization should be able to order an elevator within a single day.”¹¹

Recent entries in the luxury automobile market offer another example of internal integration. Lexus and Infiniti collect important data on automobile performance during service visits and have linked it to their design and manufacturing databases. Such an integrated system lets them analyze their cars’ performance systematically and comprehensively and detect possible problems earlier. An early-warning system makes preventive maintenance possible, thereby raising the level of customer satisfaction. Similarly, Saturn Corporation has deployed information systems capable of two-way data and one-way video information exchanges to track order status and give early warnings. This system enabled Saturn to recall 1,800 cars that had defective cooling liquid within three days. Normally, a company would discover this defect through warranty claims and may not have communicated it to manufacturing for several months.¹²

Two questions should guide how managers think about internal integration:

1. What is the rationale for internal integration? (Does it improve efficiency, give superior customer service, or coordinate decision making?)
2. How does the resultant business process compare with the “best in class” in the marketplace?

The first question emphasizes the view that each firm should develop its own vision for internal integration after assessing the benefits of integrating current business processes. As Hammer observed: “Instead of embedding outdated processes in silicon and software, we should obliterate them and start over.”¹³ If a company deems the current processes to be effective, then it is important to articulate the specific objectives of internal integration: for instance, some firms may seek to create

Table 1 Enablers and Inhibitors of Evolutionary Levels of Transformation

Technological Enablers

- Favorable cost-performance trends
- Enhanced connectivity capabilities

Organizational Enablers

- Managerial awareness
- Leadership

Technological Inhibitors

- Obsolescence of technologies
- Lack of established standards

Organizational Inhibitors

- Managerial resistance
- Financial constraints

cross-functional, horizontal business processes that are parallel to the traditional organization, reflecting vertical functional lines. Alternatively, the logic for internal integration may reflect a transition toward fundamentally redesigning the business processes over a period of time.

The second question highlights the need to ensure that marketplace considerations guide internal integration efforts. Simply fine-tuning existing outmoded processes through current technological capabilities does not create the required organizational capabilities. A frustrated manager struggling with internal integration commented, "The best way out for us is to scrap our existing DL/1 database systems on an IBM 4381 system in favor of a new database based on Natural2 fourth-generation language running on an IBM 3090. But we have not been given resources to support such a major migration, and so we have been tinkering at the margin and falling behind our competitors every day. We don't assess the *real costs of not migrating* to the new system and that's our weakness." Internal integration should not be the result of automating inefficient business processes.

Enablers and Inhibitors

The first two levels are "evolutionary" because they require minimal changes to the business processes relative to the next three levels. Table 1 summarizes the major categories of enablers and inhibitors at these two levels. The technological enablers are favorable cost-performance trends and the increased availability and affordability of technologies that operate across different platforms, time zones, and geographical boundaries. The organizational enablers are the managerial awareness of the costs and benefits associated with these levels and exercise of leadership to achieve internal integration.

The same two categories are relevant for discussing the inhibitors of these two levels. The technological inhibitors pertain to the pace of obsolescence and the absence of accepted standards for protocols and applications. A manager involved in implementing a business process requiring handwriting-recognition software capa-

bilities highlighted the dilemma: "I am constantly worried that my selection of XYZ protocols will prove to be a disaster. At the same time, I cannot remain still, waiting for the standards battle to end." The organizational inhibitors are managerial inertia and individual managers' resistance when their power base may be disturbed or reduced by seamless, interdependent business processes, as well as scarce resources to invest in

the technical platform that supports internal integration.

Perhaps the most important decision is whether to be at level two of the transformational trajectory — namely the automation of existing processes — or to be at one of the three *revolutionary* levels, since they require fundamental changes in organizational routines.

Level Three: Business Process Redesign

The third level reflects a strong view that the benefits from IT functionality are not fully realized if superimposed on the current business processes — however integrated they may be. This is because the current business processes subscribe to a set of organizational principles that responded to the industrial revolution. Organizational concepts such as centralization versus decentralization, span of control, line versus staff, functional specialization, authority-responsibility balance, and administrative mechanisms for coordination and control are all derived from the general principles. Although these concepts are still valid, IT functionality can significantly alter some of these "first principles" of business process redesign. Some modes of organizing may be rendered relatively inefficient. In the opinion of professionals and academics, the new logic of organization should be predicated on current and emerging IT and IS capabilities.¹⁴

Research from the MIT Management in the 1990s program strongly indicated that IT functionality should not be simply overlaid on existing business processes but should be used as a lever for designing the new organization and associated business processes.¹⁵ Davenport and Short developed the logic of business process redesign as "new industrial engineering" — with IT capabilities playing a central role, an exemplar of this level of transformation.¹⁶

Three critical questions for exploiting IT-related benefits at the level of business process redesign are:

1. What is the rationale for the current organizational design? (What are its strengths and limitations?)
2. What significant changes in business processes are oc-

curing in the competitive marketplace? (What are the likely impacts?)

3. What are the costs of continuing with the status quo? (When should we redesign the business process? What should be our pace of redesign?)

During my research, one manager commented, “I sense a high level of frenzy regarding business process redesign these days. Do you believe that *every* business process should be redesigned?” The answer is clearly no. What is important, however, is to understand the rationale of the current business process — especially its strengths and limitations. Such an understanding will allow managers to approach business process redesign more rationally and systematically than emotionally. I found very few cases where organizations had systematically assessed their organizational logic, given their business strategy, before embarking on their business process redesign efforts.

A company should initiate business process redesign after ascertaining the significant changes in its key competitors’ business processes — especially those of new entrants — so that it can formulate appropriate responses beforehand. In the late 1980s, a proactive credit card provider could have asked, “What does the entry of

There is absolutely no evidence that deploying proprietary interorganizational systems per se provides any competitive advantage.

AT&T and GM into the credit card market mean for my business? What responses — business process changes, as well as others — are required to counter these competitive moves?” Analyzing such questions before competitors actually launched their products would have provided more lead time for effective response.

Business process redesign is not “zero or one” but reflects several variants. A careful analysis of the costs and benefits of the current design against a feasible set of options allows an organization to execute a coordinated plan for redesign. Most business process redesign attempts that I observed during my research could be described as only “quick and dirty” responses to an operational crisis — which are not only inefficient but also ineffective in countering competitive actions.

Benefits from business process redesign are limited in scope if the processes are not extended outside the focal

organizational boundary to identify options for redesigning relationships with the other organizations that participate in ultimately delivering value to the customer. In an article on the evolution of the role of Baxter’s ASAP, James Short and I observed that “had Baxter restricted its view of the business process as being contained within its company boundaries, it would have realized efficiency benefits but not the potential to restructure the basis of competition in the marketplace.”¹⁷ Next I elaborate on the logic of business network redesign.

Level Four: Business Network Redesign

The three levels discussed thus far have focused on IT-enabled business transformation within a *single* organization. These levels — either implicitly or explicitly — assumed that the boundary of the focal organization is fixed or given. Even when there are interconnections with external businesses — such as suppliers, buyers, and other intermediaries — the distribution of business activities across the different firms is not altered. In contrast, this level represents the redesign of the nature of exchange among multiple participants in a business network through effective deployment of IT capabilities.

Strategic Considerations

- **Business network redesign is *not* electronic data interchange.** Table 2 distinguishes business network redesign from electronic data interchange (EDI) because there is a strong — and mistaken — tendency to equate the two. The selection of an EDI platform is best viewed as a technical means to redesign the business network rather than as an end in itself.

- **Business network redesign is more than the choice between common versus proprietary interfaces.** A major area of controversy is the choice between proprietary and common interfaces for dealing with external partners (such as suppliers, buyers, or other intermediaries). The popular examples of IT-based advantage — American Airlines’ SABRE system, Baxter’s ASAP system, McKesson’s Economost, and Otis Elevator’s Otisline — are based on firm-specific proprietary systems. Although these systems were deployed in the 1970s, with very different competitive conditions and interorganizational relationships, the dominant view is still that IT-based advantage accrues if (and only if) the firm deploys its own version of interorganizational systems (IOS).¹⁸

There is absolutely no evidence that deploying proprietary interorganizational systems per se provides any competitive advantage. During the 1980s, the role of

Table 2 Distinguishing Business Network Redesign from Electronic Data Interchange

Distinctive Characteristics	Electronic Data Interchange (EDI)	Business Network Redesign
Dominant Objective	Data interchange	Interdependencies across independent organizations
Primary Domain	Technical domain; data elements	Business domain; business partners
Responsibility	IT (and IS) managers	Business managers
Management Focus	Operational; tangible	Strategic; intangible
Orientation	Collaborative advantage	Competitive advantage
Performance Assessment	Efficiency of technical standards	Effectiveness of business arrangements
Action Steps	Standardized	Unique (firm-specific)

proprietary systems as a source of competitive advantage had been glorified through some overused examples with no systematic, quantitative evidence. From 1988 to 1989, I studied the benefits of proprietary IOS in the property and casualty segments of the U.S. insurance industry.¹⁹ I selected a set of eighty independent insurance agents who were electronically interfaced with one focal insurance carrier that had deployed the proprietary IOS. I also selected a matched set of eighty agents (similar in size and geographical categories) as my "control group." The performance data over a one-year period (from six months prior to the system installation to six months after) did not statistically demonstrate that the electronically interfaced agents performed any better than the control group. Subsequent analysis within the same study revealed that the agents who had redesigned their business processes to exploit the interfacing functionality performed significantly better than those agents who simply automated their inefficient business processes.²⁰

This does not mean that firms should not adopt proprietary interfacing systems. Indeed, we will continue to see the deployment of such systems in markets where there may not be sufficient forces to create common protocols from the beginning. However, it is important to reinforce the notion that such systems serve as a means to achieve differential advantage rather than as an end in itself. So, while IOS is an efficient *conduit* to exchange important information between trading partners, it is the organization's capability to leverage these systems to create interdependent processes (as in the case of my insurance study), or enhance decision making (as with the

link between American's SABRE and its revenue management systems), or provide distinctive value-added services (as in the case of Baxter's ValueLink) that leads to effectiveness.

• **The scope and benefits of business network redesign are broader than efficient transaction processing.** The most common view is that IT functionality allows efficient information exchange (by eliminating multiple data entry and responding faster). The potential benefits, highlighted in Table 3, are clearly much broader:

Transaction processing is the exchange of structured data on transactions — purchase orders, invoices, material schedules, electronic payments — in a machine-readable standard format using computers and communication capa-

bilities across independent organizations. This is facilitated by using standard EDI protocols (for example, ANSI X12 standards). The main benefit of computerized transaction processing is increased administrative efficiency (data-entry costs, mailing costs, paperwork, etc.). During the 1980s, the use of EDI for structured transaction processing increased significantly, and the forecast is that, by the end of this decade, more than 75 percent of interbusiness transactions will be over EDI networks. Thus, this becomes the basic level of interdependency among businesses as long as they accept the prespecified standards.

Inventory movement refers to moving inventory from one organization to another (based on the efficient transaction processing discussed above) without the intervention of the relevant organizations' managers. For example, in manufacturing, interconnected information systems trigger the movement of materials from one stage to another — although these stages of manufacturing may be in different organizations. However, the conditions for participation in this function are stricter than those for transaction processing. As noted in Table 3, inventory shifts across organizations are governed by standard business contracts among the relevant participating businesses, while such a condition may not be required for transaction processing. Similarly, in the airline industry, the reservation systems make the "inventory of seats" visible and available — but differentially to the different travel agents based on their preferred carrier status and CRS ownership. Finally, the potential benefits are not only in administrative efficiency (as before) but

also in operational efficiency (streamlined inventory levels throughout the supply chain).

Process linkage expands the scope of business network redesign in very important ways. For instance, the design stage of one organization linked to the manufacturing stage of another in a vertical chain through a common CAD/CAM/CIE platform represents a very different type of network redesign than the previous two functions. Navistar International has a process linkage with Dana Corporation with a common quality assurance system that eliminates duplicate tests because Navistar has the ability to monitor the quality when needed. Nestlé Rowntree — maker of such brands as KitKat and After Eight mints — has outsourced its packaging process to the Lawson Mardon Group but ensures control through electronic process linkages. Similarly, Ford Motor Company has process links with Goodyear Tire that allow it to exploit concurrent engineering and reduce the time of new product introduction. Toyota has instituted its own proprietary value-added network to create seamless processes with suppliers within its keiretsu. This type of business network redesign does not lend itself to participation by all organizations. Specialized contracts or

Any systematic attempt to reposition a firm has implications for the firm's business scope.

strategic alliances in which each party agrees to the relationship on a mutually beneficial basis govern such business arrangements. The potential benefits are that each partner can leverage the competencies in the extended network without resorting to the costly options of vertical integration.

Bose Corporation — a maker of high-end audio products — provides an example of process linkages that leverage IT capabilities to restructure business relationships. During the past five years, it has pioneered an

Table 3 Scope and Benefits of Business Network Redesign

Scope/ Functions	Description	Participation Conditions	Potential Benefits
Transaction Processing	Seamless interconnection for exchanging structured data on transactions.	Potentially unlimited under conditions of acceptance of standards and security requirements.	Administrative efficiency enhancements.
Inventory Movement	Triggered across organizations based on predefined conditions without human intervention.	Governed by standard contracts between the participating organizations.	Operational efficiency enhancements.
Process Linkage	Interdependent process linkages for unstructured tasks (for example, design and manufacturing).	Governed by specialized contracts or strategic alliances based on mutual benefits.	Potential for differentiation in the marketplace through greater coverage of sources of competencies.
Knowledge Leverage	Creation of a network for leveraging skills and expertise.	Governed by professional norms rather than contractual conditions.	Enhanced learning — potentially valuable under highly uncertain situations.

advanced version of a just-in-time manufacturing system, JIT II®. The distinctive aspect of the process linkage is that seven major suppliers have in-plant representatives at the Bose facilities, replacing the traditional roles of suppliers' salespersons and buyer's purchasing staff. The representatives are empowered to use Bose's purchasing orders to place orders with the suppliers. Additionally, they are allowed to practice concurrent engineering, attending design engineering meetings on the particular company's products, with full access to Bose's facilities, personnel, and data. Both Bose and the seven suppliers involved in the program claim that this has been mutually successful. For Bose Corporation, the benefits are: (1) the purchasing staff, liberated from low-value administrative tasks, attends to more high-value areas; (2) the cost of supplies including inventory charges is reduced; and (3) EDI capabilities create links with critical suppliers for enhanced learning. For the suppliers, the benefits are: (1) sales efforts have been eliminated (offset by a full-time in-plant representative); (2) there is an evergreen contract with no end date and no rebidding activities; (3) supply is streamlined; (4) invoicing and payments are more efficient and there is a higher probability of sales growth.²¹ Lance Dixon of Bose, who originated the concept of JIT II®, comment-

Table 4 A Summary of the Five Levels of IT-Enabled Business Transformation

Level of Transformation	Distinctive Characteristics	Major Strengths	Potential Weaknesses	Management Challenges
Localized Exploitation	Leveraging of IT functionality to redesign focused, high-value areas of business operations.	Relatively easy to identify and exploit potential IT capability; facilitates the demonstration of proof-of-concept; minimal organizational resistance to change.	Potential duplication of efforts within the same organization; lack of organizational learning; may appear attractive relative to "past practices" but may fail when assessed against best-in-class capability.	1. Identification of high-value areas. 2. Benchmark exploitation and results against "best practice" to achieve competitive differentiation. 3. Redesign performance assessment criteria to reflect exploitation.
Internal Integration	Leveraging of IT capability to create a seamless organizational process — reflecting both technical interconnectivity and organizational interdependence.	Supports the total quality movement; streamlines the organizational processes that result in enhanced efficiency and improved capability for delivering customer service.	Automating the business processes designed under a historical model of organizing may have limited impact if the competitors have abandoned them in favor of newer logic of organizing.	1. Focus on business process interdependence and technical interconnectivity. 2. Ensure that performance criteria are reassessed in light of internal integration efforts. 3. Benchmark results against best-in-class capability.
Business Process Redesign	Redesigning the key processes to derive organizational capabilities for competing in the future as opposed to simply rectifying current weaknesses; use IT capability as an enabler for future organizational capability.	The historical processes do not hinder the organization's ability to offer high value to the customers; shift away from outmoded practices toward a new business logic; opportunities for first-mover advantages.	The benefits might be seriously limited if viewed as a means to rectify historical and/or current weaknesses; potential danger of redesigning processes that might be obsolete and/or shifted outside to partners in the extended business network.	1. Articulate business rationale for redesign (e.g., rectify current weaknesses instead of future capabilities; redesign proactively instead of responding to competition). 2. Recognize that organizational issues and challenges are far greater than selection of the technology architecture supporting redesign.

ed, "JIT eliminates *inventory*, while JIT II eliminates the *salesman and the buyer*."²²

Knowledge leverage focuses on the sources of expertise within the business network through IT-based linkages. In contrast to structured EDI platforms, this platform is capable of richer, unstructured information exchange within an intellectual network that cuts across physical, organizational, and geographical boundaries. For example, at the University of Pittsburgh Medical Center, a multimedia network allows neurophysiologists from remote locations to assist neurotechnicians in performing complex operations.²³ Different experts not present in the operating room can solve unexpected complications. Similarly, networks are evolving in such specialized areas as law, finance, taxation, and geology. However, the participation in such knowledge networks is restricted, based on skill and expertise levels. For example, the neurophysicians' participation is based on their academic credentials and prior achievements within the profession. The potential benefits lie in one partner's ability to

leverage critical sources of knowledge and expertise in a broader domain than possible without the functionality the technology offers.

• **Effective business network redesign calls for coordinating distinct strands of relationships through a common IS platform.** During the past decade, firms have devoted increased attention to restructuring external relationships: purchasing departments have devised their own approach to streamlining the supply process (e.g., reducing the number of suppliers, increasing the length of contracts, shifting performance criteria to reflect nonprice factors, and enhancing use of EDI); marketing departments have attempted to reconfigure the product delivery and customer service process (e.g., vertical channels, cooperative advertising, micromarketing, product and service customization); finance and insurance departments have restructured their relationships through self-insurance, risk sharing, and so on. In most of the firms that I studied, the redesign of business relationships in these "functional domains" has occurred in-

Table 4 (continued)

Level of Transformation	Distinctive Characteristics	Major Strengths	Potential Weaknesses	Management Challenges
Business Network Redesign	Articulating the strategic logic to leverage related participants in the business network to provide products and services in the marketplace; exploiting IT functionality for learning from the extended network as well as for coordination and control.	Elimination of activities where the focal organization may not have the required level of competence; streamlining business scope to remain flexible as well as responsive to fast-changing and diverse customer needs; ability to exploit sources of competence in the larger business network (beyond what is available within the focal organization).	Absence of a well-coordinated approach to involve the various participants in the business network may result in efficiency benefits but may not provide the requisite source of differential advantage. Lack of a streamlined internal IT infrastructure could hinder the ability to learn from the extended business network.	1. Articulation of the firm's strategy for business network redesign (e.g., efficiency gains as opposed to differentiation through positions in the network; selected partners as opposed to a large array of extended partners; proactive versus reactive stance). 2. Elevation of importance of business network redesign (i.e., pursuit of partnerships and alliances) within strategy process. 3. Redesign of performance assessment criteria to reflect strategy of business network redesign.
Business Scope Redefinition	Redefining the corporate scope (e.g., what's done inside the firm, what's obtained through special partnerships and related arrangements, etc.) that is enabled and facilitated by IT functionality.	Opportunity to leverage information processing capabilities to create a more flexible and effective business entity; substitution of inter-firm business relationships as an effective alternative to vertical integration.	Potential danger of not developing a consistent area of competence for the future; possibility of "hollowing" the corporation so that it may not have opportunities for future growth and survivability.	1. Articulation of business vision through creative mix of internal activities and external relationships and business arrangements. 2. Shift in assessing business success away from return on assets (managed inside firm) to measures such as return on value added or return per employee.

independently (akin to localized exploitation). Such independent efforts have increased operational efficiency but have fallen short of exploiting the full potential of business network redesign through a seamless IT platform exploiting a wide array of functions — ranging from transaction processing to knowledge leverage.

Based on the four considerations discussed above, managers seeking to exploit the potential of business network redesign should address these four questions:

1. What is the rationale for the current approach to business network redesign? (What are its strengths and limitations?)
2. Does it make sense to invest in proprietary interfaces to define the new rules of network interrelationships, or does it make sense to pursue common standards?
3. What are the opportunities for restructuring the business network? (What are the potential functions for information technology applications, from transaction processing to knowledge leverage?)
4. Does our firm have a coherent strategy for redesign-

ing the business network, or is the network simply isolated strands of relationships?

I strongly believe that the real power of IT for any firm lies not in streamlining internal operations (efficiency enhancements) but in restructuring the relationships in the extended business networks to leverage a broader array of competencies that will deliver superior products and services. It is clear that any systematic attempt to reposition a firm has implications for the firm's business scope — the fifth level of the transformation.

Level Five: Business Scope Redefinition

Strategy analysis typically starts with the proverbial question, "What business(es) are we in — and why?" The fifth level of transformation directly addresses the question but with an important variant: "What role — if any — does IT play in influencing business scope and the logic of business relationships within the extended business network?"

Strategy concepts, such as economies of scale (within the hierarchy), product-line extension through vertical integration, and mergers and acquisitions that led to increased emphasis on vertical integration, are being replaced by newer concepts such as joint ventures, alliances and partnerships, and virtual business networks with a marked emphasis toward a more flexible and fluid corporate scope.²⁴ I focus here on the specific enabling role of information technology in this movement. The redesign of business networks (level four) — from transaction processing to knowledge networks — has direct implications for the logic of business scope and the consequent redistribution of revenue and profit (margin) streams in a given market. This is because some tasks may be eliminated (such as repetitive quality control steps, billing invoices, preparing delivery slips, and so on), some tasks may be restructured optimally across organizational boundaries (joint design or collaborative manufacturing), and some tasks expanded (value-added services that are rooted in IT functionality).

During the past decade, there have been some illustrations of IT-enabled redefinition of business scope. American Airlines has clearly leveraged SABRE beyond the traditional marketing support role to derive a significant proportion of its total revenue from SABRE-relat-

IT is not simply a utility like power or telephone but a fundamental source of business scope reconfiguration to redefine the "rules of the game."

ed fees: by one estimate, the profit level from SABRE is higher than from flying airplanes.²⁵ Similarly, Otis Elevator has leveraged IT-enabled features like remote elevator monitoring (REM) as an additional source of revenue (fee of \$50 per elevator per month with high profit margins).²⁶ With the advent of electronic filing of individual tax returns in the United States, innovative tax-return preparation firms have expanded their business scope to include refund-anticipation loans and other financial and tax-related services.²⁷ Baxter has evolved from the distribution of hospital products to managing inventory within hospitals on a stockless basis.²⁸ Federal Express has leveraged its reliable IT platform to handle customer service processes for noncompetitors as well as to manage time-sensitive inventory of spare parts for companies like IBM and Boeing.²⁹

Beyond these examples, which highlight expansion of business scope, this level of transformation also fundamentally restructures activities within a value chain. Thus business scope should be articulated *not* in terms of historical considerations ("we have always done this process inside and we can never think of getting it done outside"). Managers should increasingly demonstrate that it is both efficient and effective for carrying out the set of business processes inside and also demonstrate how it coordinates with the business processes outside ("we leverage the 'best-in-class' expertise within our extended business network") — through the use of IT applications for enhanced coordination and control.³⁰

Companies should accompany the current strategic thrusts toward core competence and outsourcing with a systematic approach to *combine* the critical competencies in a form acceptable to the customer. IT capabilities greatly enhance and facilitate such attempts at combining the required competencies on a flexible basis. I fully agree with Quinn's observations that "Companies are outsourcing integral and key elements of their value chains, because outsiders can perform them at lower cost and higher value-added than the buying company" and that "Strategy concepts need to focus internally more on developing 'best in world' capabilities around a few key activities . . . and externally more on managing a rapidly changing network of 'best in world' suppliers for its other needs."³¹ However, I extend Quinn's logic further by emphasizing that the flexible combination of different fragments of activities to provide customers with the required products and services is fundamentally enabled by superior information processing capability. We cannot talk effectively about network-based coordination to deliver flexible products and services if we do not have a supporting IT infrastructure for efficient coordination and control.

Hence, for strategists, IT is not simply a utility like power or telephone but a fundamental source of business scope reconfiguration to redefine the "rules of the game" — through restructured business networks (level four) as well as redesigned business processes (level three). Thus the core logic of organizational strategy involves the three higher levels of the transformational framework with business processes designed (level three) to support the logic of business scope definition (level five) and the specific positions in the business network (level four).

Strategic Management Challenge: Exploiting IT Capabilities

One of the most common questions about this framework is "Which level of transformation is appropriate

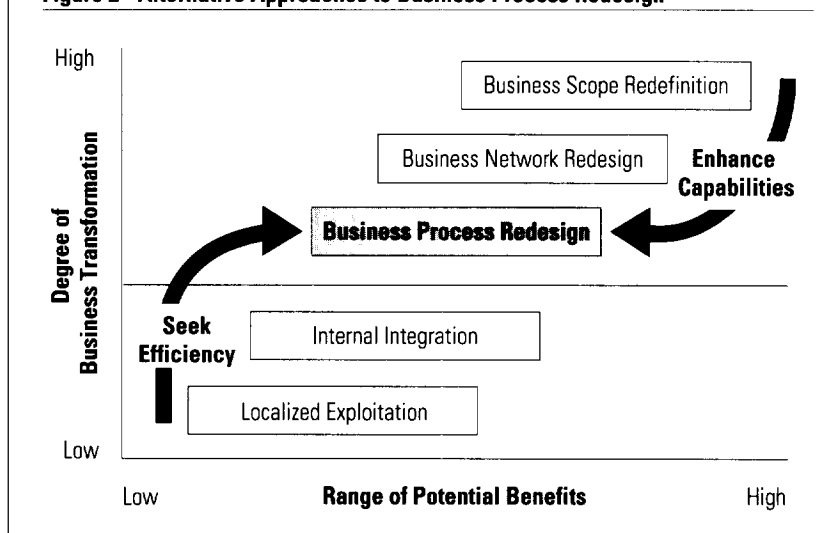
for our company?" There is no one best level for all companies because each level indicates potential benefits that are consistent with the organization's exploitative capability. Managers should view the evolutionary levels (one and two) as transitions toward creating the new strategic logic that reflects and exploits the potential of the revolutionary levels. However, the pace of transformation is dictated by several factors, both internal and competitive.

My framework is based on a strong premise that IT's potential benefits are directly related to the degree of change in organizational routines (strategies, structure, processes, and skills). Thus, a critical issue in deciding on the desired transformational level is to evaluate whether the managers view IT capabilities as a source of opportunity to redefine their strategies or as a threat to the status quo. In some companies, I have encountered situations where managers invoked flimsy and unsubstantiated excuses — "we tried something like this before and it didn't work" or "we can't afford to make such changes now" — to prevent initiation of the higher levels of transformation.

Assessing where leading competitors are positioned within this framework is very useful not only for creating awareness of the limitations of the status quo but also for gaining commitment. For instance, if Federal Express has developed a logic for its business processes that is derived from its articulation of business scope (level five) and its unique interorganizational business arrangements in the business network (level four), then it does not make too much sense for its competitor (say, UPS) to have internal integration as its ultimate goal. Similarly, if you are competing against Otis Elevator, which is redefining its business scope using IT capabilities, simply being at the evolutionary levels — one or two — may be inadequate, unless you have other distinctive sources of advantage. Table 4, which summarizes the key characteristics of the five levels of transformation, is a managerial guide for deciding which level is right for a company at a given time.

What is the reason for business process redesign? Is it to rectify current deficiencies or to create capabilities for tomorrow? In my framework, a company can approach business process redesign from two different (and sometimes contradictory) perspectives. Figure 2 shows the two avenues — "seek efficiency," which focuses pre-

Figure 2 Alternative Approaches to Business Process Redesign



dominantly on rectifying current weaknesses (lower left arrow), and "enhance capabilities," which aims to create strategic capabilities for future competition (top right arrow). Both are valid, but managers should understand the context favoring one over the other before embarking on business redesign.

When a company seeks efficiency, the boundaries of the current strategy (business network and business scope, reflecting levels four and five in the framework) are fixed and given. Thus the main objectives of redesign are to achieve operational excellence within the boundaries. Even if the redesign efforts extend outside the focal organizational boundary, no attempt is made to shift the scope of the business from within the firm to outside and vice versa (except for streamlining administrative efficiency). Much of the current literature on business process redesign embraces this view.³² For instance, Hammer and Champy define reengineering (their term for redesign) as "the fundamental rethinking and radical redesign of business processes to achieve dramatic improvements in critical . . . measures of performance."³³ They use examples of business process redesign at IBM Credit Corporation, Ford Motor Company, and others that involved minimal changes to business network and business scope yet achieved significant improvements in operational measures of performance. Such an approach is perfectly valid under conditions where we do not expect a radical redefinition of business scope through fundamental realignment of business processes within the business network.

On the other hand, the other avenue to business process redesign, namely, "enhance capabilities," starts with the articulation of business scope and the corresponding

logic for business network redesign to specify which business processes need to be redesigned and under what guiding conditions. This approach starts with a careful and focused analysis of how the organization is likely to be positioned in the business network before deriving the objectives and requirements for business process redesign.

An example of a college textbook publisher illustrates the importance of this distinction. The traditional business processes for manufacturing and distributing standard textbooks are acquisition, editing, printing and binding, selling, distributing, and adoption by universities and colleges. It is a linear, sequential set of processes that convert the author's ideas into a form educators can use. If the textbook company sought to enhance efficiency in redesigning these business processes, it would leverage the current and emerging IT capability to improve operational performance of cost and quality. However, the key capability for competing in the market is shifting away from efficient distribution of standard textbooks to providing custom textbooks suited to the educators' individual requirements. McGraw-Hill has pioneered its custom textbook offering, Primis®, through a set of business processes that begin with the user specifying its requirements, which invariably involve reconfiguring chapters and articles from various sources, and end with a custom textbook in lot sizes as small as twenty-five, all within one week. The result is a radically different set of business processes that cuts across multiple partners with a diverse set of business competencies (scanning, selective binding, information sources, electronic printing, and so on). In this case, redesign for operational efficiency alone might not have yielded the desired impact on the marketplace.

Conclusion

It is clear that IT will have a profound impact on businesses. It is also clear that successful businesses will not treat IT as either the driver or the magic bullet for providing distinctive strategic advantage. Successful companies will be differentiated by their ability to visualize the logic of the new business world (level five of the transformation model) and leverage IT to create an appropriate organizational arrangement — internal and external (levels three and four) — to support the business logic. The transformation trajectory is a moving target, shaped by the fundamental changes in the competitive business world. Management's challenge is to continually adapt the organizational and technological capabilities to be in dynamic alignment with the chosen business vision. ♦

References

I thank Michael Scott Morton, who directed the Management in the 1990s Research Program, and Jack Rockart, director of the Center for Information Systems Research at MIT, who gave me the opportunity to do the research that forms the basis of this article. I also thank Hugh Macdonald of ICL; Ed Guthrie of the U.S. Army; Lee Morris, formerly of CIGNA; Jan Hopland of Digital Equipment Corporation; Tom Main of Aetna Insurance; Randy Grossman of Gemini Consulting; John Henderson of Boston University; James Short of London Business School; and Tom Valerio of CIGNA.

1. See, especially, M.S. Scott Morton, ed., *The Corporation of the 1990s* (New York: Oxford University Press, 1991); P.W. Keen, *Shaping the Future: Business Design Through Information Technology* (Boston: Harvard Business School Press, 1991); F.W. McFarlan, "Information Technology Changes the Way You Compete," *Harvard Business Review*, May-June 1984, pp. 98-103; R.I. Benjamin, J. Rockart, M.S. Scott Morton, and J. Wyman, "Information Technology: A Strategic Opportunity," *Sloan Management Review*, Spring 1984, pp. 3-10; and J. Rockart and J. Short, "IT in the 1990s: Managing Organizational Interdependence," *Sloan Management Review*, Winter 1989, pp. 7-16.
2. "Does Investment in IT Pay Off?" *Computerworld*, 25 November 1991, p. 7.
3. See M. Hopper, "Rattling SABRE — New Ways to Compete on Information," *Harvard Business Review*, May-June 1990, pp. 118-125.
4. P. Strassman, *Business Value of Computers* (New Canaan, Connecticut: Information Economic Press, 1990).
5. See R.L. Huber, "How Continental Bank Outsourced Its 'Crown Jewels'," *Harvard Business Review*, January-February 1993, pp. 121-129; see also N. Venkatraman and L. Loh, "Diffusion of IT Outsourcing: Influence Sources and the Kodak Effect," *Information Systems Research*, December 1992, pp. 334-358; and N. Venkatraman and L. Loh, "Stock Market Reaction to IT Outsourcing: An Event Study" (Cambridge, Massachusetts: MIT Center for Information Systems Research, Working Paper, November 1992).
6. See N. Venkatraman, "IT-Induced Business Reconfiguration: The New Strategic Management Challenge," in Scott Morton (1991).
7. "Keeping up with Jones," *Computerworld*, 6 August 1990, p. 70.
8. See N. Venkatraman and J. Short, "Beyond Business Process Redesign: Redefining Baxter's Business Network," *Sloan Management Review*, Fall 1992, pp. 7-21.
9. "The High-Tech War," *The Economist*, 26 December 1992-8 January 1993, pp. 47-48.
10. "Steely Determination: Ingersoll Forges a Flexible Strategy," *Computerworld*, 19 February 1990, p. 81.
11. Details on Otis Elevator are based on primary research interviews with Otis managers, primary documents, and sources such as: "Otis MIS: Going up," *InformationWeek*, 18 May 1987, pp. 32-37; "Otis Elevator Introduces Thinking Control System," *Business Wire*, 30 May 1990, section 1, p. 1; and "Otis Elevator Dispatches Peace of Mind," *Inbound/Outbound*, August 1988, pp. 20-28.
12. R.G. LeFauve and A. Hax, "Managerial and Technological Innovations at Saturn Corporation (Cambridge, Massachusetts: MIT Sloan School of Management, Working Paper, 1992).
13. See M. Hammer, "Reengineering Work: Don't Automate,

Obliterate," *Harvard Business Review*, July-August 1990, pp. 104-122; and

M. Hammer and J. Champy, *Reengineering the Corporation* (New York: Free Press, 1993).

14. For an overview of the emerging principles of organizing, see J.B. Quinn, *Intelligent Enterprises* (New York: Free Press, 1992); and T. Peters, *Liberation Management* (New York: Knopf, 1992).

15. Scott Morton (1991).

16. T. Davenport and J. Short, "The New Industrial Engineering: Information Technology and Business Process Redesign," *Sloan Management Review*, Summer 1990, pp. 11-27; and

T. Davenport, *Process Innovation: Reengineering Work through Information Technology* (Boston: Harvard Business School Press, 1993).

17. See Venkatraman and Short (1992).

18. See J.I. Cash and B.R. Konsynski, "IS Redraws Competitive Boundaries," *Harvard Business Review*, March-April 1985, pp. 134-142.

19. See N. Venkatraman and A. Zaheer, "Electronic Integration and Strategic Advantage: A Quasi-Experimental Study in the Insurance Industry," *Information Systems Research*, December 1990, pp. 377-393.

20. In a different data collection effort, A. Zaheer and I demonstrate that the degree of interdependent business processes enabled by the interfacing system is an important determinant of the level of business channeled by an agent to the focal carrier. See

A. Zaheer and N. Venkatraman, "Determinants of Electronic Integration in the Insurance Industry: An Empirical Test," *Management Science* (forthcoming).

21. "JIT II Is Here," *Purchasing*, 12 September 1991, pp. 7-10.

22. Remarks at MIT Center for Transportation Studies seminar, February 1992.

23. "Computer Helps Physician Skills," *Computerworld*, 9 December 1991, p. 31.

24. See, for instance, Quinn (1992);

"The Virtual Corporation," *Business Week*, 8 February 1993, pp. 98-103;

W. Davidow and M.S. Malone, *The Virtual Corporation* (New York: HarperBusiness, 1992); and

Peters (1992).

25. See Quinn (1992), p. 81.

26. "Otis Elevator Dispatches Peace of Mind," *Inbound/Outbound*, August 1988, p. 28.

27. See N. Venkatraman and A. Kambil, "The Check's Not in the Mail: Strategies for Electronic Integration in Tax Return Filing," *Sloan Management Review*, Winter 1991, pp. 33-43.

28. See Venkatraman and Short (1992).

29. Field interviews with Federal Express and IBM executives.

30. For background discussion on the role of IT in restructuring relationships, see

V. Gurbaxani and S. Whang, "The Impact of Information Systems on Organizations and Markets," *Communications of the ACM*, January 1991, pp. 59-73; and

T. Malone, R.I. Benjamin, and J. Yates, "Electronic Markets and Electronic Hierarchies: Effects of Information Technology on Market Structure and Corporate Strategies," *Communications of the ACM*, June 1987, pp. 484-497.

31. Quinn (1992), pp. 47 and 49.

32. See, for instance, Hammer and Champy (1993); and

Davenport (1993).

33. Hammer and Champy (1993), p. 32.

Reprint 3526