IT AND THE NETWORKED ORGANIZATION: TOWARDS MORE EFFECTIVE MANAGEMENT OF INTERDEPENDENCE

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I. INTRODUCTION

This paper is about one form of organization innovation, the networked firm, and the role of information technology in making the many networks operating within the firm more effective. A major premise is that IT-enabled networks permit us to more effectively manage organizational interdependence, or the firm's ability to achieve concurrence of effort along multiple dimensions of the organization.

Parallel to most firms' efforts to increase performance, set competitive strategy, or alter strategic market positioning is the firm's concurrent need to innovate organizationally, changing the way work is defined and accomplished within the organization. Innovation may take the form of changing the "formal" organization, i.e., structure, roles or hierarchy, or it may involve changes in work allocation and production, i.e., how specific work tasks are defined, allocated and performed. Of course, we think of organizational change as encompassing many more dimensions than that of simply work production or work allocation and structure, but these are clearly major dimensions, if not the most important ones.

The interest in "networks" as an innovative, organizational design is based largely on two related concepts:

From a *design standpoint*, "networked firms" are usually conceived of as communication rich environments, with information flows blurring traditional intra-company boundaries. Networks are seen to foster, and utilize, important role changes in individual managers, increasing role complexity and requiring greater skills on the part of both workers and management.[1] In short, the organization is seen as information rich, and by connecting information, people, and skill (talent) together more effectively within the firm, the firm in aggregate is more effective. While important, these benefits (which are, for the moment, implied -- we will take each up later) are not new. Galbraith, Lawrence and Lorsch, and others have detailed the importance of enabling and enriching internal communications and information processing capability within the firm to increase performance. And others have

commented on the importance of "networks" as a key organizational innovation. What *is new* about networks in the current emphasis, however, is the tight meshing of the design of networks with the information technology (IT) required to enable them. IT is seen as a more powerful design factor in organizational change and innovation, and not just as an enabler of more effective organizational functioning once a given design has been put into place.[2]

From a *performance standpoint*, networked organizations are thought to allow firms to retain small company responsiveness while becoming larger and more complex. All other things being equal, the more complex the organization, the more it has to be organized along the principle of size.[3] We have tended to build large and complex organizations to produce multiple, integrated products and services. Then, using the same organizational form, we have tried to streamline and simplify the firm's key processes to enable flexibility and responsiveness to local market needs. In short, we have typically decentralized large firms to ensure responsiveness. Conversely, very rarely have we successfully built large, complex *and* flexible organizational forms. The attractiveness of the "networked firm" is that by *adding information technology as a design factor*, we may be able to design firms that can simultaneously increase size, complexity *and* responsiveness.[4]

A. DEFINITIONS AND ATTRIBUTES OF THE NETWORKED FIRM

"Networks" are forms of social or work relationships. For business purposes, we define "networks" as *one part of the firm's overall system of interrelationships to accomplish work*.[5] Note that this definition does not assert that networks are the *only* way in which work is done in the firm, nor does it state how many networks operate to accomplish any specific work task. This is an important point. There is a tendency to equate a single work task with a single network design; for example, design engineers designing new automotive components or semiconductor chips. In both cases, however, there is one work task -- producing the component or chip -- but many people and work networks are involved: design engineers,

manufacturing personnel, quality engineers, the ultimate customer, and so on. In short, there are many networks comprising the "networked" organization.

Networks, in this view, are not organization structures *per se*, but one of several ways to organize and accomplish work. What are the key attributes of the more networked approach? We see seven:

- ***Shared Goals.*** Networks typically organize around shared goals or objectives (note, however, this does not mean people uniformly agree on how to achieve these goals).

- ***Shared Work.*** Networks allow for the sharing of work across groups not normally part of the local structure.

- ***Shared Expertise.*** Networks allow for the sharing of expertise and knowledge across the firm.

- ***Shared Decision Making.*** Networks allow for shared decision making, mainly through enhanced access to critical information across the firm. As a result, more expertise is brought to bear on specific decisions. Note, however, that while better quality decisions may result, they may not be faster decisions.

- ***Shared Timing and Issue Prioritization.*** Networks depend on shared prioritization and time horizons for critical issues and action steps.

- ***Shared Responsibility, Accountability and Trust.*** Networks depend on the sharing of responsibility, accountability, and trust in the organization. Trust is a critical and difficult issue. We have depended largely on face-to-face interaction to develop and solidify trust among people in most of our firms. A more IT-enabled, networked approach will eventually replace, or significantly reduce, many forms of face-to-face interaction with a technology interface (electronic mail, videoconferencing, design-station-to-design-station electronic connection, etc.). This raises serious questions about how trust will be established and developed in this kind of environment or conversely, the use of networks cannot be truly effective until a certain level of trust is established in the organization.[6]

- ***Shared Recognition and Reward.*** Implicit in the effective functioning of networks is shared recognition and shared rewards for cooperative work.

A final point is that while networks depend on and enhance the sharing of work, expertise, responsibility, decision making, and recognition within the firm, a major effect of networks may be to enhance internal conflict. In their research on investment banking firms, Eccles and Crane point out that "network structures of investment banks are flat, flexible, complex, and rife with conflict."[7] Their point about conflict echoes Lawrence and Lorsch's observation that "recurring conflict is inevitable" in differentiated organizations.[8] To paraphrase their point, the high degree of work differentiation resulting from specialization, and the resulting need to integrate across this specialization, means that conflict is inevitable in the highly differentiated or networked firm. In short, professionals may disagree about how to work. Eccles and Crane go on to identify organizational capabilities for resolving this conflict -- basically, flexibility and good communications -- and we address several of these capabilities later in this paper.[9]

B. WHY NETWORKED FIRMS NOW?

Though we are getting slightly ahead of our story here, we need to introduce one additional concept and a simplified framework of our key points before we stop to outline the entire paper. This will help us to address the question: Why the move to networked firms now?

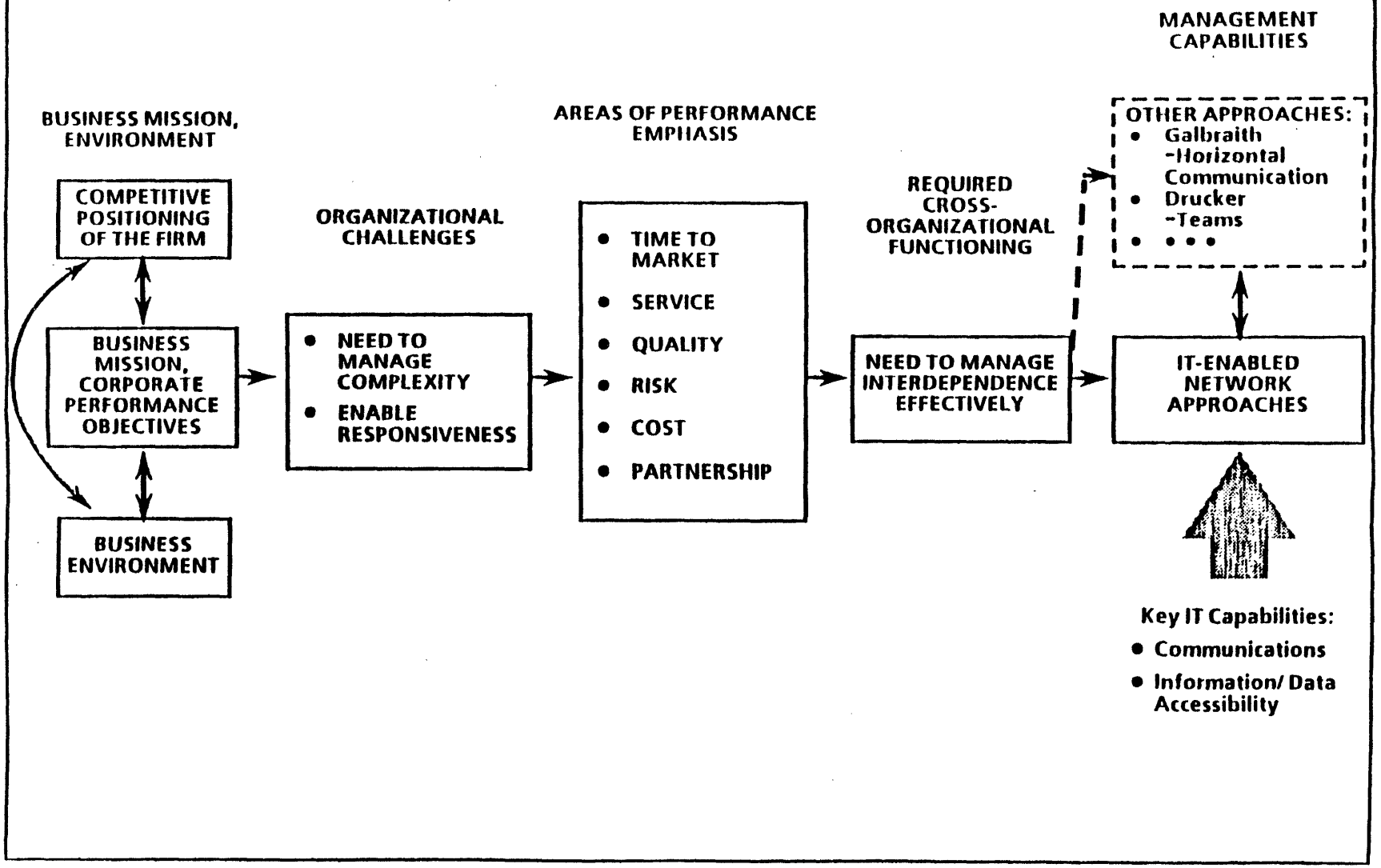
We can summarize the concept as follows: in the firm's efforts to change strategic market positioning, set strategy, or increase performance, the need to effectively manage the interdependence of subunits and people within the firm is increasingly recognized. By "effective management of interdependence" we mean the firm's ability to achieve concurrence of effort along multiple dimensions of the organization.[10] Our research in sixteen firms

suggests that the need to manage interdependence is growing significantly. Moreover, it is a major, managerial thrust today as executives cope with the demands of both managing complexity and increasing responsiveness across the organization.

The firm's ability to continuously improve the effectiveness of managing interdependence is a critical element in both product, service, and geographical (scope) innovations in the marketplace (the proactive dimension to strategy), or in effectively responding to new competitive threats (the reactive dimension). Networks, designed and enabled by information technology, are the keys to effectively managing this interdependence.

Figure 1 illustrates our points in simplified form. (A more detailed summary is provided in Figure 2). The essence of the framework is outlined in the five boxes: as firms position themselves in the competitive environment, there is need to manage the size and complexity of the organization while ensuring responsiveness and flexibility. Firms typically select areas of performance emphasis to manage this balance at the customer interface, for example, in areas such as quality service, risk management, and cost or product quality. In order to improve performance in these emphasis areas, firms must more effectively manage interdependence across the organization. Although there are several ways to do this (examples are Galbraith's liaison roles or Drucker's team concepts, both discussed later), the key to effectively managing this interdependence is IT-enabled networks. Critical IT capabilities include advanced communications and data accessibility, and the steadily improving cost-performance of the technologies themselves, leaving the machines, software, and communications more broadly available than ever before.

FIGURE 1: THE MOVE TO NETWORKED ORGANIZATIONS

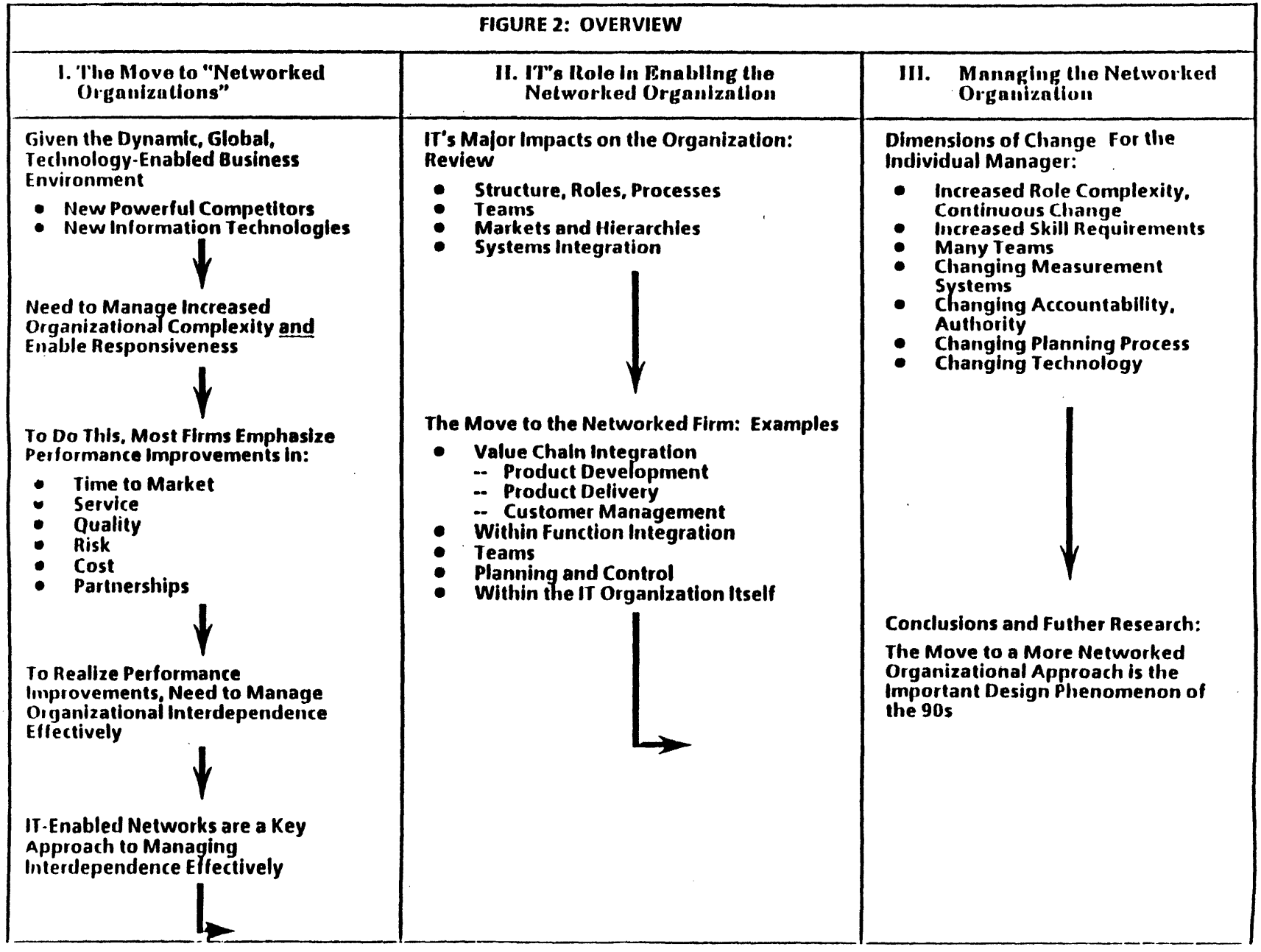


C. OVERVIEW OF PAPER

Our research program over the past two years has studied the impacts of IT on organizational structure, roles and behavior in a sample of sixteen firms. Our approach has been case-oriented and longitudinal. In earlier published work, we argued that the current "IT impacts" literature was incomplete, and sought to refocus the issue by arguing that IT provided a new approach to one of management's oldest problems: that of effectively managing interdependence.[11] This paper suggests another dimension which has grown out of a rethinking of that research. Although we did not explicitly address networks during the research program, it is clear that the management of interdependence is heavily based on the set of IT-enabled networks supporting the required intraorganizational functioning. Our interest in networks, therefore, became a natural outgrowth of our research into managing interdependence.

Figure 2 illustrates our detailed approach. In Part I, we discuss the two key forces driving today's dynamic, technology-enabled, global business environment: new and powerful competitors and new and powerful information technologies. Next, we identify several areas of the business where firms are attempting to increase performance. We then link these areas of performance emphasis with the increasing need to manage interdependence effectively, and identify the importance of IT-enabled networks in managing this interdependence.

FIGURE 2: OVERVIEW



Part II provides examples of how information technology enables a more networked approach to the firm in our sixteen field research organizations. We identify five organizational contexts where IT-enabled networks have strikingly improved a company's ability to effectively manage its functional, product or geographic subunits: value chain integration; within function integration; IT-enabled team support; within the firm's planning and control system; and within the IT organization itself.

Part III addresses the managerial implications of moving to the more networked organizational approach. We discuss the key dimensions of change from the perspective of the individual manager, and conclude with several thoughts on needs and implications for further research.

II. THE MOVE TO "NETWORKED ORGANIZATIONS"

A. DRIVERS: A DYNAMIC, GLOBAL, TECHNOLOGY ENABLED, INCREASINGLY COMPETETIVE BUSINESS ENVIRONMENT

The need to effectively coordinate the activities of organizational subunits is vastly greater in 1989 than it was even a few years ago. Competitive pressures are now forcing all major firms to become global in scope, to decrease time to market, and to redouble their efforts to manage risk, service, quality and cost on a truly international scale. The dynamic, global, increasingly competitive business environment is driven by two critical forces:

New and Powerful Strategies and Competitors Who Have Changed the Rules of Global Competition. Hamel and Prahalad argue that a small group of highly innovative firms, many of them Far Eastern, have defined a whole new approach to competitive strategy, altering the rules of global competition.[12] The major impact of this has been to remove the many traditional buffers enjoyed by firms in inventory, people, space, time, quality, and lack of consumer knowledge. Removing these buffers has two direct effects: first, it reemphasizes the need to share information and to work cooperatively across the organization; and second, it prompts managers to focus on horizontal work groups, such as teams, to facilitate the required cooperation and information sharing. Both emphasize the need for increased integration of effort within the firm.

Information Technology. The rapid diffusion of key information technologies into the business environment has created new business markets and dramatically affected the cost structures of traditional ones. Familiar examples include airline reservation systems, cash management accounts, automated teller machines, and automated order entry systems. Technology provides firms with the technical capability to more tightly couple the firm's

internal business processes, and to link externally with major suppliers, customers and other firms (alliances, etc.) in new and different ways.

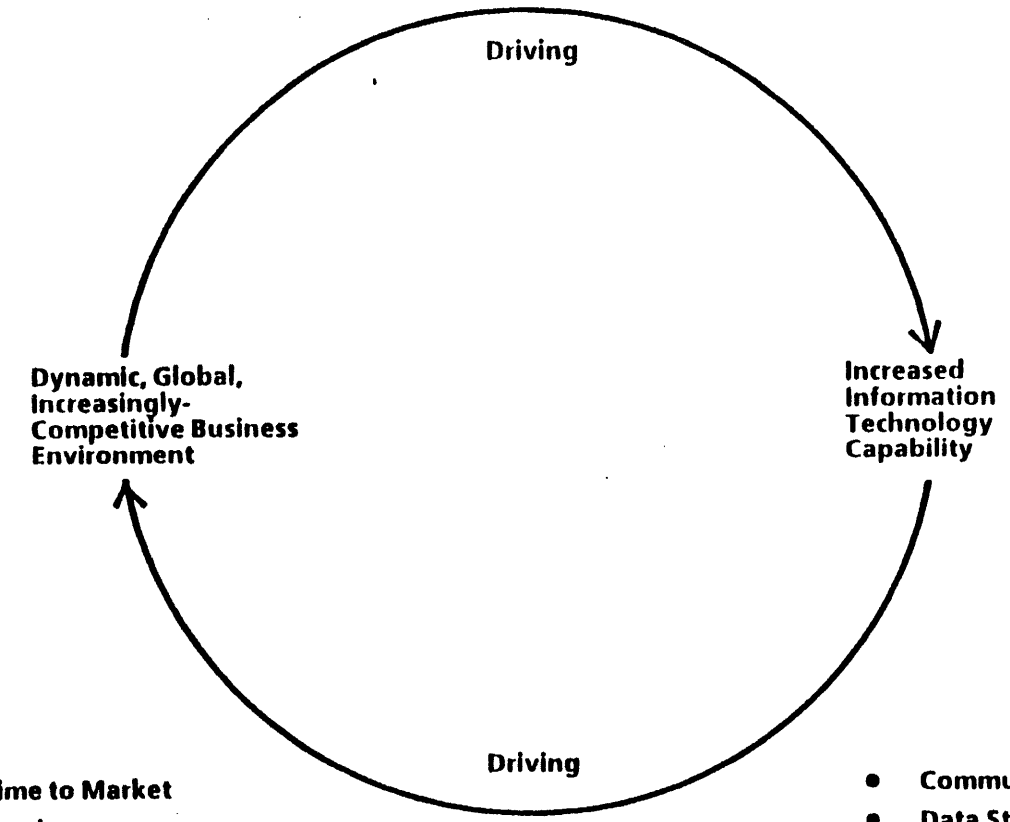
The combined effects of new competitors and new information technologies has produced a new, dynamic, global, technology enabled, increasingly competitive business environment (see Figure 3). The growing demands of this environment have dramatically affected the firm's competitive positioning and the need to increase performance against growth, profitability, quality, marketplace, and customer goals.

B. THE NEED TO INCREASE ORGANIZATIONAL PERFORMANCE

As firms set new strategy objectives, experiment with new organizational forms, or otherwise strive to improve internal performance in response to the increasingly global business environment, competitive pressures challenge firms not only to increase corporate, financial and customer performance (market share, ROI, customer satisfaction, quality measures, etc.), but also to reexamine how they measure performance in the first place. The networked firm will require new, likely unconventional measures of firm performance. For example, individual performance measures which track span of authority and control for compensation and promotion purposes (dollar volume of business managed, number of employees, etc.) have little to do with the more diffuse, cooperative and shared work environment necessary for effective networks. As one executive with considerable team experience told us: "I know very well who works effectively in teams. What I don't know is how to separate out individual contributions from that of the team, or whether I should be really trying to do this in the first place."

To achieve the company's revenue growth, profitability, market share or other aggregate, financial objectives, most firms interviewed were working aggressively to improve internal operations and increase effectiveness in all "customer facing" activities. Additionally, significant emphasis is being placed in the following areas:

Figure 3: What is Pushing the Move to "Networked Organizations?"



Time To Market. Today's marketplace demands more rapid new product introductions and more effective management of existing product lines. "Time to market" refers to the firm's ability to design, produce and bring to market new products quickly, or to better manage existing product lines. Black & Decker, for example, now brings new products to market in half the time it took before 1985. Xerox has made similar product design and manufacturing improvements in its copier division. And Ford shortened its usual product development cycle by over a year in the introduction of its Taurus/Sable vehicle line. In each case, compressing time to market required increased integration of effort among departments such as design, engineering, manufacturing, purchasing, distribution and service.[13]

Service. Effective service to the customer requires an effective service orientation throughout the business.[14] Service, of course, is not only based on the effectiveness of a single person or team in charge of a customer account, but on organization-wide knowledge of the customer's status, current problems, and anticipated problems. The need to improve service is therefore a driver for management's increased attention to integration across many tiers of the organization.

Quality. "Quality" has come to mean both product ***and*** process quality. "Product quality" refers to the accuracy of the end product of design and manufacturing processes (example: number of defects or failures in a specific part or final assembly). "Process quality," defined in terms of customer outcomes, refers to the degree of conformance to customer needs. In short, assessing process quality is assessing how well the ultimate product or service delivered to the customer meets the customer's needs, measured in the customer's terms.[15]

Risk. Market volatility, business complexity, and competitive pressures can easily overcome a firm's ability to accurately track and manage its business risk. Merrill Lynch, for example, lost over $250 million in less than a week when the firm failed to adequately oversee an employee trading a complex form of mortgage backed securities.[16] And Banker's Trust New York reported in 1988 that it had overstated its fourth quarter, 1987 foreign exchange

revenues by over $80 million -- in effect stating that the bank had not accurately valued its currency trading positions over a full quarter's worth of trading activity.[17]

In addition to growing business risks, the rapid development of key technologies and their effects on markets and companies carries with it growing technology risks. There are three dimensions to technology risk: the risk of not keeping pace with current technologies, and, conversely, the risk of investing in new, unproven, or inadequately understood technologies where the payoff may never come. There is also the risk of not understanding how the rules of competition change in electronic markets.[18]

Cost. Cost management and cost reduction are concerns for all organizations. In response to the "drivers" noted earlier, manufacturing firms, for example, have moved increasing amounts of manufacturing offshore in search of lower labor costs. Other firms have worked to rationalize product lines to capture global scale economies. Still others have mimicked Japanese practices, including instituting quality circles and just-in-time production techniques.

Another trend has been to consolidate "shared" activities across subunits within the company into one (or a very few) centralized operations to reduce costs and improve service quality. For example, several functions in auditing, cost accounting, some research activities, and some transaction processing of routine business tasks have all been candidates for consolidation into "shared services" organizations in firms such as Citicorp, General Electric, American Express, DuPont, Baxter Healthcare, Sun Company, and IBM. Of course, consolidating people and work to leverage expertise and to achieve economies of scale across the firm is nothing new. What ***is new*** in these cases is the role of information technology in redefining ***what*** functions are consolidated, and ***how*** these functions are then performed in the new services organization.

Partnerships. A final area of performance emphasis is in the firm's external links with suppliers, customers, and other firms. Firm to firm linkages through electronic data interchange (EDI), value added networks, partnership programs, and strategic alliances have

grown remarkably in recent years. In the automotive industry, for example, "arms-length" supplier relationships common just a few years ago now operate more as "strategic partnerships," where one company may contract out part of its own value added chain to the other. Ryder Truck, for example, now handles key pieces of Ford Motor Company's inbound and outbound logistics for vehicle assembly and distribution.

A second example is McKesson Corporation, well known to IS professionals for its successful leveraging of information technology to improve customer service and cut order-entry costs. As pointed out by Johnston and Lawrence, however, McKesson also transformed itself into the hub of a large value-adding partnership, successfully defending itself against its primary competition, the large, vertically integrated drugstore chains.[19]

The point to the Ryder-Ford and McKesson examples, however, is that each firm's individual, financial performance is increasingly tied to that of its major trading partners. For these companies, therefore, there is increasing need to develop effective internal and external procedures to define, track, and manage joint performance across these partnerships and/or strategic alliances.

C. THE NEED TO EFFECTIVELY MANAGE INTERDEPENDENCE

As firms work to improve performance in these areas of emphasis, the need to improve work coordination and cooperation, and to share information, decision making and responsibility across many tiers of the organization is increasingly recognized. We have earlier identified this need for increased concurrence of effort along multiple dimensions of the organization as effectively "managing interdependence." We asserted that the firm's ability to continuously improve the management of interdependence is the critical element in responding to new and pressing competitive forces. Unlike previous eras, managerial strategies based on optimizing operations *within* functional departments, product lines, or geographical organizations simply will not be adequate in the future.

Managers, of course, oversee innumerable large and small interdependencies every day. What happens in one function or product line affects others. Specialists in one area of the company must communicate effectively with specialists in other areas of the firm. 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. Some examples:

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

- Sales representatives for a nationwide or a 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 procedures must be maintained. Feedback can be important.

- Companies themselves rely on other companies to supply parts and services. When Toshiba faced the possibility of major economic sanctions for its sale of defense-related technologies to the Soviet Union, several U.S. computer manufacturers, including DEC and IBM, filed briefs in support of Toshiba's case. These U.S. firms feared that sanctions against Toshiba would harm them as well, given the high degree of interdependence in the industry.

In short, interdependence is a fact of business and organizational life. What is different today, however, is the increasing need to manage interdependence, driven by the competitive environment, and information technology's role in enabling a more networked organizational approach to help meet this need.

D. MANAGING INTERDEPENDENCE IN THE NETWORKED FIRM

How do companies today manage interdependence? Several approaches have been proposed, each with the goal of producing the concurrence of effort necessary to allow the organization to compete effectively in the marketplace. Mintzberg, for example, argued 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] Lawrence and Lorsch found that successful companies differentiated themselves into suborganizations to allow accumulation of expertise and simpler management processes driven by shared goals and objectives. Conversely, these same successful firms adopted integrating mechanisms to coordinate work activity across suborganizations. Lawrence and Lorsch postulated five mechanisms to manage the needed integration: integrative departments, whose primary activity was to coordinate effort among *functional* departments; permanent and/or temporary cross-functional teams; reliance on direct management contact at all levels of the firm; integration through the formal hierarchy; and integration via a "paper-based system" of information exchange.[21]

Galbraith later expanded the intellectual understanding of managing integration through people-oriented mechanisms.[22] He noted that direct contact, liaison roles, task forces, and teams were used primarily for lateral relations, permitting companies to make more decisions and process more information without overloading hierarchical communication channels. He also introduced the concept of computer-based information systems as a vertical integrator within the firm.

The IT-enabled network has now been added to this list of approaches. Several leading edge firms are working to redesign basic business processes through a more IT-enabled, networked organizational approach with the goal of dramatically improving performance in the six emphasis areas noted earlier (market, service, quality, risk, cost and partnership). We

address specific, company examples in Part II of this paper, following our discussion of performance in networks below.

E. PERFORMANCE IN NETWORKS

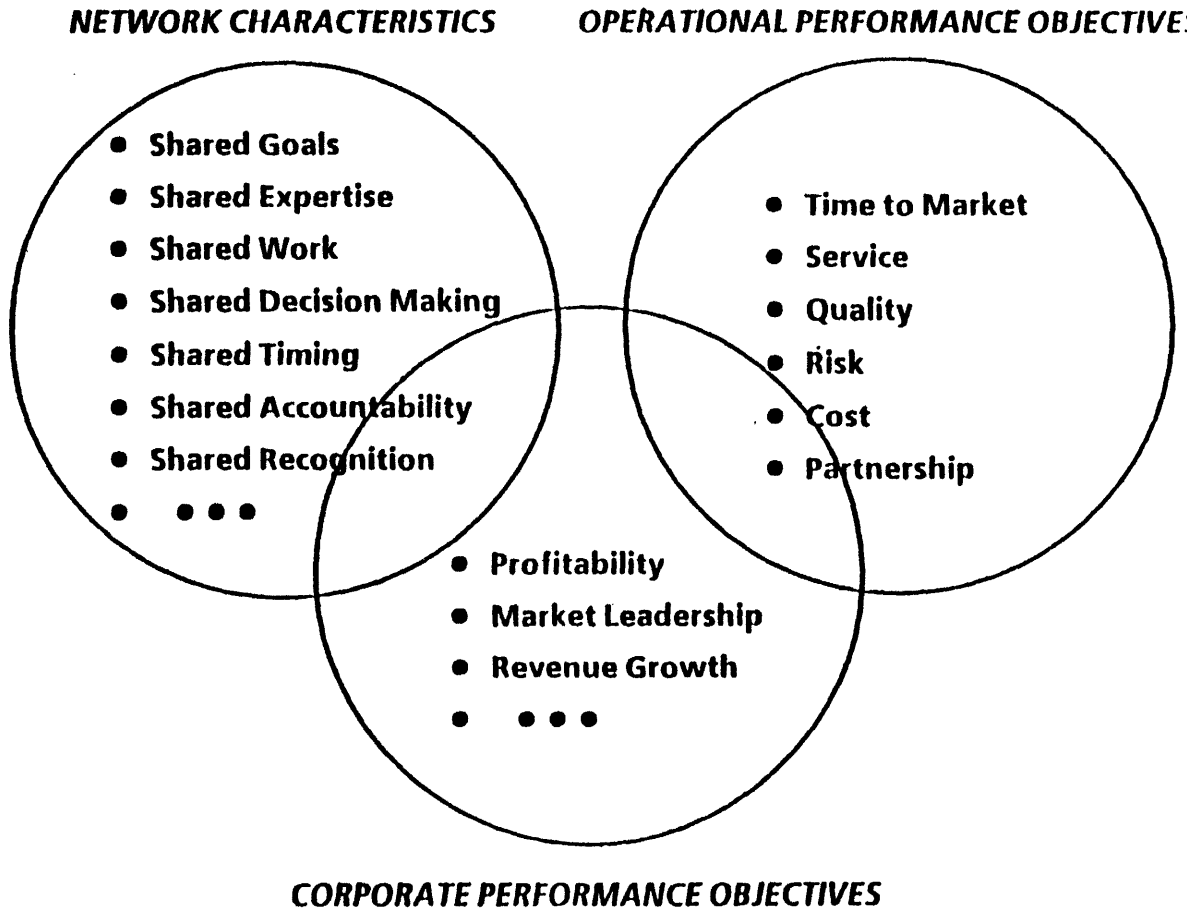
Effective networks operating within the firm are assumed to contribute readily to improved aggregate firm performance.[23] Implicit in this view are two key assumptions: first, that the improved sharing of information, work, decision making and responsibility improves aggregate work performance (in short, the more information and cooperation in accomplishing work the better); and second, that we have a well-trained and motivated work force with adequate management philosophies and procedures to enable, manage and maximize the benefit.

Our research, however, underscores the need for a way in which we can link specific characteristics of networks with specific performance objectives of the firm. In other words, we seek to answer the question, "In what way will the networked firm help to improve, for example, time to market, quality service, or cost?"

Figure 4 is our initial attempt to draw together several generic performance objectives with the characteristics of how networks function. The reader will recognize this as a preliminary attempt to identify several key dimensions of networks and of firm performance with the intention of associating the two. The exercise we have in mind is to ask "How does the improved sharing of work, enabled by improved information technologies such as EDI, CIM or office automation, contribute to our aggregate ability to service customers, or to produce and bring to market new products quickly?"

To address this question in a specific business situation, take for example IT support for currency trading in commercial banking. In the past several years, foreign exchange trading has become one of the largest profit generators in many of the nation's biggest banks,

Figure 4: Linking Network Characteristics With Areas of Performance Emphasis Within the Firm



including Citicorp, Chemical Bank, Banker's Trust, and Manufacturers Hanover. As trading has become more profitable, and riskier, significant emphasis has been placed on improving trading floor performance in three critical areas: time to market (quickly developing and bringing to market new financial instruments); risk management (accurately assessing global risks across multiple, financial instruments in multiple trading markets), and cost management (driving costs out of low value-added activities, such as clearance and settlement, and moving investment into high value-added activities, such as product development or risk management). Significant IT investments are now being made by most banks in the following areas:

- Enhanced trader work stations. Better, faster trading "front end" (better user interface, better decision support tools).
- Enhanced back office. Faster clearance and settlement of completed trades.
- Integration of "front end" and back office. Ensuring front end and back office systems integration and ultimately "seamless" electronic trading.
- Integration across trading markets and across financial instruments. For example, position and risk management across foreign exchange and municipal bond markets, and across spot, futures, and swap transactions.

Whether these IT investments have enabled a more networked approach to trading is far less clear, however. Traders are highly individual and highly entrepreneurial as a professional group. This is very much the culture, which is reinforced by measurement and compensation systems which reward individual entrepreneurship. In some of this IT investment we can see potential, significant enhancements to individual work productivity (in, for example, improved work stations). We can also see, however, the potential for greater monitoring of individual trader behavior. Back office systems will not only clear trades but

integrate with the trading "front end" to provide real-time, global position reporting capability. Which is it? Better traders or better control of traders? The technology is there to enable either possibility. We can only speculate at this moment, but clearly there will come the time when continued investment in individual productivity tools will yield diminishing marginal returns. At that point we expect to see increased attention to a more team-based, cooperative, integrated approach to trading. Similarly, if the aggregate, bank risk of this still highly individual, entrepreneurial activity continues to grow, fueled in part by IT investment, integration of trading from a management control and risk perspective will move onto the trading floors very quickly.

F. IMPLICATIONS OF OUR VIEW OF NETWORKS

There are a number of key assumptions and implications embedded within our view of networks:

Networks can be thought of as capabilities for organizational functioning. Networks allow for dynamic, multidisciplinary coalitions to form. Authority is derived not through a vertical chain of command but through characteristics of how networks function -- in short, through the sharing of work, expertise, decision making and responsibility as detailed earlier. This capability can lead to responsive and adaptive organizational functioning, but it also may not (see next point).

Networks do not automatically mean that the organization is flat, flexible or responsive. There is no "organizational law" that states the networked firm is flat or responsive. Some networked firms, as pointed out by Eccles and Crane, are rife with conflict. They may not have the time to be responsive to the customer. Similarly, there is no organizational law that states networks have to operate in "flat" organizations. In theory, they can operate just as

effectively within hierarchical organizations as within any other.[24] Our point is simply that flatness, responsiveness and flexibility are management issues in effectively managing networks. *They are not simple attributes of any networked organization.*

Networks do not automatically mean that all, or most, employees are networked. Many daily work activities and routines do not require complex, cross-organizational integration or network activity.

There are many networks. Implicit is the existence of many, overlapping networks in the firm. In general, the number of networks is tied to the complexity of work tasks to be accomplished.

Networks are highly sensitive to complexity. Finally, it is important to note that if the firm's products and services are complex, then the networks supporting them are complex. Again, there is no organizational law stating that a more networked approach to the firm implies simplicity. Moreover, there may be realistic, upper boundaries to network complexity for the individual manager. As the firm grows more complex, how many networks do we expect the individual manager to track effectively -- Five? Fifty? Five hundred? Conversely, what kind of complexity would the manager face without the network?

III. IT'S ROLE IN ENABLING THE NETWORKED ORGANIZATION

A. INTRODUCTION

We turn now to reviewing several of the academic literatures which discuss the impact of information technology on the organization. We review how our concept of managing interdependence through IT-enabled networks expands and refocuses this earlier work, and then turn to our examples from the field. We identify five organizational contexts where IT-enabled networks have strikingly improved a company's ability to effectively manage its functional, product or geographic subunits: in integrating across the firm's value-added chain; in within-function integration; in IT-enabled team support; in the firm's internal planning and control system; and within the IT organization itself.

B. IT'S MAJOR IMPACTS ON THE FIRM: A BRIEF REVIEW

We have argued earlier that a more networked, organizational approach to managing interdependence is enabled by two key characteristics of information technology. Vastly improved communications capabilities and more cost-effective computer hardware and software have enabled the "wiring" together of individuals and suborganizations within the single firm, and of firms to each other. It is this multifunctional, multilevel, multi-organizational, coordinative aspect of current technology that provides managers the capability to design networks to manage interdependence. It is the technical dimension or platform through which managers have access to the people and data they need to direct and accomplish work.[25]

The second major characteristic is management's capacity to enable and drive organizational innovation and business process redesign through IT. As Venkatraman (1989) points out, business process redesign reflects a "conscious effort to create alignment between

the IT infrastructure and the business process...Instead of treating the existing business process as a constraint in the design of the optimum IT infrastructure, the business process itself is redesigned to maximally exploit the IT capabilities."[26]

Our research in IT-enabled networks and managing interdependence refocuses and expands several earlier "IT impacts" perspectives in the academic and business literatures. While these literatures often disagree, four major classes of impact are generally posited. First, there is the view that technology changes many facets of the organization's *internal structure*, affecting roles, power and hierarchy. A second body of 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 "dis-integrating" -- their borders punctured by the steadily decreasing costs of electronic interconnection between firms, suppliers and customers. Companies, it is believed, will gradually shift to more market-based organizational forms, with specialized firms taking over many of the functions formerly performed within the hierarchical firm.

Finally, a fourth view of organizational impact 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 function, product or geographic lines. We now elaborate on these four perspectives.

Major Changes in Managerial Structure, Roles, and Processes

In the first class of literature, Leavitt and Whisler argued as early as 1958 that information technology would lead to a general restructuring of the organization, ultimately eliminating middle management.[27] In their view, IT moved middle managers out of

traditional roles, and allowed top managers to take on an even larger portion of the innovating, planning and other "creative" functions required to run the business.

Others were quick to comment on these predictions. Some speculated that IT would lead to greater organizational centralization. Others predicted that greater decentralization, reduced layers of middle or upper management, greater centralization of managerial power, or, alternatively, greater decentralization of managerial power would occur.[28] Others developed contingency-based models of organizational impact.[29] While it is clear that IT has affected many organizations in many different ways, it is also clear that this often conflicting literature has produced very little insight into how managers should plan for IT-enabled role or structural changes within their firms. Three more recent perspectives begin to address this issue.

"The Team As Hero"

According to this second view, teams and other ad hoc decision-making structures 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 evolving.[30] 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.[31] Drucker sees in the emergence of teams flatter companies which will look 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). Again, the design concept is a flatter, team-based organization.

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 different geographically dispersed groups to better coordinate their activities through

enhanced electronic communications.[32] On the other hand, some authors stress the importance of "groupware" in facilitating teamwork through better decision-making aids and project and problem management.[33]

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 such a manner that moves primary reporting relationships away from the more usual hierarchical, functional, geographic, or product structures. These structures work to immerse employees in pools of "front line," continually renewed expertise. Team members separated too long from these bases tend to lose this expertise.[34]

Corporate "Disintegration": More Markets and Less Hierarchy

A third perspective argues that today's hierarchical organizations are steadily dis-integrating -- 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 instantaneously through a central database), and electronic integration (tighter coupling between inter-organizational 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.[35] They argue that advances in IT will steadily shift firms toward proportionately more forms of market coordination, since the costs therein will gradually fall beneath those of hierarchical coordination. Johnston and Lawrence argue that IT-enabled value-adding partnerships

(VAPs) are rapidly emerging.[36] Typified by McKesson Corporation's "Economist" drug distribution service, VAPs are groups of small companies that 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 and have only small amounts of sample data to support them. And the exact opposite case -- the case for increased, vertical integration of firms--is also being strongly propounded.[37]

Systems Integration: Common Systems and Data Architecture

A fourth, more technically oriented view is that business integration is supported by systems and data integration. Here the concept of IT-enabled, organizational integration is presented as a natural outgrowth of two IT properties: improved interconnection and improved shared data accessibility.[38] In this view, "integration" refers to integration of data, of organizational communications (with emphasis on groups), and of business processes across functional, geographic or product lines.

C. THE MOVE TO THE NETWORKED FIRM

While each of these four perspectives offers important insights, there is need for a fifth perspective that expands these views into a more active managerial framework. We have argued that technology's major impact on the firm will be in supporting a more networked approach to effectively managing interdependence within the firm. Technology, as we have stated, provides both the technical capacity for interconnection of people and resources, and the management capacity for business process redesign.

Given pressures from the "drivers" noted earlier, our research has uncovered six organizational contexts where characteristics of a more IT-enabled, networked approach has strikingly improved a company's ability to manage its functional, product, or geographic

subunits. We focus here on five of the six, as illustrated in Figure 5. The sixth area, interorganizational integration, is discussed by Venkatraman (1989), as noted earlier.

Integration Across the Firm's Valued Added-Chain

Lawrence and Lorsch noted the use of "human integrators" to manage the concurrence of effort between adjacent functions in the value-added chain (e.g., between manufacturing, distribution and sales) more than twenty years ago.[39] Today this integration is performed increasingly through an electronic interface, via communications, computers, and databases. Firms attempt between-function integration for at least one of three reasons: to increase their capacity to respond quickly and effectively to market forces (time to market); to improve the quality of conformance to customer requirements (what we have earlier termed process quality objectives); or to reduce costs.

We have found that successful between-function integration collapses the multi-stage value-added chain into three major segments: producing new products, delivering products to customers, and managing customer relationships (See Figure 6).[40] In manufacturing companies, for example, it is clear that interdependence revolves around these three macro-organizational activities. In the insurance industry, discussions with five major companies revealed that the same three segments were targets for functional integration.

Turning to the two "ends" of the modified value-added chain -- the product design segment on the one hand, and the customer service segment on the other -- the effects of a more networked, technology-enabled integration are clear. To speed *product development*, companies such as Xerox, Lockheed, and Digital are introducing CAD/CAM and other design aids that 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

Figure 5: Examples of Network Approaches in Five Organizational Contexts

1. **Value Chain Integration**

Supplier	Design	Purchasing	Manufacturing	Sales	Service	Customers

2. **Functional Integration**

Sales Function	Service Function
Department 1	Department 1
Department 2	Department 2
Etc.	Etc.

3. **IT-Enabled Team Support**

4. **Planning and Control**

5. **Within the IT Organization Itself**

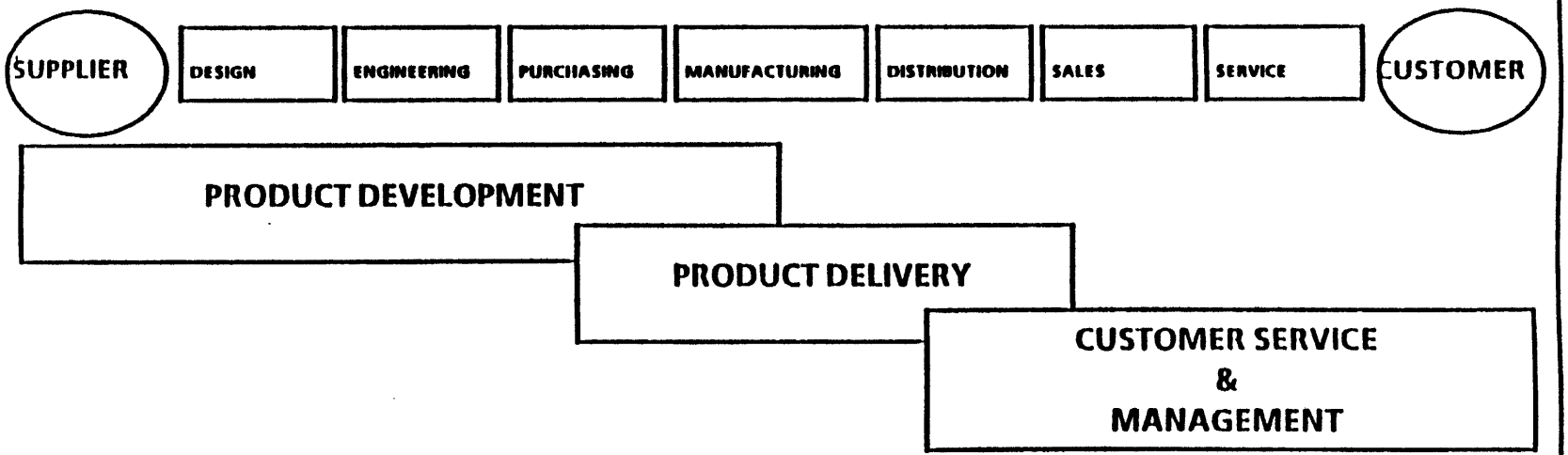
lengthy iterative development process (which occurred because the designers did not take the needs and capabilities of other departments into account). Dramatically shortened product development time -- a key component in improving aggregate time to market -- has been a consequence of this buy-in.

At the *customer service* end of the chain, Otis Elevator, Digital, Xerox and other firms have developed new service strategies and new service approaches based on electronic communications networks, an integrated database of customer and service history, and fault signaling that goes directly from damaged equipment to the supplier's maintenance-monitoring computer. The advantages of Otis' centrally coordinated electronic service system have been well publicized.[41] A major advantage is senior management's 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 the company's design, engineering and manufacturing personnel with direct access to fault data.

In many ways the most interesting stage of the collapsed value chain is *product delivery*, which requires integrating several different information systems: order entry, purchasing, materials resources planning, and distribution management. The critical business issues are to provide customers with information about when orders will be completed, and to forecast and manage outside supplier, product manufacturer, and product distribution processes.

No company has yet accomplished the fully networked, 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 the company and its distributors), to a more effective order-processing system, to a series of manufacturing technologies targeted at flexible manufacturing and automated materials control.[42] More recently, Westinghouse

Figure 6: Product Development, Product Delivery, and Customer Service and Management: Collapsing the Value-Added Chain



initiated a product delivery integration process in several segments of the company. And at General Foods a series of task forces has been charged with developing a similar approach.

Most efforts, however are more limited in scope. British Petroleum Company's chemical business has developed an integrated order management process spanning 13 divisions. Baxter Healthcare Corporation is working to enhance its well-known ASAP order entry system to provide customers with full product line visibility to their 125,000-plus products. 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.

Within Function Integration

Many companies are also recognizing the interdependence of multiple units *within* the same function. This recognition has prompted several actions to enhance a more network-oriented improvement of coordination and cooperation across subunits -- for example, centralization of certain like tasks or functions within the organization into a single group, central management of geographically separate units, and (in some firms) the development of common systems and/or standard data definitions to facilitate coordinating diverse organizational units.

At Sun Refining and Marketing Company, for example, senior management identified crude oil trading as one of the most critical business activities in the company three years ago. At that point Sun's traders were dispersed 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. Today Sun recognizes the importance of its integrated trading function in managing risk exposure and in developing effective pricing strategies for the volatile crude market.

Similarly, 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 function 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 can be observed as the pattern develops, and corrective action taken on a nationwide basis. In addition, the quality of telephone responsiveness to anxious customers can be closely monitored.

Other examples: Eastman 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 worldwide manufacturing plants. DuPont has installed common financial systems in all of its European operations. 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 they all recognize that no single unit within a major function is truly independent.

IT-Enabled Team Support

Ken Olsen, chairman of Digital Equipment Corporation, believes that the ability to bring teams together electronically is one of the most important features of the company's IT capability. Ford Motor has claimed that the "Team Taurus" approach, much of it IT-enabled, shaved more than a year off the time needed to develop, build and bring to market the new Taurus/Sable model line. In the future, as Drucker points out, many tasks will be done primarily by teams.[43]

Teamwork, of course, is not a new way to coordinate interdependent activities among separate units and people in an organization. What *is* new is that IT, chiefly electronic mail, video conferencing and computer to computer links such as those integral to CIM and EDI, is now facilitating teamwork and steadily adding capability to teams. Today, for example, it

is feasible for team members to coordinate asynchronously (across time zones) and geographically (across remote locations) more easily than ever before. Teams, as such, are one part of the increasingly networked firm.

The development and use of computer software to support teams is also moving into an explosive phase. There is a growing body of software labeled "groupware," a generic label for specialized computer aids designed to support collaborative work groups. 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."[44] Several companies, including Xerox, General Motors, Digital, Eastman Kodak, IBM and AT&T, are experimenting with state-of-the-art meeting and conferencing aids in addition to more "routine" communications systems such as electronic mail or voice mail systems.

Planning and Control

A fourth area where a more IT-enabled, networked organizational approach increasingly is in evidence is in planning and control. It is also an area where until very recently the typical process looked much the same across most major firms.[45] Before the new fiscal year began, an intense planning process culminated with an extended presentation to senior management of each strategic business unit's (SBU's) proposed activities. Agreed upon plans were then monitored on a monthly basis. Parallel to this formal control process was an informal system of "keeping in touch," by which senior management assured itself that "all was 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 management with efficient communication and information, is radically changing this traditional planning and control scenario. The major issue is how best to use IT for coordination and control of the firm's activities.

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, networked, communication- and coordination-based process. The system requires all of Xerox's thirty-four business units to submit their plans over an electronic communications network in a particular format. Doing this allows the staff to critique the plans more effectively and to reintegrate these plans when looking for factors such as competitive threats across all SBUs, penetration into particular industries by all SBUs, and so forth.

More important, each SBU's plans can be reviewed not only by senior executives and corporate staff but also by other top officers in the firm. Each officer receiving an SBU's plans is encouraged to send corporate headquarters an electronic message raising the issues he or she sees in the plan. The officer may also be asked to attend the review meeting. There is no "upfront" presentation at this meeting. Only the issues raised by the executives, the staff, or the other officers are discussed.

In short, Allaire's planning and control process is a computer-age process. By using a communications and coordination oriented network, it draws on the entire executive team for input. Understanding of the important issues facing each SBU is deeper and its activities are therefore sometimes subtly, sometimes more precisely, coordinated with the other SBUs.

A team-based, networked approach to the senior executive job of managing the business is also in evidence at Philips Petroleum Company's Products and Chemicals Group. There, Executive Vice President Robert Wallace is linked to his other top nine executives through an executive support system that provides on-line access not only to one another, but also 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 used 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 a manner as Allaire and Wallace do.[46] 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 a growing reality, as geographically separated executives can concurrently access and assess data and communicate in "real-time." Vertical on-line access to lower levels of data and text, however, violates many, long established management practices. Yet informal telephone-based systems have always provided some of this information. 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.

Within the IT Organization Itself

Line managers 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 on 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."[47]

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. In short, the IT organization is responsible for building the network infrastructure--the vital set of "roads and highways" through which the networks of shared work, expertise, decision making and so on work. A key first step in planning and developing this infrastructure is partnership between the line businesses and their IT organizations in

designing, developing and implementing new systems.[48] 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 present a far greater challenge than do systems of previous eras. Today's integrated, cross-functional product delivery systems require database, project management, telecommunications, and 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 in defining this "seamless," networked IT infrastructure.

Third, there is a need for IT management to educate line management to its new responsibilities. And fourth, IT executives must educate themselves and their staffs in all significant aspects of the business. Only if this happens will IT personnel be able to knowledgeably assist line management in creating effective, strategy-enhancing systems.

The concomitant demand on line management is twofold: the need to learn enough about the technology to view it as a key factor in strategic and operational business planning, and the need to select effective information technology personnel and to work closely with them.

IV. MANAGING INTERDEPENDENCE IN THE NETWORKED FIRM

Tomorrow's successful corporations will require increasingly effective management of interdependence to realize the performance gains made possible by a more networked organizational approach. IT-enabled changes in cross-functional integration, in the use of teams, or in within-function integration will force individual managers' agendas to change as well. In short, what managers do now and what they will do in the future is in the process of important change.

Zuboff argues that in the new "informated" organization, there is considerable interdependence among four domains of managerial activity: intellective skill development, technology development, strategy formulation, and social system development.[49] She notes that intellective skill development cannot proceed without the social system management that helps to foster roles and relationships appropriate to a new division of learning. Similarly, activity in either domain cannot proceed without technological development that supports an informating strategy.

This view of a multiplicity of dimensions which together enable a more networked approach to organizational functioning is widely established. The key problems confronting researchers, however, have been to define the operational components of these dimensions, and to specify the sequence of changes in the transition from current to future organizational functioning. This presumes of course that we do not have some sort of "big bang" theory of organizational change, which would posit instead that no such sequence or linearity of change takes place, only the move from "before" to "after."

A. DIMENSIONS OF CHANGE

What then are the dimensions of change to the more networked approach to organizational functioning? Our research has uncovered seven:

Increased Role Complexity Brought On By Continuous Changes in Products, Markets, Processes, and Organization

The manager's job is getting harder. The critical difficulty will be the need to manage continuous change in many dimensions of the organization. As companies seek new business opportunities by aggressively defining and executing "new ways of doing things" -- e.g., new strategies, new products and services, new customers -- managers will need to define and adjust more rapidly to new situations. Similarly, companies must also respond to heightened competitive pressures by continually improving (renewing) internal processes.[50] Again managers must initiate and respond to new situations. Frequently this will involve organizational changes.

A second dimension to increased role complexity is the manager's need to cope with unclear lines of authority and decision making. As the complexity of shared work, decision making, expertise, and accountability increases, uncertainty increases. When March and Olsen, Mintzberg and others have studied decision making under uncertainty, they invariably find -- not surprisingly -- that good managers respond to uncertainty by defining and sorting things out for themselves.[51] Of course, as individual managers in any organization see information, decision making and responsibility differently in many circumstances, conflict and uncertainty about the way in which some decisions will go is inevitable. This will be very uncomfortable for many managers.

Increased Skill Requirements

Skill requirements increase markedly in the transition to a more networked organizational approach. We think of skills to include both the tools and techniques necessary for higher-order analysis and conceptualization, and the intuitive capacity, experience and interpersonal skills necessary to work effectively with others. There are a variety of theories, stemming largely from cognitive science, which define skills more in terms of cognitive complexity, conceptualization and different problem solving capacities.[52] Whatever the level of analysis, however, managing networks requires more coordinative skills in team-based conceptualization, problem solving and decision making.

Many Teams

Teams are real. A vastly increased number of space- and time-spanning, problem-focused, task-oriented teams are becoming the norm. This growth in peer-to-peer, as opposed to hierarchical activities, requires new managerial skills and role definitions.

Changing Measurement Systems

Measurement systems are also changing. Measuring individual, team, or suborganizational success is difficult in an environment where cooperative work is increasingly the norm. New measurement approaches will need to be devised. We are entering a transitional period, during which people will need to adjust both to a changing work mode and to a changing measurement process. There is generally a lag in understanding and applying the correct measures of performance after a change in organization or roles. As new measurement systems evolve, therefore, they will almost surely lag behind other

organizational changes. Appendix 1 develops a preliminary list of changes in dimensions of organization and performance as firms move from their current organizational designs to the more networked approach.

Changing Accountability and Authority

We have trained an entire generation of managers to equate accountability with full control over the resources which affect them.[53] Increasingly, we will now require managers to share resources more freely and operate in an environment of more diffuse responsibility and accountability for many decisions. In many peer-to-peer situations within the firm, for example, there may not be a single individual "in control" or accountable. This will be hugely counter cultural in many corporate environments.

Changing Planning Process

Information technology is enabling the new planning approaches required to meet new competitive conditions. Our research underscores two major new capabilities. First, better information access and information management allow firms to target what is most critical to the organization. Second, organizations now have the ability to conduct "real-time," stimulus-driven planning at all levels -- in short, to bring key issues to the surface and react to them quickly. The technology provides both the conduit for moving critical data to all relevant decision makers and, more important, the capability to disseminate changes in direction to all parts of the firm.

Changing Technology Infrastructure

Changes in the technology infrastructure of the organization are now a top management priority. As technology becomes more deeply embedded within the business process, changes in either will influence and respond to the other.

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. Developing these resources, however, is not easy. Justifying organization-spanning networks whose benefits are uncertain and will occur in the future, and whose costs cannot be attributed clearly to any specific suborganization, is in part an act of faith. Developing common coding systems and data definitions is a herculean job. This task increases short-term costs for long-term gain -- a practice not encouraged by most of today's measurement systems.

Schein has pointed out that in the complex interweaving of cultural and technological factors in an organization, cultural assumptions which favor innovation will increase the likelihood of individuals inventing and implementing those new ideas that can make the organization more adaptive.[54] In other words, if technological and cultural conditions favoring innovation and change are not present, people will simply resist the kinds of changes that may be necessary. This is to remind us that while IT may enable the technical infrastructure to connect people and information together more effectively in the networked firm, to realize the benefits we are looking for, we need also to have -- or to develop -- a favorable cultural setting for innovation and change.

B. CONCLUSIONS AND FURTHER RESEARCH

We believe that the IT-enabled, networked organizational approach is *the* important design phenomenon of the 90s. Firms increasingly will turn to network approaches with the goal of improving performance through the existing organization. In this paper, we have identified several key characteristics of the more networked, organizational approach, and discussed specific areas where firms are attempting to increase performance in the business. We then argued that in their efforts to increase performance, firms are recognizing the need for more effective management of interdependence across subunits and people within the firm. IT-enabled networks are the most effective way for firms to effectively manage this interdependence.

Part II discussed specific examples of the network approach, and Part III looked at the implications of networks for the individual manager. Further research will in part consider two key questions raised in Parts I and III: how do specific characteristics of the networked firm contribute to improved, aggregate firm performance? And what are the implications of these network characteristics for managing interdependence effectively?

APPENDIX

The following template was developed with several sponsoring firms to help illustrate changes in business performance and organization as we move to a more networked organizational approach. In the absence of any powerful, theoretical model which can link these dimensions of organizational change to actual performance changes in the firm, the reader will recognize this template as a preliminary effort. Our objective is to identify and track several key dimensions in these firms over two or three time periods, successively honing the measures used for each change dimension. A cautionary note. Given the complexity in measuring and associating changes in these dimensions, over time, in any organization, it is important to note that this is not intended to be a theoretical exercise. Rather, it is intended to help surface managerial issues related to setting and measuring performance objectives and organizational capabilities in the more networked approach.

Appendix: Understanding the Transition to the Networked Organization			
Dimensions of Change	Time 1	Time 2	Time 3
Performance Goals			
• MARKET LEADERSHIP/FINANCIAL RETURN – Profitability, ROI, ROA – Revenue Growth Rate, Investment Productivity – Strategic Market Position – Market Share Relative to Key Competitors – Time to Market Key Product Line(s), New Product Intros. • SERVICE – Customer Satisfaction – Internal Customer Partnership Orientation • QUALITY – Product, Process Quality • RISK MANAGEMENT • COST MANAGEMENT – Cost Performance – Cost/Investment Attitude • PARTNERSHIP – External Partnership/Alliance Strategies, Performance			
Actions			
Product/Market Strategy Changes • NUMBER OF PRODUCTS, MARKET SEGMENTS TARGETED • PRODUCT LINE INTEGRATION			
Organization Structure Changes • DIVISION, SBU, FUNCTION, GEOGRAPHIC STRUCTURE • MANAGEMENT LAYERS			
Management Process Changes • PLANNING AND CONTROL SYSTEM – Individual Performance Measures – Management Structure – Accountability and Authority • HUMAN RESOURCES – Management Education – Motivation, Guidance, Control – Compensation and Span of Control			
Network Infrastructure, Capacity Changes • COMMUNICATIONS INFRASTRUCTURE • INFORMATION ACCESSIBILITY • USE OF TASK FORCES, TEAMS, OTHER HORIZONTAL LINKAGES			
Information Systems Changes • SYSTEM DEVELOPMENT – Development Approach/New Technologies • OPERATIONS – Data Management • MANAGEMENT PLANNING AND CONTROL – Degree of Business/IS Integration • IS ORGANIZATION STRUCTURE – Centralization/Decentralization			

NOTES

1. S. Zuboff, *In the Age of the Smart Machine* (New York: Basic Books, 1988); R.G. Eccles and D.B. Crane, *Doing Deals: Investment Banks at Work* (Cambridge: Harvard Business School, 1988); P.F. Drucker, "The Coming of the New Organization," *Harvard Business Review*, January-February 1988, pp. 45-53. Also see R.K. Mueller, *Corporate Networking: Building Channels for Information and Influence* (New York: Free Press, 1986), p. 2.

2. See, for example, Chapter 1, "A New Industrial Organization Approach," and Chapter 2, "The Emergence of the Network Firm," in C. Antonelli, Ed., *New Information Technology and Industrial Change: The Italian Case* (Dordrecht, The Netherlands: Kluwer Academic Publishers, 1988).

3. P.F. Drucker, *Management* (New York: Harper & Row, 1973), p. 638.

4. Mueller (1986: p. 2), for example, argues that networks help enable the appropriate "balance" between organizational responsiveness and complexity: "human networks and the process of social networking are prime components for a properly balanced organizational system... One way to get things done quicker and better, given the barriers and complexities in our... institutions."

5. For example, in small group research "communications networks" are generally considered one of three variables, work task and leadership are the others, which together establish norms for group interaction. As early as 1951, Bavelas and Barrett compared group performance, in their case problem solving ability, across "centralized" and "decentralized" communications networks. See A. Bavelas and D. Barrett, "An Experimental Approach to Organizational Communication," *Personnel*, 27 (1951), pp. 366-371. Other definitions of networks and network characteristics are found in research in social psychology, organizational communications, and cognitive science. For example, see "Chapter 12: Communication Networks," pp. 260-277 in A. Paul Hare, *Handbook of Small Group Research* (New York: Free Press, 1976); L.K. Porter and K.H. Roberts, "Chapter 35: Communication in Organizations," pp. 1553-1589 in M.D. Dunnette, ed., *Handbook of Industrial and Organizational Psychology* (Chicago: Rand McNally, 1976); R.L. Burgess, "Communication Networks: An Experimental Reevaluation," pp. 165-179 in B.M. Bass and S.D. Deep, eds., *Studies in Organizational Psychology* (Boston: Allyn and Bacon, 1972); and E.P. Hollander and R.G. Hunt, eds., *Current Perspectives in Social Psychology* (New York: Oxford

University Press, 1976). A more cognitive based view is contained in T. Winograd and F. Flores, *Understanding Computers and Cognition: A New Foundation for Design* (Norwood, NJ: Ablex Publishing, 1986).

6. In this paper, we do not address the "informal" organization as such, in which trust is a key factor. The classic reference in this area is C. Barnard, *The Functions of the Executive* (Cambridge, MA: Harvard University Press, 1938).

7. R.G. Eccles and D.B. Crane (1988). See Chapter 6, "The Self-Designing Organization," pp. 119-146.

8. P.R. Lawrence and J.W. Lorsch, *Organization and Environment: Managing Differentiation and Integration* (Homewood, IL: Richard D. Irwin, 1967), p. 13.

9. R.G. Eccles and D.B. Crane (1988), p. 133.

10. Researchers disagree over a precise definition of interdependence. An early, influential view is contained in J.D. Thompson, *Organizations in Action: Social Science Bases of Administrative Theory* (New York: McGaw Hill, 1967). Also see J.E. McCann and D.L. Ferry, "An Approach for Assessing and Managing Inter-Unit Interdependence - Note," *Academy of Management Journal 4* (1979): 113-119; and B. Victor and R.S. Blackburn, "Interdependence: An Alternative Conceptualization," *Academy of Management Journal 12* (1987): 486-498.

11. J.F. Rockart and J.E. Short, "IT in the 1990s: Managing Organizational Interdependence," *Sloan Management Review* Volume 30, No. 2 (1989).

12. G. Hamel and C.K. Prahalad, "Strategic Intent," *Harvard Business Review*, May-June 1989, pp. 63-76.

13. There are at least three key dimensions to this integration of process: shared work, shared information and expertise, and shared accountability. Getting agreement on what and how to measure joint performance across formerly independent operations is a key management issue. The dilemma is "how joint" are the measures?

14. T.J. Peters and R.H. Waterman, Jr., *In Search of Excellence* (New York: Harper & Row, 1982), p. 156.

15. See G.A. Pall, "Quality Process Management" (Thornwood, NY: The Quality Improvement Education Center, IBM, 16 February 1988).

16. "The Big Loss at Merrill Lynch: Why It Was Blindsided," *Business Week*, 18 May 1987, pp. 112-113.

17. "Banker's Trust Restatement Tied to Trading Style," *New York Times*, 22 July 1988, p. D2.

18. T.W. Malone, J. Yates, and R.I. Benjamin, "Electronic Markets and Electronic Hierarchies," *Communications of the ACM* 30 (1987): 484-497.

19. R. Johnston and P.R. Lawrence, "Beyond Vertical Integration - The Rise of the Value-Adding Partnership," *Harvard Business Review*, July-August 1988, pp. 94-104.

20. H. Mintzberg, *The Structuring of Organizations* (Englewood Cliffs, NJ: Prentice-Hall, 1979).

21. P.R. Lawrence and J.W. Lorsch (1967).

22. J.L Galbraith, *Organization Design* (Reading, MA: Addison- Wesley, 1977). Galbraith also introduced the concept of the organization as information processor in this work. He distinguished computer-based, vertical information systems from lateral relations and emphasized the division of organizations into suborganizations because of the need to minimize the cost of communications.

23. R.K. Mueller (1986). Note also how the *Wall Street Journal* reported GE's decision to invest in new, global communications technology: "GE has of late been pushing communications as the way to build a common system of corporate values and culture. John F. Welch, Jr., the company's chairman, believes that better communications is the key to giving GE a small-company culture while becoming a global corporate giant. Mr. Welch himself insisted on having videoconferencing technology to enable him to talk to his employees in Europe." See "GE Will Give Major Contract To Phone Firms," *The Wall Street Journal*, 26 May 1989, p. A6.

24. Though in this case there are important implications for how information moves throughout the network, and the potential for significant information overhead at each level in the hierarchical firm.

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