Information Technology and the New Organization: Towards More Effective Management of Interdependence

John F. Rockart
James E. Short

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For the past two decades, the question of what the impact of information technology (IT) will be on business organizations has continued to puzzle both academicians and practitioners alike. Indeed, in an era where the business press has widely disseminated the idea that IT is changing the way that businesses operate and the way they relate to customers and suppliers, the question of technology's impact on the organization itself has gained renewed urgency.

The literature posits four major classes of impact. First, there is the view that technology changes many facets of the internal structure of the organization, with emphasis on changes in roles, power and hierarchy. A second literature focuses on the emergence of team based, problem-focused, often-changing work groups, supported by electronic communications, as the primary organizational form.

Third, there is the view that organizations today are "disintegrating" -- their borders punctured by the steadily decreasing costs of electronic interconnection between firms, suppliers and customers. Companies, it is believed, will gradually shift to greater market-based forms of organization, with specialized firms taking over many of the functions previously performed within the hierarchical firm.

Finally, a fourth view of organizational change arises from a technical perspective. Here, it is argued that today's improved communications capability and data accessibility will lead to systems integration within the business. This, in turn, will lead to vastly improved group communications and, more importantly, the integration of business processes across traditional function, product or geographic lines.

While each of these four "IT impacts" literatures offers important insights, there are significant and unresolved questions with each. To shed additional light on this issue, the Center for Information Systems Research (CISR), MIT Sloan School of Management, conducted a fourteen month study of sixteen major companies. Emerging from this study is the strong belief that the current "IT impacts" picture is incomplete. There is clear evidence for a fifth viewpoint which draws on and expands these perspectives, providing a more integrated, managerial view with important implications for today's executives.

We will argue here that information technology provides a new approach to one of management's oldest organizational problems: that of effectively managing interdependence. Our fundamental thesis is that a firm's ability to continuously improve the effective management of interdependence is the critical element in responding to new and pressing competitive forces. Unlike previous eras, these forces have altered our traditional understandings of how markets, customers and organizational structure, roles and processes work together. Historical strategies based on optimizing within functional departments, product lines or geographical organizations simply will not be adequate strategies for the future.

By "effective management of interdependence" we mean a firm's ability to achieve concurrence of effort along multiple dimensions of the organization.[1] Organizations historically have been divided into subunits along several dimensions such as functional departments, product lines, and geographic units. It has long been understood that the activities in each of these dimensions, and in each of the subunits within these dimensions, (e.g., branch offices, manufacturing locations), are far from independent. Many approaches (e.g., integrating roles, teams, matrix organizations) have been devised to manage the evident interdependence. Each approach attempts to produce the necessary concurrence of effort to allow the organization to compete effectively in the marketplace at one point in time.

Information technology has now been added to this armament of approaches -- and it is in this role that it will have its major impact on the firm.

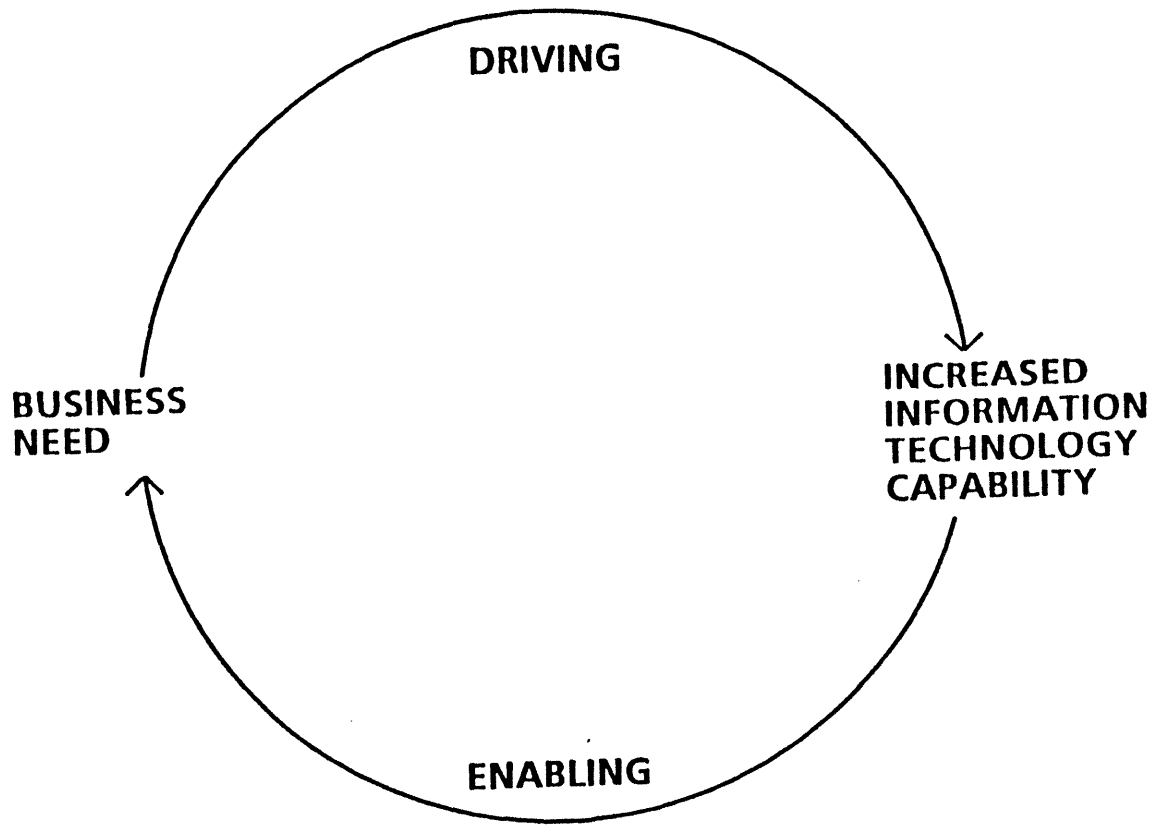
COMPETITIVE FORCES DRIVING THE NEED TO MANAGE INTERDEPENDENCE

The need to effectively coordinate the activities of individual, organizational subunits is vastly greater in 1988 than even a few years ago. It is driven by an increasingly competitive world. Competitive pressures are now forcing almost all major firms to become global in scope, to decrease time to market and to redouble their efforts in managing risk, service and cost on a truly international scale. The companies in our sample identified five competitive drivers as key to their current and future business environments (see Figure 1):

o Globalization. The globalization of companies is rapidly taking place. In a world linked by communication networks and television, global competition stresses the firm's ability to innovate, to capture global levels of manufacturing efficiency and to understand international marketing and the diversity of the world's markets. All require increasing knowledge and coordination of the firm's operations throughout geographically dispersed subunits. Too, companies must also react quickly to events occurring in one country which can affect others.

Figure 1

WHAT'S PUSHING THE NEED TO MANAGE INTERDEPENDENCE?



- Globalization
- Risk Management
- Time to market
- Service
- Cost

- Networks
- Data Standards
- Common Systems

o Time to Market. Black & Decker now brings new products to market in half the time it took before 1985. Xerox and Ford have claimed similar improvements in respective product lines. "Time to market" refers to both the firm's ability to develop new products quickly, and to effectively deliver the products in its current portfolio. In either case, compressing time to market requires increased integration of effort among functional departments such as design, engineering, manufacturing, purchasing, distribution and service.

o Risk Management. Market volatility and competitive pressures can easily overwhelm a firm's ability to accurately track and manage its risk. In one well-publicized incident, Merrill Lynch lost over $250 million when it failed to adequately oversee an employee trading a complex form of mortgage backed securities.[2] In other industries, risk management may involve the corporate controller monitoring the firm's foreign currency exposure, or, in a pharmaceutical firm, senior management reviewing the range of investments slated for new and unproven drugs. Whatever the industry, the globalization of markets and global market volatility increases the need for effective risk management across formerly independently managed operations.

o Service. "The excellent companies really are close to their customers," Peters and Waterman wrote in The Search for Excellence. "Other companies talk about it; the excellent companies do it."[3] Of course, service is not only based on the effectiveness of a single repairman, but also on management's ability to have organization-wide knowledge of customers' and equipment's status and problems.

o Cost. Cost reduction is an ongoing goal for almost all organizations. Reductions in clerical personnel, staff positions and layers of management are increasingly important in industries where foreign competitors are becoming dominant. These companies compete with lower labor cost advantages and different labor-management relationships.

In sum, increasing market competition, complexity and market volatility today require firms to more tightly couple their internal and external business processes. As firms begin to draw core processes more tightly together, slack resources such as inventories and redundant personnel are being reduced. These reductions require a well-defined meshing of subunits and the need for more effective management of interdependence.

It is here that information technology is playing a major role. Vastly improved communications capability and more cost

effective computer hardware and software enables the "wiring" together of individuals and suborganizations within the single firm, and of firms to each other. It is this multi-function, multi-level, multi-organization, coordinative aspect of current technology that provides managers with a new tool and approach to effectively managing interdependence.

TECHNOLOGY'S MAJOR IMPACTS ON THE ORGANIZATION: FOUR CURRENT VIEWS

Several decades of work have produced a number of conflicting perspectives on technology's impacts on the organization. Here we briefly review the four approaches noted above.

Major Changes in Managerial Structure, Roles and Processes

In an early, celebrated article in the field, Leavitt and Whisler argued that information technology (IT) would precipitate a general restructuring of the organization, ultimately eliminating middle management.[4] In their view, the impact of IT would move middle managers out of their traditional roles (either up or down the hierarchy), and allow top managers to take on an even larger portion of the innovating, planning and other "creative" functions required to run the business. Staffs, they suggested, would also accrue greater power.

Other authors were quick to comment on Leavitt and Whisler's predictions. Some speculated that IT would lead to greater organizational centralization,[5] greater decentralization,[6] reduced layers of middle or upper management,[7] greater centralization of managerial power[8] or, alternatively, decentralization of managerial power.[9] Others developed contingency-based models of organizational impact.[10] While it is clear that IT has engendered many impacts on indvidual organizations, it is also clear that this often conflicting literature has not pointed to any generalizable conclusions. Moreover, this work has produced very little insight into how managers should plan for role or structural changes within their organizations. Three newer perspectives have begun to address this issue.

"The Team as Hero:" Organizations as IT-Enabled, Problem-Solving Teams

One view holds that teams and other ad-hoc, decision-making structures such as corporate task forces or specialist work groups will provide the basis for a permanent organizational form. Reich, for example, argues that a "collective entrepreneurship," with few middle level managers and only modest differences between senior managers and junior employees, is developing.[11] In short, he suggests a flat organization composed of teams.

Drucker speculates that the symphony orchestra or hospital may be models of future team-based organizations.[12] He sees the emergence of flatter organizations looking more like an assembly of players in a symphony -- each player responsible for a specific part of a larger score, with only minimal guidance from the top (the conductor).

The relationship between teams and technology in much of this work appears based on a technical dimension. On the one hand, this view stresses technology's role in enabling geographically dispersed groups to better coordinate their activities through enhanced electronic communications.[13] On the other hand, other authors stress the importance of "groupware" in facilitating the team's internal work efforts through better decision making aids, project and problem management, scheduling aids and so forth.[14]

Unfortunately, the team-based literature to date is highly speculative. As a general model of organizational structure, it leaves many questions unanswered. Primary among these are the long term implications of organizing in a manner which removes primary reporting relationships away from the more usual hierarchical function, geographic or product structures. These structures work to immerse employees in pools of "front line," continually renewed and updated expertise. Team members separated too long from these bases tend to lose this expertise.[15]

Corporate "Disintegration:" The Move Towards More Markets and Less Hierarchy

A second perspective argues that today's hierarchical organizations are steadily disintegrating -- their borders punctured by the combined effects of electronic communication greatly increased flows of information), electronic brokerage (technology's ability to connect many different buyers and suppliers through a central database instantaneously), and electronic integration (tighter coupling between interorganizational processes). In this view, the main effect of technology on organizations is not just in how tasks are performed (faster, better, cheaper, etc.), but rather in how firms organize the flow of goods and services through their value-added chains.

There are two major threads to this argument. Malone, Yates and Benjamin state that new information technologies will allow closer integration of adjacent steps in the value-added chain through the development of electronic markets and electronic hierarchies.[16] They argue that advances in IT will steadily shift firms toward proportionately more forms of market coordination, since the total costs therein will gradually fall below those of hierarchical coordination.

Johnston and Lawrence have proposed a related thesis in their "value-adding partnerships (VAPs)."[17] In this view, low-cost computing and communication have tipped the advantage from large vertically-organized companies with expensive but efficient production machinery to groups of small companies that perform different steps along the value-added chain. Typified by McKesson Corporation's "Economist" drug distribution service, VAPs share information freely and view the whole value-added chain -- not just part of it -- as one competitive unit. These proposals, however, are very recent. There is only small sample data to support them. And the exact opposite case, that for increased integration of firms, is also being strongly propounded today.[18]

Systems Integration: Common Systems and Common Data Architecture from a Technical Point of View

A third perspective addresses a more technically oriented view of business integration achieved by systems and data integration. Here, the concept of IT-enabled, organizational integration is presented as a natural outgrowth of two properties of IT: improved interconnection and improved shared data accessibility.[19] In this view, "integration" refers to integration of data, of organizational communications (with emphasis on groups), and of business process across function, geographic or product lines.

While some authors in the school do point to various business impacts, this view suffers from a mild form of technological determinism. As a literature, its balance is much more towards addressing the functionality of systems within the business rather than focusing on the business needs for integration.

THE NEED TO MANAGE INTERDEPENDENCE

While each of the four literatures discussed above offers important insights, there is need for a fifth perspective which draws on and expands these views into a more active managerial framework. We find the concept of "managing interdependence" as the most reflective of what managers are actually doing in today's business organizations.

Managers, we find, oversee a myriad of small and large interdependencies. What happens in one function affects another. Although companies maintain "independent" product lines, success or failure in one product line casts a long shadow on the others.

Individual specialists within organizations are also highly interdependent. Surgeons, for example, cannot operate without nurses, technicians, anesthetists and well-scrubbed operating rooms. And even the simplest of manufacturing processes, installing a car windshield for example, requires the precise

interconnection of hundreds of small steps. Other examples of interdependence:

- Production engineers rely on product designers to design parts which can be easily and quickly fabricated. Conversely, designers depend on product engineers to implement design ideas and concepts faithfully.

- Salesmen for a nationwide or worldwide company are also interdependent. The same large customer may be served by many sales offices throughout the world. Common discounts, contract terms and service proceedures often must be maintained. Feedback to each often can be important.

- Companies themselves rely on other firms to supply parts or provide service in support of key business strategies and objectives. The current shortage of memory chips, and the resulting shortage of some types of computers available for purchase, is a good example of industry-wide interdependence.

Other examples of interdependence abound. It is a fact of organizational life. What is different today, however, is the increasing need to manage interdependence and technology's role in providing tools to help meet this need.

How do companies manage interdependence? Several approaches have been proposed: Mintzberg, for example, argues that firms coordinate work through five basic mechanisms: mutual adjustment, direct supervision, standardization of work process, standardization of work output, and standardization of worker skills.[20] Mutual adjustment occurs in very small companies. The next four occur in progressively larger organizations where work tasks and individual roles can be sufficiently clarified and standardized. However, Mintzberg argues that companies return to mutual adjustment when tasks and roles get more complex, e.g., in larger organizations which must cope with multiple dimensions such as geographical, product and functional expertise.

Lawrence and Lorsch also focused on this process of mutual adjustment among suborganizations in large firms.[21] They were the first researchers to cast a spotlight on the functional interdependence of organizations and the integrative mechanisms used to manage this interdependence. Successful companies, they found, differentiated themselves into suborganizations to allow accumulation of expertise and simpler management processes driven by shared goals and objectives. Conversely, the same firms adopted integrating mechanisms to coordinate activity across these suborganizations. They postulated five mechanisms to manage interdependence: (1) integrative departments, whose primary activity was the integration of effort among <u>functional</u>

departments; (2) permanent and/or temporary cross-functional teams; (3) reliance on direct management contact at all levels of the firm; (4) integration through the formal hierarchy; and (5) integration via a "paper-based" system of information exchange.

Galbraith expanded the intellectual understanding of managing interdependence through people-oriented, integrative mechanisms.[22] He noted that direct contact, liaison roles, task forces and teams were primarily utilized for lateral relations. These mechanisms, Galbraith argued, permitted the organization to make more decisions and process more information without overloading hierarchical communication channels. However, Galbraith also introduced the concept of computer-based information systems as a vertical integrator within the organization.

Mintzberg, Lawrence and Lorsch, and Galbraith each provide a slightly different but compatible set of views on how companies organize to effectively manage interdependence. Whether the central issue is the need for mutual adjustment, the need to integrate necessarily differentiated suborganizations, or the use of horizontal and vertical integrating mechanisms, each author focuses on the need to manage interdependent subunits and the individuals they contain.

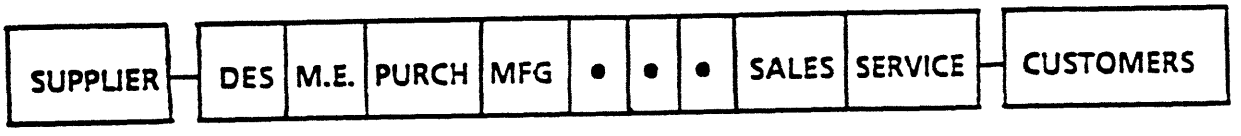
FIVE EXAMPLES OF MANAGING INTERDEPENDENCE

Today, Galbraith's vision of computer-based information systems as a vertical integrator appears prescient, if incomplete. Given pressures from the "drivers" noted earlier, major aspects of information technology (data bases, etc., see Figure 1), are increasingly serving as mechanisms for both horizontal and vertical integration. They are assisting management efforts to manage interdependence in many contexts. In particular, our work has uncovered six organizational contexts where IT enabled integration projects have strikingly improved a company's ability to more effectively manage its functional, product or geographic subunits. We focus here on five of the six, as illustrated in Figure 2: IT-enabled integration across parts of the firm's value-added chain; integration within functions; team-based integration; IT-enabled integration in planning and control; and integration between line businesses and the IT function itself. A sixth area of interest, interorganizational integration (e.g., IT's role in changing patterns of interfirm competition and collaboration) is well documented in the literature, and can be viewed as carrying intra-organizational integration into the multi-firm context.[23]

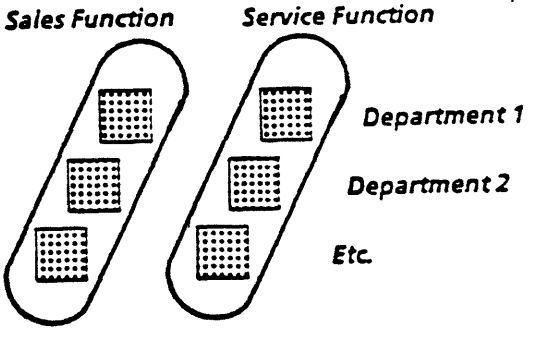
Figure 2

Managing Interdependence in Five Organizational Contexts

1 VALUE CHAIN INTEGRATION



2 FUNCTIONAL INTEGRATION



3 IT-ENABLED TEAM SUPPORT

4 PLANNING & CONTROL

5 WITHIN THE IT ORGANIZATION ITSELF

IT-Enabled Integration Across Parts of the Firm's Value Added Chain

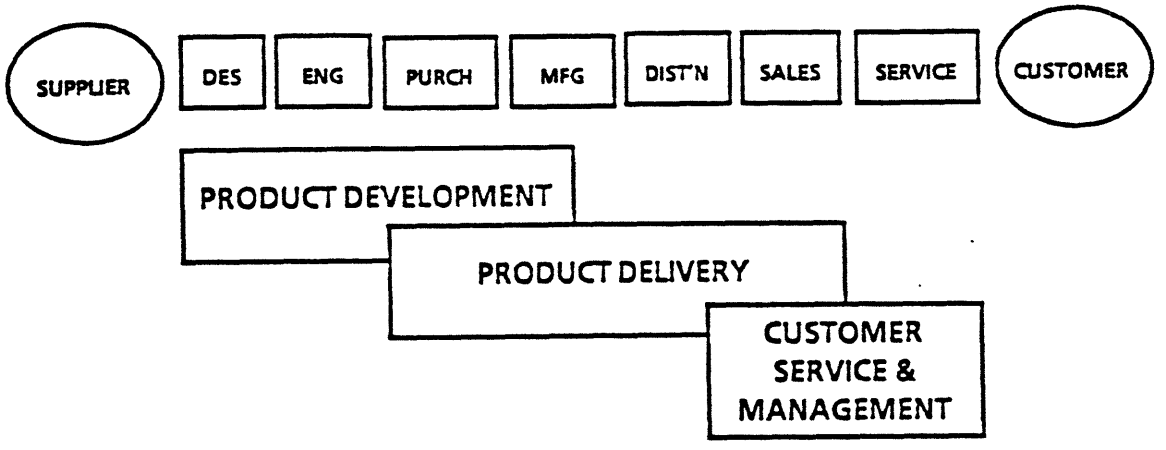
Twenty years ago, Lawrence and Lorsch noted the use of "human integrators" to manage the needed concurrence of effort between adjacent functions of the value-added chain (e.g., between manufacturing, distribution and sales). Today this integration is increasingly performed through electronic networks, computers and data bases. Firms attempt between-function integration for at least one of three reasons: first, to increase their capacity to respond quickly and effectively to market forces; second, to improve their level of quality in conforming to customer requirements; and third, to reduce costs.[24]

In our view, successful between-function integration collapses the multi-stage, value-added chain into three major segments: developing new products, effectively delivering products to customers, and managing customer relationships (which includes service and maintenance)[25] (see Figure 3). Increasingly, firms in our sample are viewing activities within each of these three segments as heavily interdependent and requiring computer-based support.

In manufacturing companies, for example, it is clear that interdependence revolves around these three macro-organizational activities. The simplified, three-part value chain also appears

Figure 3

Product Development, Product Delivery, and Customer Service & Management: Collapsing the Value-Added Chain



to generalize beyond manufacturing. Discussions with five insurance companies in our work revealed the same three segments as targets for functional integration.

Turning to the two "ends" of the value-added chain -- the product design phase on the one hand, and the customer service segment on the other -- the effects of technology-enabled integration are clear. To speed product development, companies such as Xerox, Lockheed and Digital, among others, are rapidly moving to CAD/CAM and other design aids to provide integrated support to product designers, product engineers, materials purchasing and manufacturing personnel involved in the design-to-production process. This compression has resulted in joint "buy-in" on new product designs, eliminating a lengthy iterative development process (which occurred because the needs and capabilities of other departments in the organization were not taken into account by the designers), and dramatically shortened product development time.

At the customer service end of the chain, Otis Elevator, Digital, and Xerox have developed service strategies and new service markets based on electronic networks, an integrated data base of customers and service history, and fault signalling which can come directly from the installed equipment to the supplier's maintenance-monitoring computer. The advantages of Otis' centrally coordinated, electronic service system have been

well publicized.[26] Perhaps most important, however, is senior management's enhanced ability to view the status of maintenance efforts nationwide and to direct sales and service attention where needed. In addition, it is now feasible to provide direct access to fault data to the company's design, engineering and manufacturing personnel.

In many ways the most interesting stage of the collapsed value chain is product delivery. Product delivery requires integrating many different information systems: order entry, purchasing, materials resources planning, and distribution management. The critical business issue is to provide to the customer information on when an order will be completed, and to forecast and manage product shipment, outside supplier, manufacturing and distribution processes.

No company has yet accomplished the large-scale integration of functions and systems required to fully manage the product delivery process. A division of the Norton Company, however, pioneered efforts in this direction in the mid-1980s. Norton initiated a set of major IT projects ranging from the "Norton Connection" (a computer based telecommunications link between Norton and its distributors), to a more effective order processing system, to a series of manufacturing technologies targeted at flexible manufacturing and automated materials control.[27] More recently, Westinghouse has initiated a

product delivery integration process in several segments of the company. And a series of task forces charged with a similar vision are working at General Foods.

Most efforts, however, are more limited in scope. British Petroleum Co.'s chemical business has developed an integrated order management process spanning 13 divisions. Baxter Healthcare Corporation is working to provide customers full product line visibility to the company's 125,000+ products through enhancements to its well-known ASAP order entry system. And a host of manufacturing integration projects have been initiated at Digital Equipment Corporation, Ford Motor, IBM, General Motors, Hewlett-Packard and Texas Instruments to name just a few.

In short, there are many partial efforts underway in a number of companies in different industries. Several of these efforts are the result of one manager in the organization having the vision to develop the "ultimate, integrated product delivery system." However, while developing such a system is extremely difficult, and while the ultimate result of partial efforts is unclear, the critical business needs of time to market and service to the customer insure that these efforts are, at the least, in the right direction.

2. IT-Enabled Integration Within Functions

In addition to integrating across parts of the value-added chain, many companies are recognizing the interdependence of multiple units within the same function. This has led to several actions designed to improve coordination across subunits. In some firms, this has resulted in the centralization of the function; in some, central management of still-geographically separate units; and in some, the development of common systems and/or standard data definitions to facilitate the coordination of the units.

At Sun Refining and Marketing Company, for example, three years ago senior management identified crude oil trading as one of the most critical business activities in the company. At that point Sun's traders were dispersed in several groups worldwide, each acting relatively autonomously. Sun began developing a centralized, on-line trading function supported by integrated market information from Reuters and other trade data sources. Sun today recognizes the importance of its integrated trading function in managing risk exposure and in developing effective pricing strategies for the volatile crude market.

At Chemical Bank in New York, foreign exchange trading has become the largest profit generator in the bank. To facilitate improved management of its worldwide trading, Chemical's

information technology efforts have ranged from advanced trader workstations to more effective integration of the trading "front end" (booking a transaction) with the back office (transaction clearance and settlement). Chemical has also developed an improved capital markets auditing system using expert systems support.

Finally, while OtisLine can be viewed as an application enabling integration across stages of the value-added chain, it is also an integrating mechanism within the field maintenance organization itself. Customers with difficult problems can be immediately directed to a specialist, not left to the limited resources of a remote branch office. Frequent trouble from a specific type of elevator or a geographic locality can be observed as the pattern develops, and corrective action taken nationwide. In addition, the quality of telephone response to anxious customers, now done centrally, can be closely monitored.

Similarly, a number of other companies are aggressively working to coordinate the efforts of subunits within a single function, whether it be manufacturing, maintenance, purchasing, sales and marketing, or others. Kodak has developed an executive support system to assist in the worldwide scheduling of manufacturing plants. Digital is installing common MRP systems throughout all of its manufacturing plants. And so it goes. The business drivers underscoring each of these efforts range from service to

cost to time to market to global responsiveness. But all recognize that no single unit in a major function within an organization is truly independent.

3. Teams: Managing Interdependence Through IT-Enabled Teamwork

At Digital Equipment Corporation, Chairman Ken Olsen believes that the ability to bring teams electronically together is one of the most important features of the computing and communications capability now utilized by the company. Ford Motor has claimed that the "Team Taurus" approach, much of it IT-enabled, shaved over a year off the time to develop, build and bring to market the new Taurus/Sable model line. Indeed, as Drucker points out, for many tasks, teams are likely to be the primary way work is carried out in the future.[28]

Teamwork, of course, is not a new way to coordinate interdependent activities among separate units in an organization. What is new, however, is that today electronic mail, computer conferencing and video conferencing are facilitating this process, making it feasible for team members to coordinate asynchronously (across time zones) and geographically (across remote locations) more easily than before.

The development and use of computer software to support teams is also moving into an explosive phase. There is a growing body of work under the term "groupware," a generic label for specialized computer aids designed to support collaborative work groups such as business teams. As Bullen and Johansen point out: "Groupware is not a thing. Rather it is a perspective on computing that emphasizes collaboration -- rather than individual use."[29] Several companies, including Xerox, General Motors, Digital, Eastman Kodak, IBM and AT&T are focusing significant attention in this area, both experimenting and working with a number of state-of-the-art meeting and conferencing aids in addition to more "routine" communications systems such as electronic mail or voice mail systems.

4. Planning and Control: Managing Interdependence Both Horizontally and Vertically

For the past two or three decades, the managerial control process has looked much the same across major companies.[30] Before the start of a new fiscal year, an intense planning process culminates with an extended presentation of each SBU's proposed activities to senior management. Once agreed upon, these plans are then monitored on a monthly basis through reporting to management. Parallel to this formal control system, however, is an informal, process of "keeping in touch" by which senior management assures itself that "all is going

well" in key areas of the business in the interim between formal reports.

Volatility in the business environment coupled with technology's ability to provide efficient communication and information to management is radically changing this traditional planning and control scenario. Two issues arise as management attempts to utilize technology to assure effective coordination of the firm's activities. First, in what ways can senior management most effectively use information technology? Second, at a time when information is more rapidly generated and captured than ever before, what is the appropriate use of this information at each level of the organization? The firms with which we worked were aggressively tackling each of these issues.

At Xerox, Chairman David Kearns and President Paul Allaire have implemented an executive support system that now makes the annual planning and control process a more on-line, team-based, communication and coordination-based process. The system requires all business units to submit their plans over an electronic network in a particular format. This allows the staff to more easily critique the thirty-four SBU plans, and to reintegrate them when looking for things such as competitive threats across all SBUs, penetration into particular industries by all SBUs, and so forth.

More importantly, each SBU's plans can be reviewed not only by senior executives and corporate staff but also by a selection from among the other fifty top officers of the firm. Each executive receiving an SBU's plans is encouraged to send to corporate headquarters an electronic message raising the issues he or she sees in the plan. The executive may also be asked to attend the review meeting. There is no "up-front" presentation at the meeting. Rather, only the issues raised by the executives, staff, or other officers are discussed.

In short, Allaire's planning and control process is a computer-age process. It draws, through the network, on the entire executive team for input. Understanding of the issues involved for each SBU is therefore deeper and its activities are therefore sometimes subtly, sometimes more precisely coordinated with the other SBUs. In addition, with deeper understanding available to him, Allaire can provide a guiding, coordinating hand on the success factor of the entire business.

A team-based, network-linked approach to the senior executive job of managing the business is also in evidence at Philips Petroleum Products and Chemicals Group. There, Executive Vice President Robert Wallace is linked to his other nine top executives through an executive support system which provides on-line access not only to each other, but to varying levels of daily sales, refinery, and financial data. External news

summaries relevant to the business are entered into the system three times a day. Unlike Allaire, who limits his input to planning and review meetings, Wallace has utilized the system to take operating command of a few critical decisions for the business. In the volatile petroleum pricing arena, Wallace believes that he and his top executive team can confer with the advantage of data access and can make better pricing decisions than those further down the line. He cites increased profits in the tens of millions as a result of the system.

By far the majority of senior executives today do not use their systems in nearly as dramatic manner as Allaire or Wallace.[31] Yet, the technology provides the capability for better coordination at the senior management level. It also provides opportunities to move decisions either up or down in the organization. Team decision-making is an increasing reality, as even geographically-separated executives can concurrently access and assess data and communicate in "real-time." While most of the attention in on-line, networked information systems has been to horizontal linkages, vertical on-line access to "lower-levels" of data and text violates some established management pratices. Yet, informal telephone-based systems have always provided some of this information. And, in an era where management is seen more as a cooperative, coaching activity than an iron-fisted one, vertical as well as horizontal networking may come of age.

The second issue -- the appropriate use of information at each level of the organization -- is equally challenging. The presence of instantaneously-captured information today allows "control" over formerly independent professionals in many firms. The situation is perhaps most evident in firms which trade in financial, petroleum, and other markets. As each trader completes a trade, the information on his actions can be immediately captured.

As experience at Merrill Lynch and Citicorp has shown, unmonitored trading can lead to significant losses. Yet, the traders view themselves as "professionals," each of whom is managing an independent position or positions, often using information processing algorithms which are unique to the trader. To manage risk, many organizations such as Chemical are monitoring the effectiveness of trades against actual market movements in a delayed manner using expert systems. The ability to almost instantaneously monitor these professionals and their activities through computer-captured data is now available. Significant choices on the degree and type of control which should be exerted in this and other information-rich situations must be made.

5. The IT Organization: Managing Interdependence between the Line Businesses and the Technology Managers

As technology plays its new role in facilitating increased coordination in organizations, line and information technology managers are finding themselves more mutually dependent than ever before. Today, there is a small but rapidly growing number of senior line and staff executives who are taking responsibility for significant strategic projects centered around computer and communication technologies in their companies, divisions or departments. We have described elsewhere the full extent and importance of "the line taking the leadership."[32]

As the line role grows with regard to innovative systems, the role of the information systems group is becoming more complex, more demanding and more integrated into the business. Our sample of companies included several firms whose IT planning efforts involved significant degrees of partnership between the line businesses and their IT organizations in designing and implementing new systems.[33] This necessary degree of partnership places four major demands on the IT organization.

First, with regard to systems development, even those systems in which the line is heavily involved require greater competence and skills on the part of the IT organization. The technical

design, programming, and operation of business-critical, often highly complex systems presents a far greater challenge than systems of previous eras. Today's integrated, cross-functional product delivery systems require data base, project management, telecommunications and a host of other skills not previously demanded of IT personnel.

Second, today's new systems require the development and implementation of a general, and eventually "seamless," information technology infrastructure (computers, telecommunications, software and data). The challenge to IT management is to provide leadership for this vital set of "roads and highways" in the volatile competitive environment.

Third, there is a need for IT management to help educate line management to its new responsibilities. Indeed, the need is to get <u>all</u> line executives to take on this new role. Fourth, IT executives must educate themselves and their staffs in all significant aspects of the business. Only if this is done will IT personnel be able to knowledgeably assist line management in creating the systems which will be most useful in carrying out the organization's strategy.

The concommitant demand on line management is twofold: there is the need to learn enough about the technology to incorporate its

capabilities into their business plans; and there is the need to select effective information technology personnel and to work closely with them.

THE NEW MANAGERIAL AGENDA: DESIGN FOR INTERDEPENDENCE

Tomorrow's successful corporations will require increasingly effective management of interdependence. As organizations change through IT-enabled changes in cross-functional integration, in the use of teams, in within-function integration, and so on, the agenda of individual managers will change as well. Designs for interdependence tilt the evolving managerial agenda far more towards roles emphasizing linkage and integration than towards roles aggressively driving task and performance objectives down an organizational hierarchy. In short, what managers do now and how they will manage in the future is in the process of important change.

Dimensions of Change

What are the areas of emphasis for senior management stemming from the growth of increasingly interdependent organizations? In our view, there are five:

1. Increased Role Complexity. The typical manager's job is getting harder. One dimension of this complexity is in the

increased pace of organizational change. As companies seek new areas of business opportunity by aggressively defining and executing "new ways of doing things" -- e.g., new strategies, new products and services, new customers -- managers must adjust more rapidly and more frequently to new situations. Similarly, companies must also respond to heightened, external competitive pressures by improving internal processes. Again, managers must respond quickly and frequently to new situations.

A second dimension of increased role complexity is the manager's need to cope with lines of authority and decision-making which are not clear. As interdependence increases, sharing of tasks, roles and decision-making increase. Managers will be faced with making the difficult calls between what is local to their function and global to the business. Moreover, as planning and control systems change, line managers will be required to work more effectively with a wider scope of people in the firm.

2. Teamwork. Teams are real, if not altogether new. A vastly increased number of space- and time-spanning, problem-focused, task-oriented teams will become the norm in the short run. This growth in peer-to-peer, rather than hierarchical activities will require new managerial skills and role definitions to achieve organizational performance.

3. A Changing Measurement Process. Measurement systems reflect organizational goals and approaches to the business. Measuring individual or sub-organizational success will be difficult in an environment where cooperative work among suborganizations is increasingly necessary. New measurement approaches will need to be devised. This will result in a transitional period where people must adjust both to a changed mode of work and to a changed measurement process. As new measurement systems evolve, they will almost surely lag the changed organizational reality.

4. A Changed Planning Process. Information technology is enabling the new approaches to planning required to meet today's competitive conditions. Two major capabilities were underscored in our sample of firms. First, there is an opportunity for organizations to gather all the relevant information needed by senior management to target what is most critical for the organization, and to develop the most strategic approaches leading to market success.

   Second, there is the ability, working within the strategic umbrella, to surface and react to key issues -- in short, to conduct effective "real-time," stimulus-driven planning at all levels. The technology provides both the base for getting this critical data to all relevant decision makers and, more importantly, provides the capability to

disseminate changes in direction to all parts of the interdependent organization affected by each change.

5. Creating an Effective Information Technology Infrastructure. People-intensive, integrative mechanisms are limited in what they can accomplish. Accessible, well-defined data and a transparent network are, therefore, the keys to effective integration in the coming years. Making this happen, however, is far from easy. The justification process for organization-spanning networks whose benefits are uncertain, occur in the future, and together with their costs cannot be attributed clearly to any specific suborganization is, in part, an act of faith. Developing common coding systems and data definitions from the data now present in most organizations is a herculean job. This increases near-term costs for long-term gain, a practice not encouraged by most of today's measurement systems.

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