Part II

Opportunities and Constraints Provided by New Communication Technologies in the Business Arena

Chapter 5

Communication and Comparative Advantage in the Business Arena

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Communication and Comparative Advantage in the Business Arena

INTRODUCTION

The U.S. economy has fared reasonably well over the past few years. However, many observers are beginning to have serious reservations about the future of the U.S. economy and its ability to compete in an increasingly global environment.[1] They point out that economic growth in the United States has been fueled by borrowing foreign capital. Export growth in the manufacturing sector has been increasing at a much slower rate than import growth, which, rising precipitously, reached about $160 billion in 1986. Experts note, moreover, that the continued decline of the U.S. economic position in world trade is likely to have serious consequences for labor. Between 1980 and 1984 alone, the number of jobs generated by exports fell from over 6 million to 4.5 million.[2] Pointing to the apparent success of the Japanese model of business organization, some have even suggested that the United States may also need to develop and adopt new ways of organizing for production if it is to be competitive.[3]

Many of those who are concerned about the U.S. economy look towards the communication and information sectors to provide the impetus for future growth.[4] This focus on "telematics" is not surprising, given the trend toward a greater role for information in advanced industrial societies, and the fact that the United States has traditionally had a comparative advantage in this area. Communication is regarded, moreover, not only as a source of economic growth, but also as a means of reconfiguring work relationships to make them more effective.[5]

Just as the growth and development of the communication sector is considered to be critical to the well-being of the economy as a whole, so too is it considered a strategic factor in competition among firms. Increasingly, companies need to take communication into account in developing their overall business strategies. As Clemens and McFarlan have pointed out:

> The new technologies of communication have the power to change the competitive game for almost all companies of all sizes.[6]

Given the linkages between communication regimes and economic activity, the way in which the U.S. communication infrastructure evolves over the next several years is likely to have significant impacts on the business world and the economy as a whole. To determine these impacts, and to suggest possible policy choices about them, this chapter will examine the nature of the opportunities and constraints presented by new communication technologies in the economic realm. To this end, it will:

. characterize the economic realm,

[1]For a discussion, see Robert Z. Lawrence, *Can* America Compete? (Washington, DC: The Brookings Institution, 1984); President's Commission on Industrial Competitiveness, *Global Competition: The New Reality* (Washington, DC: U S. Government Priming Office, 1985); George Cabot Lodge and William C. Crum, "U.S. Competitiveness: The Policy Triangle, ''Harvard *Business Review*, vol. *63*, January -February 1985, pp. 34-36,38-39,4142, 46,48, 50, and 52; and Peter G. Peterson, "The Morning After, ''Atlantic *Monthly*, vol 260, October 1987, pp. 43-50,52-55.

[2]OTA staff, personal communication, Mar. 14, 1989. The labor content of exports also fell from 30,300 jobs per $1 billion of exports to less than 25,000.

[3]For three very different discussions, see Bob Reich, *Tales of a New America (New* York, NY. Time Books, 1987), especially ch. 10; David H. Bernadin and Michael A. Harrison, *The Technology War: A Case for Competitiveness (New* York, NY: John Wiley & Sons, 1987); and Michael J. Piore and Charles F. Sabel, *The Second industrial Divide (New* York, NY: Basic Books, Inc., 1984).

[4]See, for example, Charles Jonscher, "Information Resources and Economic Productivity," *Information Economics and Policy (North* Holland: Elsevier Science Publishers, 1983), pp. 13-35. Note that telecommunication industry shipments are expected to grow to an annual rate of 9 percent, in real (deflated) terms, for the next 5 years. International Trade Administration, U.S Department of Commerce, *1987 U S Industrial Outlook for Over 350 industries* (Washington, DC: U.S. Government Printing Office, January 1987). pp 30-37.

[5]For example, see Shoshana Zuboff, *In The Age of the Smart Machine: The Future of Work and power (New York,* NY: *Basic* Books, 1988); see also Ramchadran Jaikumar, "Postindustrial Manufacturing, ''Harvard *Business Review*, November-December 1986, pp. 69-76.

[6]Eric K. Clemons and F, Warren McFarlan, "Telecom: Hook Up or Lose Out," *Harvard Business Review,* July-August, 1986, pp. 91-97; see also Peter G.W. *Keen, Competing in Time Using Telecommunications for Competitive Advantage* (Cambridge, MA: Ballinger Publishing Co., 1986); Donald A. Marchand and Forest W, Horton, Jr., *Infotrends: Profiting From Your Information Resources (New* York, NY: John Wiley and Sons, 1986); and James I. Cash, Jr., F. Warren McFarlan, and James L. McKenney, *Corporate Information Systems Management: The Issues Facing Senior Executives* (Homewood, IL: Irwin, 1988).

. describe how communication technologies have affected economic activity in the past, and
- provide a framework for analyzing economic impacts in the future.

This framework will be used to analyze the potential uses and impacts of communication technologies in several key business activities, and to identify the major factors and related policy issues that will determine the impact of communication technologies in the economic realm.

THE ECONOMIC REALM

The economic realm is that sector of human activity in which the production and exchange of goods and services takes place. In modern capitalistic societies, it is the market system that serves, for the most part, to manage the processes of economic activity, coordinating supply and demand and allocating goods and services. To the extent that the structure of the market replicates a state of perfect competition, that each producer selects the combination of factors of production that will maximize profits, and that each consumer seeks to maximize preferences, the price system can be assumed to distribute goods and services in the most efficient fashion.[7]

In the economic realm, behavior is considered to be governed by self-interest. Hence, self-interest is the criterion that is most likely to be used in evaluating economic outcomes.[8] Accordingly, producers will seek higher profits; workers better wages and an improved quality of work life; investors higher returns on their investments; and consumers higher quality products at a lower price.

From a more general perspective, the performance criteria of a firm, industry, or national economy are generally those of efficiency and growth.[9] As the sociologist, Daniel Bell, has noted, the principal value underlying the economic realm is that of "fictional rationality ''—that is, each individual and each group in the system carry out rationally conceived, specified roles that, taken together, are designed to maximize production. The principal means of achieving this value is by economizing; decisions are made on the basis of cost/benefit analyses, and technology is applied to substitute more efficient processes for less efficient ones.[10]

Communication is inherent in the coordination required for all economic activity. The exchange of information, for example, is at the heart of the market system.[11] Capitalism depends on the communication of information to efficiently allocate resources. Within firms, the delivery of timely and accurate information is key to decisions about whether to enter or exit markets, how to secure financing, how to organize and manage workers effectively, and how to distribute and market goods. Firms without access to such data, and the communication networks required for their use, will be at a severe disadvantage when competing with other firms that have such access.

COMMUNICATION TECHNOLOGIES AND ECONOMIC ACTIVITIES

Given the link between communication and economic activity, it is not surprising that communication technologies have historically played an important role in economic development and growth. At one time, market relationships consisted almost entirely of face-to-face exchanges. Today, mediated communication has replaced most of this primary contact. Now, an exchange of information often precedes or inheres in an economic transac-

[7]For a discussion of the resumptions and values underlying the economic realm, see Duncan MacRae, Jr., *The Social Function of Social science* (New Haven, CT and London: Yale University Press, 1976), p. 160. See especially chs. 5 and 6. See also Robert Heilbroner, *The Nature and Logic of Capitalism (New York, NY:* W.W. Norton and Co., 1985).

[8]Ibid. It should be noted that self-interest is assumed to be a driving motivation only insofar as individuals are operating in economic roles. In real life individuals play many, and often conflicting, roles, Hence, in other contexts individuals' motivations and values might be quite different.

[9]Economic growth was the main concern of classical economists. By economic growth we mean the process by which real national income increases over a very longtime period. For a discussion, see Gerald M. Meier and Robert E. Baldwin, *Economic Development: Theory, History, Policy (New* York, NY: John Wiley & Sons, Inc., 1961). It should be noted, however, that the focus on growth may exhibit historical and cultural biases. For a comparison of U.S. and Japanese perspectives on economic growth, see James Fallows, *More Like Us: Making America Great Again* (Boston, MA: Houghton Mifflin Co., 1989).

[10]Daniel Bell, The *Cultural* Contradictions *of Capitalism (New* York, NY: Basic Books, 1976), PP. 10-11,

[11]For an in-depth discussion of the role of communication in the market system, see James R. Beniger, *The control Revolution: Technology and the Economic Origins of the Information Society* (Cambridge, MA: Harvard University Press, 1986). As Steiner has pointed out, fundamentally a market can be defined as the "entire web of relationships between buyers, sellers, and products that is revolved in an exchange." Peter Steiner, "Markets and Industries," *International Encyclopedia of Social Science (New* York, NY: Macmillan), vol 9, pp. 575-581.

tion. Advertising, for instance, alerts consumers to the availability and characteristics of products and services, and information alone virtually drives securities and commodity markets.[12]

The deployment of communication technologies has increased economic activity and fostered economic growth in a number of interrelated ways. First, communication technologies have dramatically increased both the speed and the number of economic transactions that can take place. Second, by diminishing the relevance of geographic distance, communication technologies have facilitated the expansion of trade and markets. At the same time, the development of mass media technology served to reinforce national markets by helping to mold tastes and preferences into a more uniform cast. In turn, this increase in market size led to greater specialization, standardization, and economies of scale. By enhancing intrafirm coordination, communication technologies allowed businesses to grow vertically and horizontally, and thus to exploit these economies.

The important role that communication and information technologies have played in economic terms can be seen by tracing their development in conjunction with industrial development in the United States. Box 5-A provides a chronological list of these technological developments from 1830 to 1887.[13]

From the 15th century until the development of the railroad and the telegraph in the last half of the 19th century, material goods were transported very slowly—at the speed of draft animals if they traveled by roadway or canal, or "at the whim of the winds" if they traveled by sea.[14] Because transportation and communication over long distances was difficult and slow, trade was discouraged and markets were geographically limited in size. At such distances, merchants did not have a great deal of information on which to base their sales. Prices differed significantly from market to market, and considerably exceeded the costs associated with distribution. As a result, most merchants refrained from long-distance trading. When they did engage in such trade, they generally remained at home, relying on merchants in other trade centers to sell their goods on a commission basis. To minimize and spread the sizable risks involved, they sold a wide variety of products rather than specializing.[15] Given the 4-month lag in transatlantic communication, as well as European mercantilist policies, it is not surprising that trade between the American colonies and Great Britain was generally limited,

Although the speed of transportation and communication did not greatly increase in post-revolutionary America, the volume of trade did grow as a commercial infrastructure was gradually established and as more effective means of transportation and communication were deployed.[16] Equally important to the development of trade was the establishment of a network of people who, in their various roles as middlemen, helped to convey market information and goods across both the North American continent and the Atlantic Ocean. Included among them were shippers, financiers, jobbers, transporters, insurers, brokers, auctioneers, and retailers. [17]

The impacts of these developments were cumulative. Trade gave rise to more trade. *8 As markets expanded, so did the density of merchant exchange networks and the amount of available market information. As a result, distribution costs declined, and merchants were further encouraged to engage in trade. Moreover, with larger markets and better information, merchants faced fewer risks, and thus they were able to specialize in particular aspects of trading such as importing, wholesaling, retailing, or exporting. This increased specialization led, in turn,

[12]Richard B. Kielbowicz, "The Role of Communication in Building Communities and Markets: An Historical Overview," OTA contractor report, November 1987, p. 2.

13 Beniger, op. Cit., footnote 1"

[14]Ibid., p. 219.

[15]Ibid., p. 174.

[16]The commercial infrastructure was comprised of commercial banks (1780s), a Federal banking system (1791), State insurance regulations (1799), Federal bankruptcy law (1800), and joint stock companies (1810). The new technologies included a Federal postat service (1791), the first turnpike (1795), coastal steamboat travel (1809), mail delivery by steamboat (1813), regular packet service to England (late 1810s), steam railroads and Atlantic clipperships (early 1830s), local postal delivery service (1836), regular transatlantic steamship service (1 847), and regular steamboat to California (1849). Ibid., p. 130.

[17]Ibid., pp. 155-165.

[18]Ibid., pp. 173-174.

Box 5-A-Selected Innovations in Information Processing and Communication, 1830-87

Year	Innovation
1830s	Wagon lines carrying freight between rural towns and ports begin to operate on regular schedules.
1837	Telegraph demonstrated, patented.
1839	Express delivery service between New York and Boston organized using railroad and steamboat.
1840s	Freight forwarders operate large fleets on canals, offer regular through-freight arrangements with other lines.
1842	Railroad (Western) defines organizational structure for control.
1844	Congress appropriates funds for telegraph linking Washington and Baltimore; messages transmitted.
1847	Telegraph used commercially.
1851	Telegraph used by railroad (Erie). First-class mail rates reduced 40-50 percent.
1852	Post Office makes widespread use of postage stamps.
1853	Trunk-line railroad (Erie) institutes a hierarchical system of information gathering, processing, and telegraphic communication to centralize control in the superintendent's office.
1855	Registered mail authorized, system put into operation.
1858	Transatlantic telegraph cable links America and Europe, service terminates after 2 weeks.
1862	Federal Government issues paper money, makes it legal tender.
1863	Free home delivery of mail established in 49 largest cities.
1864	Railroad postal service begins using special mail car. Postal money order system established to insure transfer of finds.
1866	Telegraph service resumes between America and Europe. "Big Three" telegraph companies merge in single nationwide multiunit company (Western Union), first in United States.
1867	Railroad cars standardized. Automatic electric block signal system introduced in railroads.
1874	Interlocking signal and switching machine, controlled from a central location, installed by railroad (New York Central).
1876	Telephone demonstrated, patented.
1878	Commercial telephone switchboards and exchanges established, public directories issued.
1881	Refrigerated railroad car introduced to deliver Chicago-dressed meat to Eastern butchers.
1883	Uniform standard time adopted by United States on initiation of American Railway Association.
1884	Long-distance telephone service begins.
1885	Post Office establishes special delivery service.
1886	Railroad track gauges standardized.
1887	Interstate Commerce Act sets up uniform accounting procedures for railroads, imposes control by Interstate Commerce Commission.

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to greater coordination of markets and reduced costs, making trade even more attractive.[19]

Also critical to the growth of markets was the development of mass media technologies such as power-driven, multiple rotary printing and the national postal system. By drawing audiences into larger and larger communities, these technologies accelerated the marketing of consumer goods on a national scale. The increasing use of syndicated material in newspapers and the advent of nationally circulated magazines in the late 1800s anticipated true mass communication.[20] Catalogs also became popular as an advertising medium. In 1887, Montgomery Ward distributed nationally a 540-page catalog that offered more than 24,000 items for sale.[21]

Despite the development of national markets and greatly increased trade, specialization and rationalization of production was limited until the late 1800s by the relatively low speed of transportation and communication technologies. As both Alfred Chandler and James Beniger point out, specialization can only take place, and productivity can only be increased, to the extent that goods can be moved, processed, and distributed and that the production process itself can be coordinated.[22] It was only with the development of the railroads in the 1830s and the telegraph in 184 that the requisite speed and control in the processes of production and exchange could be achieved. By increasing the speed of communication and extending the range of possible control, the railroad, the telegraph, and later the telephone facilitated the growth of large-scale organizations with modern management structures, a first step in the centralization of production and distribution.[23]

Given the speed of the new technologies, the growth of the modern corporation was not limited by national geographic boundaries. Employing communication technologies to coordinate their activities, a number of these new enterprises invested abroad in what proved to be very successful international ventures.

Although communication technologies affected all economic relationships, their impact was not distributed equally nor experienced uniformly. As Joseph Schumpeter has pointed out, technology gives rise to economic growth through the process of "creative destruction."[24] Thus, although the economy as a whole prospered as a result of communication and information technologies, some segments within society found themselves worse off.

For example, one group whose fortunes changed radically as a result of the vertical integration of many marketing tasks was the numerous middlemen who had performed the function of transmitting and distributing market information and goods. As Beniger notes, the decade of the 1880s:

> . . . saw the wholesalers challenged by new mass retailers--department and chain stores and mail-order houses—that purchased from manufacturers directly and thereby integrated still further the processes of distribution and marketing. Although the total number of wholesalers continued to grow into this century, increasing six- to eightfold between 1880 and 1925, their market share began to decline in the early 1880s. Between 1869 and 1879 the ratio of wholesale to direct sales rose to 2.40 from 2.11, with only $1 billion worth of goods passing directly from manufacturers to retailers in the latter year, while some $2.4 billion worth went by way of wholesalers. After 1889, however, when wholesaling's predominance had already declined slightly to 2.33, the ratio began to fall evermore sharply: to 2.15 in 1899, to 1.90 in 1909, and to 1.16 by 1929.[25]

[19]Ibid. The positive effect that increased information exchange had on trade was clearly exhibited, for example, with the development of the transatlantic cable in 1866. Before the completion of the Atlantic telegraph, New York financiers were unwilling to trade in London markets, unless prices were very attractive, because it took 6 weeks to clear prices and have their orders executed there. The completion of the undersea cable radically changed the situation, bringing about an immediate convergence of prices on both sides of the Atlantic. Kenneth D. Garbade and William L. Silber, 'Technology. Communication, and the Performance of Financial Markets 1840-1975," *Journal of Finance, vol. 33,* June 1978, pp. 819-832.

[20]Theodore Peterson, *Magazines* in *the Twentieth Century* (Urbana, IL: University of Illinois Press, 1964, 2d ed.).

21 Beniger, op. cit., footnote 11, pp. 18-19.

[22]Ibid., p. 208; and Alfred D. Chandler, Jr., *The Visible Hand: The Managerial Revolution* in *American Business* (Cambridge, MA: Harvard University Press, 1977).

[23]Ibid., and Beniger, op. cit., footnote 11. Before the development of these technologies, businesses were usually run by their *owners* who, focusing on a single line of products, generally operated either a single unit of production or a single unit of distribution. 'here were only a few salaried managers who typically worked directly with the owners. Alfred D. Chandler, Jr., "The Evolution of Modern Global Competition," Michael E. Porter (cd.), *Competition in Global Industries* (Boston, MA: Harvard Business School Press, 1986), p. 405.

[24]Joseph Schumpeter, *The Theory of Economic Development*, translated by R. Opie (Cambridge, MA: Harvard University Press, 1934).

[25]Beniger, op. cit., footnote 11, p. 258.

The new technologies also favored large firms at the expense of small ones, contributing to the growth of oligopoly. As the scale of operations also grew, size served as a barrier to entry because most small firms lacked the resources needed to function nationally or regionally. With the development of national advertising, the small, local retailers, who had once served their communities with little competition, found themselves facing a succession of challengers—department stores, mail-order firms, and chain stores.[26] Compounding the advantages reaped by large firms was the slow, uneven diffusion of the telephone. Although patented in 1876, it took 12 years for lines to reach Chicago, and another 17 for a transcontinental service to be inaugurated. Thus, businesses headquartered in the northeastern corridor had a considerable advantage in using the new technology .27

Just as the telegraph, telephone, and broadcast media have affected economic activities and relationships in the past, so, too, will today's technological advances have a profound effect on the economy of the future. To gain a better understanding of what this impact might be, we need to begin by characterizing the socioeconomic context in which new technologies are emerging.

Socioeconomic Context: Enhanced Economic Stakes in Communication and Information-Related Activities

The impacts of new communication technologies on economic activity will be due not only to the inherent nature of the technologies themselves, but also to the development of two major and interrelated trends: the trend toward a society that is information- or knowledge-based, and the trend toward a global economy. Driven in part by technological advances, these trends serve to increase the economic stakes in how new communication technologies evolve and are deployed; hence, they may intensify many of the policy issues that relate to their development. To fully anticipate the impacts of the new technologies, it is necessary to look more closely at these two trends.

Trend Toward an Information-or Knowledge-Based Society

Today, the new information technologies provide numerous ways of enhancing the values of the economic realm. They can improve efficiency and increase productivity, thus engendering economic growth. Information itself is reusable and, unlike capital resources such as steel or iron, its production and distribution require very few physical resources. Not only can information be used to substitute more efficiently for labor; it can also be used to improve the overall efficiency of the productive process itself. And, as productive processes become increasingly complex in advanced industrial societies, the largest reserve of economic opportunities will be in organizing and coordinating productive activity through the process of information-handling.[28] Given these characteristics and capabilities, information is likely to become more important as a resource in the economic realm.

This increasing importance of information to the economy is evident from the continued growth of the information sector of the economy, a trend that has been paralleled in other advanced industrial societies. In fact, it was to highlight this change that terms such as the "information society" and the "information age" were first employed.[29] A recent analysis estimates that the information sector constitutes 34 percent of the gross national product (GNP), and accounts for 41.23 percent of the national labor force .30

The changing economic role of information can also be seen by examining how information technologies are being used by business and industry. Businesses are now applying computer technology to almost all of their activities—from recruiting to laying off workers; from ordering raw materials to

[26] Kielbowicz, op. cit., footnote 12.

[27] Ibid.

28 Jonscher, op. cit., footnote 4, pp. 13-35.

[29] Fritz Machlup was one of the first to note these changes and to measure the information sector in his pioneering work, now a classic, entitled *The Production and Distribution of Knowledge in the United States* (Princeton, NJ: Princeton University Press, 1962). Others have followed this tradition.

[30] Michael Roger Ruben and Mary Taylor Huber, *The Knowledge industry in the United States." 1960-1980* (Princeton, NJ: Princeton University Press, 1986). This volume updates the work done by Fritz Machlup. In their breakdown of the information sector of the economy, Rubin and Huber note that, leaving education aside, the contribution of knowledge-production to the GNP increased from 17.9 percent in 1967 to 24.5 percent in 1980. The contribution of education, on the other hand, fell from 16.6 percent to 12.0 percent during the same period, a decline that accounts for the fact that the overall contribution of knowledge-production remained relatively stable at about one-third of the GNP.

manufacturing products; from analyzing markets to performing strategic planning; and from inventing new technologies to designing applications for their use. The extent of this deployment can be seen clearly from figure 5-1, which shows the compositional trends in capital spending in terms of the mix of the work force.[31] As the upper half of the figure illustrates:

> From the mid-Sixties through last year (1983), high-tech spending as a portion of total business fixed investment almost tripled-rising from about 1290 to roughly a third. Similarly, over the same period, the employment share of information workers is estimated to have risen around 10 percentage points to about 5570 of the nonfarm workforce.[32]

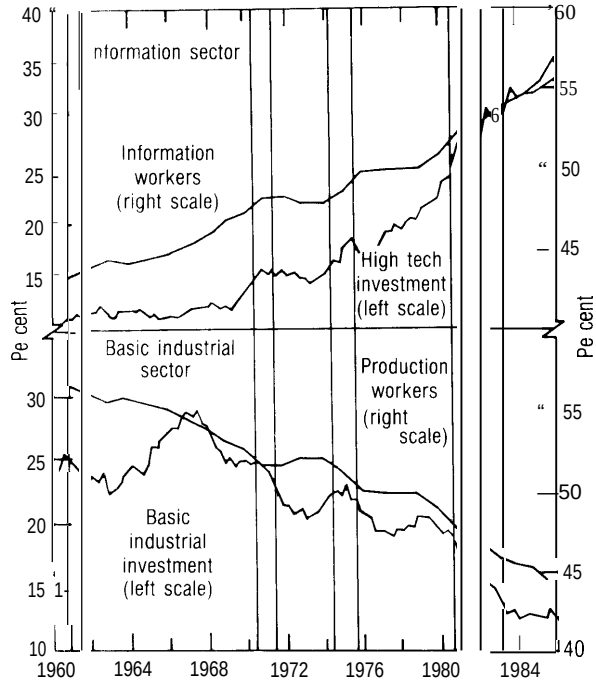
In contrast, from the lower half of the figure one can see that along with the decline in production workers, there was a decline in the basic industrial share of capital spending.

> As a portion of total expenditures in plant and equipment, such outlays dropped to almost 12% in 1983-down almost two and a half times from the peak share of the late Sixties.[33]

To take full advantage of new technologies in all of these activities, many businesses are finding it necessary to merge the data-processing, office automation, and telecommunication functions. Executing these functions often requires "large capital investments, large projects, large and complex implementation, and extensive user training. "[34] But, given the convergence of information and communication technologies, these three services can increasingly be provided via one network, allowing for considerable economies.[35]

Because these tasks were previously carried out independently of one another, the organizational changes required to execute this kind of restructuring can be quite extensive. In the past, for example, telecommunication services were purchased from AT&T, which constituted a quasi-public utility. Now, all sorts of purchasing decisions need to be made in a multi-vendor environment. And, as

Figure 5-l-Structural Change and the Information Economy (investment and employment shares)



NOTE. Shaded areas indicate recessionary periods as designated by the National Bureau of Economic Research. Dashed lines indicate Morgan Stanley Economics projections.

SOURCE: Adapted from *Information Management Review,* vol. 1, No. 1, p. 14, with permission of Aspen Publishers, Inc., Copyright Summer 1985.

McKenney and McFarlan have pointed out, the situation is complicated by the fact that vendors from each of the three sectors are seeking to provide the overall technological base for all these services. In view of the fact that information plays a strategic role in configuring interorganizational relationships, a number of decisions also have to be made about where in the organization to locate the management, and whether or not the operations should be centralized or decentralized. How these questions are answered may have significant consequences for business since, as once corporate executive has noted, in an information economy, "a premium is

31 Marchand and Horton, op. Cit., footnote 6, p. 16.

32 Stephen S. Roach, "The Industrialization of the Information Economy," testimony at hearings before the House Subcommittee on Economic Stabilization, June 12, 1984, pp. 6-7, as cited in ibid., pp. 16-17.

33 Ibid.

34 James L. McKenney and E. Warren McFarlan, "Information Archipelago--Maps and Bridges," *Harvard Business Review,* September-October 1982, p. 111.

35 Ibid.

placed on managing information and not just on [its] automation."[36]

Given the enhanced value of information, many firms and corporations that have never been involved in information-related activities before are, for the first time, beginning to see themselves as potential information-providers. A number of these companies are now repackaging their transactional data and computer software for sale. Both American Airlines and the Travelers Insurance Co., for example, have developed subsidiaries that sell software and training services to external customers. Through its subsidiary, Travtec, Travelers also markets a software package for managing IBM's system network architecture (SNA) networks.[37]

In an information-based economy such as this, the role of communication technologies as a competitive weapon is likely to be greater than ever before. Information has become a key strategic economic resource, and communication technologies (as they have been combined with information-processing and storage technologies) the most effective means for taking advantage of it. In this context, businesses are less apt to be satisfied with simple access to a public communication network. Increasingly, they are looking for communication options that allow them greater management and control over their information resources.

Trend Toward a Global Economy

A second but interrelated socioeconomic trend that will influence how new communication technologies will be perceived in, and used by, the business community is the trend toward a global economy. Like the trend toward an information economy, this development is likely to reinforce the inclination of business leaders to increasingly consider their communication needs in more strategic terms.

From the U.S. perspective, the beginnings of a global economy can be traced back to the final decades of the 19th century and the rise of the large, multifunctional corporation, a number of which established branches or subsidiaries abroad. Many of these firms have continued to be highly successful. Taking advantage of being the first of their kind, they were able to use their size and complex corporate structures as effective barriers to entry to discourage potential, latecoming rivals.[38] U.S. multinational firms also had an advantage over their European counterparts, who were constrained in their operations by their much smaller domestic markets and, unlike American companies, were unaccustomed to competing on the basis of efficiency improvements and cost reductions.[39]

As European and Japanese economies recovered from World War 11 and managed to overcome the U.S. technological lead, however, this pattern of U.S. economic hegemony shifted significantly, and American multinationals increasingly found themselves competing intensely with their European and Japanese counterparts.[40] Japanese corporations, benefiting from their export-oriented industrial policy, have been particularly successful in their efforts to establish international connections by investing and producing abroad.

The proliferation of international economic actors has been facilitated and fostered by a number of developments. According to Michael Porter, these include:

. the growing similarity of countries, both with respect to tastes as well as to infrastructure, distribution channels, and marketing approaches;

[36] Marchand and Horton, op. cit., footnote 6, p. 24.

[37] Tom Valovic, "Public and Private Networks: Who Will Manage and Control Them?" *Telecommunications*, February *1988*, p. *42*.

[38] Chandler, op. cit., footnote *23*, pp. 408-409.

[39] Ibid., pp. 433-434. As Chandler has pointed out, in Europe, "the lack of antitrust legislation meant that market power was achieved and maintained in the domestic market far more by contractual cooperation than through functional and strategic differences. In those British industries where a single firm did not dominate, federations of relatively small, usually family enterprises, normally in the form of holding companies, maintained agreements ss to price, output, and marketing territories." Because of the dominant position of American firms, the term "multinational corporation" originally was, according to Robert Gilpin, "a euphemism for the foreign expansion of American giant oligopolistic corporations." The strength of the U.S. economic position was reflected by the fact that, in 1981, more than two-fifths of the world's direct foreign investment was accounted for by the United States, with the bulk of it being invested in advanced manufacturing, Moreover, foreign investment and the activities of American multinationals were increasingly critical to the U.S. economy in that, in the early 1970s, a sizable number of American corporations held more than $500 billion of their assets and gained more than one-half of their earnings abroad. Robert Gilpin, *The Political Economy of International Relations* (Princeton, NJ: Princeton University Press, 1987), p. 238.

[40] Ibid., p. 240.

- the emergence of a global capital market as witnessed by large flows of funds between countries;
- declining tariff barriers and the establishment of regional trading agreements;
- shifting opportunities for competitive advantage due to technology restructuring;
- the integrating role of advanced information and communication technologies;
- slow and uneven world economic growth that has fanned the flames of international competitiveness; and
- the emergence of new global competitors, principally from East Asia.[41]

Together, these developments have given rise to a global economy in which patterns of international trade now primarily reflect patterns of international production. Specialization takes place on the basis of parts and specialized components, rather than on the exchange of finished products as in the past. Today, for example, Japan provides approximately 40 percent of U.S. component parts in electronics and automobiles.[42] As Jack Behrman has pointed out, specialization has also taken place:

> . . . based on different product characteristics: mass consumption versus high fashion, or low quality versus high quality, or generic versus trademarked goods.[43]

Whereas in the past most multinational corporations tried to exploit comparative advantage by producing or selling in a single country, in today's global environment they are seeking more the comparative advantage that can be gained by integrating all their activities on a worldwide basis.[44] To compete globally, firms must allocate all their activities among a number of countries to gain the optimum advantage.[45] As Michael Porter has said:

> In global competition, a country must be viewed as a platform and not as a place where all of a firm's activities are performed.[46]

Thus, depending on the particular case, it might be best for a firm to disperse many of its production facilities—such as design modification, fabrication, and assembly-to foreign countries, and to focus its own domestic production on the fabrication of key components.[47] Or, alternatively, a firm might decide to manufacture a product domestically, but transfer abroad such downstream activities as distribution, sales, marketing, and service.[48]

Vertically integrating all of these activities, modern multinational corporations generally take the form of large, international oligopolies.[49] And where corporations are not fully integrated at the global level, they are often becoming linked to activities in other countries through alliances and contractual arrangements such as cross-licensing of technology, joint ventures, orderly marketing agreements, offshore production of components, secondary sourcing, and crosscutting equity ownership.[50]

In many cases, these multinational corporations are aided in their competitive endeavors by the increasingly protectionist and interventionist policies of their home governments. Whereas in the past protectionist policies generally were designed to protect an infant or declining industry, today they are calculated to enhance or even create a comparative advantage--especially in high technology, high value-added industries-by, for example, establishing export subsidies, tax incentives, or credit guarantees.[51] To the extent that governments can alter

[41] Porter (ed.), op. cit., footnote 23, pp. 2-3.

[42] Ibid., p. 255.

[43] Jack N. Behrman, *Industrial* Policies: *International Restructuring and Transnationals* (Lexington, MA: Lexington Books, 1984), P. 72.

[44] Porter (ed.), op. cit., footnote 23, p. 19.

[45] Ibid., p. 23.

[46] Ibid., p. 45.

[47] Ibid.

[48] Ibid.

[49] Gilpin, op. Cit., footnote 39, p. 241. As Gilpin has pointed out, the key factors accounting for the expansion and success of this vertical form of multinational enterprise are similar to those that led to the domination of the Nation's economy by large oligopolistic corporations.

[50] Corporate incentives to make such international arrangements are very strong. They stem from a number of technological, political, and economic factors, including: 1) a rapidly changing, high-cost technology that requires large firms to spread their risks; 2) new economic protective measures, making joint agreements a requisite for gaining market access; 3) the enormous capital requirements needed to operate globally; and 4) access to new technology. Ibid.

[51] Ibid., p. 216.

industry advantages, one can no longer speak of comparative advantage in the classic, economic sense, which calls for free trade.[52] Furthermore, these competitive policies are self-reinforcing. Because many countries are focusing their industrial policies in the same high-technology and service sectors, there tends to be overproduction in these areas and, hence, increased pressure for protectionist policies.[53] In the light of these developments, it is understandable why the international system of industrial production has been characterized as "a complex web of interlocking relations among nation states and the world's giant corporations."[54]

In such a highly competitive, global economy, companies must choose a worldwide strategy if they are to survive. Just as the railroad, telegraph, and telephone were essential to the development of the national corporation in the late 19th century, so, too, advanced communication technologies and networks will be essential to the modern corporation that seeks to pursue a global competitive approach. As the staff vice president for worldwide telecommunications at Unisys Corp., Detroit, has described it:

> Networking on a global scale is now mandatory for Fortune 100-sized companies. . . We agonized over buying some expensive circuits in some countries, but we don't have that issue anymore. It's too expensive not to order the stuff.[55]

Key *Business Activities*

To examine concrete situations in which new communication technologies might give rise to opportunities and constraints, it is necessary to divide economic activity into a number of subcategories. In selecting these subcategories for analysis, this chapter borrows heavily from the work of Michael Porter, who has identified nine generic "value-generating activities" that all businesses carry out in the course of their operations.[56] Each of these activities entails the formulation, exchange, and interpretation of information, and, hence, each might be significantly affected by the introduction of new communication technologies. As can be seen from table 5-1, Porter has divided the nine activities that he has identified into two groups: primary activities, which relate directly to the specific work that a firm does, and support activities, which are carried out on behalf of all activities.[57] For the purposes of this chapter, we will divide these activities into those of production and exchange.

Framework for Thinking About the Business Opportunities Presented by New Communication Technologies

As we have seen from our historical account, communication technologies can affect:

- the speed of economic transactions;
- the distance that, within any given timeframe, economic information can travel; and
- the relationships and interdependencies among economic actors.

These three mechanisms for change are also employed by Michael Hammer and Glen E. Mangurian in the framework they have developed for analyzing how new communication technologies are expanding the realm of business opportunities.[58]

In addition to these mechanisms, Hammer and Mangurian also define three different kinds of value that might be created by the use of new communication technologies. These values are: 1) improvements m efficiency, 2) effectiveness, and 3) innovation. Changes in efficiency reflect new or modified means for accomplishing tasks. Such modifications typically signify alteration in the speed or cost of operations. Effectiveness measures the fit between means and ends—how well or how poorly an end or goal is realized by a particular means. Organiza-

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[52] Ibid., p. 277.

[53] Behrman, op. cit., footnote 43, p. 11.

[54] Often focusing in areas involving advanced technologies, many of these corporations are very powerful. Their worldwide foreign direct investment in 1981 amounted to approximately one-half a trillion dollars, and the resources that many of them possess far exceed those of most nations. Ibid., p. 260.

[55] Margie Semilof, "Fortune 100," *CommunicationsWeek*, CLOSEUP, June 13.1988, pp. C12.

[56] Michael Porter, *Competitive Advantage: Creating and Sustaining Superior Performance* (New York, NY: The Free Press, 1985), ch. 2.

[57] Ibid., pp. 39-43.

[58] Michael Hammer and Glenn E. Mangurian, "The Changing Value of Communications Technology," *Sloan* Management Review, vol. 28, No. 2, Winter 1987, pp. 65-71.

Table 5-l-Key Business Activities

Production

- *Operations,* consisting of all those activities associated with the compilation of a product or a service, including design, manufacturing, and assembly.
- Service, entailing activities designed to maintain or enhance product value.
- Technology development, entailing the activities involved in research and development of all of the technological applications and know-how required by the firm.
- *Human resource management,* entailing all of the activities required for recruitment, hiring, and training.
- *Firm infrastructure,* entailing all those activities required for the planning, coordination, and management of a firm.

Exchange

- *Inbound Logisfics,* entailing the activities involved in receiving, storing, and distributing product inputs.
- *Outbound logistics,* entailing activities used in gathering, sorting, and disseminating finished products to buyers.
- *Procurement*
- *Marketing and sales*

SOURCE: Michael Porter, *Competitive Advantage: Creating and Sustaining Superior Performance (New York, NY:* The Free Press, 1985), pp. 39-43.

tional and managerial controls are especially important here. Innovation signifies modified ends.[59]

Pairing impacts and values, Hammer and Mangurian have developed a matrix for identifying changes in business activities, as can be seen in figure 5-2. In the discussion that follows, no attempt will be made to fill in all of the nine boxes in the matrix; however, this framework is helpful for thinking about and classifying the changes in the economic realm that might be brought about by the use of new communication technologies.

ANALYSIS OF BUSINESS ACTIVITIES

Operations

Business operations entail all of the activities that are associated with the compilation of a product or a service, including design, manufacturing, and assembly.

Improvements in the Efficiency of Business Operations

Computer-based communication can yield more efficient business operations by reducing interaction time in the exchange of information between persons, between persons and machines, and between machines. In manufacturing, for instance, the introduction of computer links between machines speeds up production and assembly.[60] In service firms, such as insurance companies and banks, communication systems increase the efficiency of transaction processing.[61] A well-known example from banking is the reduction of time required to process letters of credit using computerized files accessible from workstations in several departments. In retailing, the use of machine-readable product codes and automatic scanners in supermarkets yields increased efficiency in store operations. Checkout time, inventory control, and accounting operations can all be improved by linking the cashiers' stations to the store's computer and automatically capturing sales information at checkout.[62]

With enhanced speed, the time required to communicate across geographic distance is greatly reduced, which allows businesses to integrate and coordinate activities distributed in space and create additional efficiencies. In the case of automobile

[59] To identify all new business opportunities, it is necessary t. employ the values of effectiveness and innovation, in addition to efficiency. As Parker and Benson have noted, traditional cost-benefit analysis is no longer adequate for most information systems' applications that are innovative or that produce or enhance revenue. Rather, to fully assess new business opportunities, one needs to take into account a diverse range of values such as nonfinancial returns on investment, the establishment of a strategic match, greater competitive advantage, improved information management, a better competitive response, and a more strategic reformation systems' architecture. Marilyn M. Parker and Robert J. Benson, "Information Economics: An Introduction," *Datamation*, Dec. 1, 1987, pp. 86-87. All of these aspects of value can be subsumed under Hammer and Mangurian's three terms.

[60] For example, if several machine tools are linked to the same mini- or micro-computer, a sequence of machine operations can be executed automatically. When one machine completes an operation, a signal is sent to the control computer, which then initiates the next machine operation in the sequence. In this fashion, overall processing time can be significantly decreased. Such intermachine communication is being facilitated by the deployment of the communication standard known as Manufacturing Automation Protocol (MAP). Barnaby Feder, "How the System Works at a GM Plant," *The* New York *Times*, June 15, 1988, p. D8. For a discussion of technology and business operations, see Abbe Mowshowitz, "Communication and Comparative Advantage in the Business Arena: Operations and Technological Developments," OTA contractor report, July 1988.

[61] Keen, op.cit., fmmoted,Pp,49,51, For example, an application for automobile or life insurance can be processed by entering client data at a remote terminal linked to the company's computer system. The information on the application can then be transmitted electronically to the underwriting department. After processing--determining risks, computing premiums, etc.--a completed policy document can be produced on the computer by entering the appropriate parameters in a file containing the basic policy form, and then directing the completed form to a printer.

[62] Judith Graham, "Bar Codes Becoming Universal," *Advertising Age,* Apr. 18, 1988, p 36.

Figure 5-2--impact/Value Framework

Impact	Value		
	Efficiency	Effectiveness	Innovation
Time	Accelerate business process	Reduce information float	Create service excellence
Geography	Recapture scale	Ensure global management control	Penetrate new markets
Relationships	Bypass intermediaries	Replicate scarce knowledge	Build umbilical cords

SOURCE: Reprinted from "The Changing Value of Communications Technology," by Michael Hammer and Glenn E. Mangurian, *Sloan Management Review*, vol. 28, No. 2, Winter 1987, p. 66, by permission of the publisher. Copyright 1987 by the Sloan Management Review Association. All rights reserved.

manufacturing, for example, transportation and computer-based communication technologies have allowed companies such as General Motors to produce components in different regions of the United States and in other parts of the world and assemble them in a variety of locations. By distributing these operations, manufacturers have been able to take advantage of the special conditions in different regions, such as lower wage rates, cheaper material prices, less expensive power, and more liberal financing, etc., and thus reduce their production costs. Communication technologies, moreover, provide the links between central management and the various field units.[63] In addition, data communication facilities allow for real-time movement of information to and from computers, which is required to determine optimal, or near optimal, production schedules, resource allocation schemes, etc.[64]

The changed relationships brought about by the deployment of new communication technology have also resulted in greater efficiencies. This is evident in information systems where virtually all transaction processing begins with data entry. Since this function is usually dependent on human operators, it tends to be slow and error-prone. The efficiency of data entry can be improved by bringing the data closer to the database, as the power utilities are trying to do by equipping meter readers with hand-held computers. These instruments store the readings gathered in the course of a day's rounds. Periodically plugging the portable device into the telephone network through a modem, the meter reader transmits the data to the company's computer system for processing. This procedure eliminates a whole link in the data-processing chain. In bypassing the data-entry clerk, the time between reading and billing is reduced, and the opportunity for recording erroneous information is diminished.[65]

Improvements in the Effectiveness of Business Operations

The increased speed of communication can contribute to increased effectiveness by facilitating timely control, either periodically or on a real-time basis. Rapid information transfer figures prominently in the drive to improve effectiveness in manufacturing companies, for example. One such system is a network of machines in a factory. Instead of having to physically oversee operations on the shop floor, the foreman can get regular status reports from a computer in his office, as can the factory manager. Such reports might include, for example, an inventory of production volume for the whole factory, a list of equipment problems, or information on the work force.[66]

A more advanced application of computer-based communication technology would involve a factory cell designed to produce all parts to specification. Such a scheme is feasible when the machines in the cell are networked together and controlled by a computer, With continual machine reports on operations, the computer can determine, for example, whether a tool must be changed or some adjustment

[63] An increasing number of firms are using Very Small Aperture Terminal (VSAT) technology to provide these links. These firms include J.C and Prudential Bache. David Meyer, "Pru-Bache Invests in VSATS," *CommunicationsWeek*, Feb. 8, 1988, p. 1.

[64] In the service sector, communication technology is more closely associated with the end-product. Brokerage firms such as Merrill Lynch Prudential Bache buy and sell securities for millions of customers all over the United States and throughout the world. These customers are ser sales personnel in geographically dispersed offices. In banking, the automated-teller machine makes it possible for the retail banks to offer their in a variety of locations and settings, some of which are not traditionally bank sites at all. For a discussion of the communication needs of institutions, see Deborah G. Tumey, "Financial Institution Communication Systems," OTA contractor report, December 1986.

[65] Matthew L. Wald, "Eliminating the Meter Reader," *The New York Times*, May 4, 1988, p. D7. The banking industry also exemplifies eff gains due to restructured relationships. For example, the automated-teller machine alters the relationship between the customer and the bank. T result is that the customer performs some of the tasks that used to be done by bank employees.

[66] These systems are commonly called Executive Information Systems (EIS). Mary dee Ojala, "Wiring the Top Execs," *Online Ac* January/February 1988, pp. 3740.

made before the given machine begins to turn out defective parts. Comparable network applications occur in all types of business.[67]

Effectiveness is also enhanced as a result of the greater control that technologies afford in directing and coordinating geographically dispersed activities and objects. In the pharmaceutical and chemical industries, for instance, companies have to coordinate the movement of an enormous variety of raw materials and end-products with hundreds of different classifications, as well as different packaging, stability, distribution mechanisms, and production constraints. Managing this geographically distributed body of information requires an information system with terminals or workstations linked by data transmission lines to databases in one or more computers.[68]

The ability to network communication among disparate locations also provides businesses with greater flexibility and, in so doing, improves their effectiveness. Because computer-based communication can monitor operations on a real-time basis, management can respond immediately to changes in demand and issue orders to one or more manufacturing plants to reduce or increase output accordingly. Moreover, because programmable machine tools can rapidly be redirected to machine cams, for example, instead of gears, new communication technologies permit manufacturers to tailor highly differentiated products to customer specifications.[69]

Altered relationships brought about by technology can also contribute to effectiveness. An important manufacturing example relates to the linkage between product design and engineering. To the dismay of many engineers and managers, the traditional separation of these two functions has often created a mismatch between product specifications and manufacturing processes. With the introduction of computer-aided design and computer-aided manufacturing, these two departments can be joined by setting up a networked database containing part specifications that is accessible to both design and engineering departments. Such an arrangement would improve effectiveness by eliminating intermediate operations, thereby facilitating a tighter coupling of means and ends.[70]

Innovative Business Operations

In addition to stimulating improvements in efficiency and effectiveness, the speed of computer-based communication makes it possible to do things that would otherwise be impossible. The distinctive features of the new communication technology in this regard are memory and processing power.

The financial services industry, for example, abounds with new products that are dependent on rapid computer-based communication. Retail banks offer electronic checkbooks to ordinary clients; merchant banks offer somewhat more sophisticated instruments to wealthy individuals and corporate customers. But all of these new products—portfolio, cash, and treasury management systems, as well as electronic checkbooks—require real-time access to market information.[71] An entirely new business that is being brought into existence by computer-communication is that of online vendors, such as Lockheed Data Systems, System Development Corp. (SDC), and Mead Data Central, who provide bibliographic, financial, legal, and many other types of data to a variety of business and government clients .72

In addition to speed, the distributive capabilities of the new communication technologies give rise to new opportunities for innovation. One such innovative product is a financial-industry offering called treasury management systems. These are designed to assist corporations in managing assets and liabilities—such as cash, notes, bonds, and debts—in various currencies throughout the world. Workstations and software are supplied by the bank. The corporate client can obtain account information and a variety of other data, such as currency exchange rates, from the workstation that is connected to the

[67]Gains in this area can be considerable. In the United States, for example, one. fourth of all manufacturing costs goes into maintaining quality. The costs tend to be high because product defects are generally only detected at quality-control stations at the end of the assembly line. Manfred Kochen, "Advanced Information Technology and Small Manufacturers," Science, April/May 1986 p. 26.

[68]Semilof, op. cit., footnote 55, pp. C12-C13.

@Ibid.

[70]John Krouse, "Engineering Without Paper," *High Technology,* March 1986, pp. 38-46.

[71]Keen, op. cit., footnote 6, p. 45.

[72]See Peter W. Huber, *The Geodesic Network: 1987 Report on Competition in the Telephone Industry,* Antitrust Division, U.S. Department of Justice (Washington, DC: U.S. Government Printing Office, January 1987), ch. 7.

bank's computer. Apart from providing "electronic checkbook" services, treasury management systems offer decision support on the choice of investment vehicles.

Restructured relations can also affect innovation. New shipping services, for example, involve installing computer terminals in customers' offices. Through these terminals, shippers can communicate with a shipping company's computer, both to initiate transactions and obtain information about shipments. This direct connection between shippers and shipping companies reduces dependence on intermediaries such as freight forwarders and customs boarders.[73] The cash management and treasury management systems offered by banks also allow customers direct access to banking computers. These new offerings exemplify the substitution of products for traditional services.

Service

Providing after-sale service includes activities that enhance the value of one's product, such as installation, repair, training, parts supply, and product adjustment.[74]

Efficiencies in the Provision of Service

With rapid computer-based communication, producers can now design systems that speed and facilitate service. Some systems provide instructions for repair and service; others repair problems as they arise. Many new photocopying machines, for example, display a coded message indicating a problem and what it entails. Some products even have instructions for repair embedded in them. Machines can also be linked to fault-analysis computers operated by producers. In this fashion, one heavy-machine manufacturer has designed its system so that when a customer's machine fails, it automatically sends a signal to the manufacturer and diagnostic information is returned immediately. Meanwhile, spare parts are dispatched and the firm's field service unit is alerted.[75] In some cases, repairs can be made online, as in an automated factory.[76]

More Effective Service Provision

By improving customer service, these gains in efficiency also give rise to greater effectiveness. Using a computer-based communication network, Mercedes Benz, for example, not only provides car owners with a toll-free 800 number to call for service; it also helps the driver to find a service provider, no matter where in the United States the driver might be. Mobile telephone and paging services also improve service delivery by linking repair personnel to their offices while they are on the road.[77] With continual access, they can easily learn about schedule changes and hear directly from clients. Improvements of this kind make firms more competitive.

Innovations in Customer Service

By allowing producers to maintain records that are more accessible and detailed, computer-based communication technologies give manufacturers a chance to create new service products. For instance, one pharmacy uses its database to analyze the combination of drugs sold to individuals to discover whether they might create dangerous synergisms.[78] Service providers can also provide ancillary services based on the data they collect about buyer purchases. For example, one national drug company offered their pharmacy customers detailed analyses of their sales, including the profitability and turnover ratios of different items, based on their orders over a period of time.[79] The company also offered to print price labels for pharmacies. Bar-code scanners allow retailers to sell producers special "maintenance" services, detailing information about buyers' purchasing habits.

Technology Development

Technology development is a support function within the firm. It consists of all of the activities that

[73] The trucking firm, PIE Nationwide, Inc., updates its customers' computer three times a day, giving the location of each shipment and listing any problems. David Wessel, "Computer Finds a Role in Buying and Selling, Reshaping Business," *The Wall Street Journal,* Mar. 18, 1987, pp. 1, 10.

[74] Porter, op. cit., footnote 56, p. 40.

[75] Keen, op. cit., footnote 6, p. 54.

[76] Cash et al., op. cit., footnote 6, p, 52; see also Clemens and McFarlan, op. cit., footnote 6, p. 95.

[77] See Alan A. Reiter, "New Pagers Put a Mailbox in Your Pocket," *High Technology Business,* April 1988, P. 32.

[78] David Stipp, "Scientists Use Medical-Record Data Bases t. Detect Adverse Side Effects of Dregs," The *Wall Street Journal,* Mar. 24, 1988, p. 33.

[79] Keen, op. cit., footnote 6, p. 47. A major distributor of magazines to newsstands and stores used its sales records to produce sales analyses fOr its small, unsophisticated customers about their absolute and relative standings. Cash et al., op. cit., footnote 6, p. 46.

are associated with research and development with respect to all technological applications and specialized knowledge required by the firm.

Efficiency Improvement in Technology Development

The increased speed of transmission and processing contributes greatly to efficiencies in technology development. For example, online retrieval systems, such as those offered by Lockheed and SDC, greatly facilitate and reduce the costs of tracking developments in any given subject area. Electronic mail and computer-conferencing are also important in maintaining research networks. Not only does electronic mail have the virtue of speed, like the telephone; it also frees parties from having to be simultaneously connected to a common communication channel. Such informal exchanges keep those in the network abreast of latest developments long before the appearance of formal publications and presentations. Computer-conferencing couples the message-handling capabilities of electronic mail with the file-management facilities of a computer system, enabling groups of researchers to participate in seminars that have neither a fixed schedule nor a fixed location.

By overcoming geographic restrictions, new communication technologies allow businesses to take advantage of the economies of global technology development. Efficiency gains are particularly evident in two areas: intelligence gathering and professional networking. One way of carrying out these two activities is to set up and maintain listening posts to monitor R&D centers throughout the world. One example is the program setup by the Advanced Products Manufacturing Engineering Systems group (APMES) at General Motors' Technical Center in Warren, MI. Designed to systematically follow all technological developments related to automobile manufacturing, listening posts that report back to headquarters regularly have been established in most major R&D centers.

Changed relationships also create new efficiencies in technology development. High-speed data transfer between computer systems eliminates the need for human intermediaries to transmit information. This improves efficiency in joint projects that involve more than one research center, as well as in projects consisting of a sequence of tasks that share the same database. In the first case, efficiencies would result from the timely exchange of data; in the latter case, from better coordination.

Enhancements in Effective Technology Development

Enhanced effectiveness associated with time compression is most evident in the area of R&D management. By making it possible to monitor activities on a real-time basis, computer networks allow managers to track the progress of various teams and subgroups in a large project. By using the technology to implement a matrix system of organization, management can use all of the organization's resources to their best advantage. This ability is especially useful for technology development because of the difficulty in anticipating and concentrating all of the expertise required for a complex research project.

More effective technological development can also be brought about through changed relationships. In some companies, research data are now being integrated into other corporate information systems, allowing for their more effective use throughout an entire organization. For example, the integration of systems at the Marion Laboratories Inc. allows the R&D department to send the formula for a new drug, along with the engineering process control data, directly to the manufacturing department. This same information is sent to the sales and marketing department where it is used to help create educational materials for physicians to use when testing the drug.[80] Similarly, the R&D department at a Detroit auto-parts manufacturer has developed a computerized performance program that allows the department to evaluate bearings and transmit specifications to their automotive customers via the corporate mainframe.[81]

Human Resource Management

Human resource management entails all of those activities required for recruitment, hiring, and training of company personnel.

[80]David Stamps, "In Search of Synergy: Linking *R&D to* Corporate IS," *Datamation*. July 1, 1988, p. 71. For a discussion of communication technology and technology development, see Mowshowitz, op. cit., footnote 60.

[81]Ibid.

Efficiencies in Human Resource Management

One way to reduce the cost of training is to reduce the travel time and costs necessary to aggregate trainers and trainees in a single geographic location. Transmission media allow for this by linking dispersed trainers and trainees via satellite and wire lines. Live presentations can be communicated to trainees who can ask the trainer questions via voice links. Interactive training sessions may take the form of teleconferences or video conferences especially tailored for a single company or to address a narrow issue.[82] Hewlett-Packard was one of the first to design such a program in 1983, installing satellite receivers at 50 field offices.[83] By the end of 1987, about 40 companies had followed suit, setting up private video networks linking more than 6,000 sites. In addition, a number of companies joined together to establish one entity, the National Technical University (NTU), which offers regularly scheduled videoconferencing courses.[84] The costs of videoconferencing are declining, due to new compression and slow scan video technologies that allow pictures to be sent over a handful of telephone lines.[85]

Effectiveness in Human Resource Management

While communication networks can bridge geographic distances between trainers and trainees, the use of new storage media, given their portability, is often more effective. Like books, stored media can be consulted at the convenience of trainees, at their workplace or even at home. Moreover, difficult portions of the material can be repeated, with trainees working at their own pace. Videotapes are also being used to tape the actions of trainees so their behavior can be observed and critiqued. Trial lawyers, athletes, salespeople, and managers are among those who have found such devices beneficial.

The interactive capabilities of computers also enhance training effectiveness. Computer simulations, for example, allow trainees to interact with others on two levels—indirectly through the computer program, and directly as part of the simulation.[86] Using computer-based training, the Department of Defense has been particularly pleased with how it has helped teams of tanks to work together in maneuvers.[87] Other evidence suggests that when course-work is well designed, incorporating simulation and expert analysis or supervision, computer-based training can raise the productivity of training significantly .88

Interactive video/CD-ROM has also proved to be an excellent training device. Its high visual quality, features such as touch-screens, and ability to simulate actual equipment and situations and focus on individual learning problems make this technology particularly engaging.[89] As the cost of producing interactive video software declines, videodisks are become more competitive with videotapes.

Firm Infrastructure

The infrastructure of a firm entails all of those activities required for planning, coordination, and management.

Enhanced Efficiency and Effectiveness in Maintaining the Firm's Infrastructure

Just as computer-based communication can make business operations more efficient and effective, they can also be employed to plan, coordinate, and

[82] Herb Brody, "Business TV Becomes Big Business, " *High Technology Business*, May 1988, pp. 26-30; U.S. Congress, Office of Technology Assessment, *Technology and the American Economic Transition Choices for the Future.* OTA-TET-283 (Washington, DC: U.S. Government Printing Office, May 1988), p. 251; and B. Zimmer, "A Practical Guide to Video Con ferencing," *Training and Development Journal*, May 1988, p. 84.

[83] Brody, op. cit. footnote 82, p. 26.

[84] Headquartered in Fort Collins, CO, NTU now coordinates more than 450 courses offered by faculty frOm mOre than 24 participating universities! to students at more than 40 companies (in more than 60 sites equipped with satellite dish receivers) as part of a Master's degree program. NTU fills two channels (on a Ku-band satellite) 24 hours a day with both live and taped courses, Other business-TV networks that provide training services to multiple companies include Automotive Satellite Television Network, Food Business Network, and Hospital Satellite Network. Ibid.

[85] Susan Dillingham, "Videoconferencing May Get Less Costly," *Insight on the News, May* 9,1988, p. 47.

[86] Shlomo Maital and Kim Morgan, "Playing at Management," *Across the Board*, April 1988, pp. 54-62.

[87] Ibid.; see also Office of Technology Assessment, op. cit., footnote 82, p. 59.

[88] Another form Of computer-based training, called embedded instruction, involves the design of microchips within machines so that workers can be automatically instructed about how the machines should be used and repaired, Office of Technology Assessment, op. cit., footnote 82, p. 246; see also U.S. Congress, Office of Technology Assessment, *Technology and Structural Unemployment: Reemploying Displaced Adults,* OTA-ITE-250 (Springfield, VA: Nationat Technical Information Service, February 1986), p. 292

[89] Ibid., *Technology and Structural Unemployment*, p. 298. The capability of interactive feedback not only permits trainees to minimize repetition and to repeat difficult materials at their own pace; it also means that trainee programs can be custom-tailored to each trainee's progress.

manage the affairs of the entire firm, no matter how dispersed the operations are or where they are carried out. The OTIS elevator company, for example, which was previously comprised of 100 local offices, now employs a computer-based communication network to centrally coordinate the activities of its repair force. When clients call, they report their problem to a highly trained and perhaps multilingual operator, who records the information in a computer and dispatches repair personnel via a telephone/beeper system. When the repair is made, the information is again stored in the computer so that senior management can track repair efforts and deal with special problems, perhaps requiring specialists, as they arise. Moreover, the recorded fault data, which are also immediately available to the company's engineers and designers, can be analyzed by management to see if there are any recurring problems that might require more general corrective action. With a system such as this, problems can be dealt with much more expeditiously than previously when up to five levels of management stood between the problem and the solution.[90]

Similarly, a major hospital center in Boston uses a relational database to carry out day-to-day management, to perform retrospective analysis, and to plan for the future.[91] This database keeps track of the "products" the hospital provides (such as a particular kind of operation), as well as the hospital resources that will be required to provide them. Using this product/resource list for annual planning purposes, the hospital will multiply each set of resources by the number of patients expected in each category. The hospital can also keep track of the use of resources—in terms of resource category, department, product, or physician-on a day-to-day basis, as patients are cared for. Moreover, the hospital can improve its budget planning process by making detailed comparisons of past budgets.[92]

Inbound Logistics

In the past, businesses that did not want to risk running out of particular materials or products were forced to stockpile large quantities of inventory, which not only tied up their money but also increased their physical storage costs. Today, they use computers to store inventory data and optical scanners and other input devices to instantly adjust inventory levels, significantly reducing their costs. Even more significant may be the ability of suppliers and customers to share such inventory data in a common database. For when suppliers have access to customers' inventory levels, they can institute just-in-time purchasing.[93]

Outbound Logistics

By employing new communication technologies to help provide delivery service of both tangible goods and less tangible information products and services, producers and retailers can expand their markets. The greatest difficulty in coordinating delivery is the task of handling the data of multiple buyers and sellers, and developing the most efficient schedules to accommodate multiple needs. These tasks can be easily handled with standardized forms and computer-based communication, as overnight delivery services, such as Federal Express and United Parcel Service, have clearly demonstrated. A less centralized form of online coordination is being used by truckers in France who consult a special Minitel "deliveries needed" database when they have extra space in their trucks.

Where the cost of home delivery is inherently expensive due to low population densities or poor traffic conditions, another delivery alternative might be to use network arrangements to set up central pick-up locations, much as banks have done with automated-teller machines. "Enhanced private post offices" such as these already exist.

The delivery of information products and services can be made still more efficient by using new communication technologies that provide video entertainment to the home for a fee. Moreover, with optical fibers, video entertainment could be delivered on demand in the form of what might be best described as a video jukebox.

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[90] John F. Rockart, "The Line Takes the Leadership--IS Management in a Wired Society," *Sloan Management Review*, Summer 1988, p. 58.

[91] Ibid.

[92] Ibid.

[93] Richard J. Schonberger and James P, Gilber, "Just-in-Time Purchasing: A Challenge for U.S. Industry," *California Management Review*, vol. 26, *1983*, pp. *54-68.*

Procurement

Efficiency

The new communication technologies are permitting firms to improve the efficiency and effectiveness of their procurement processes. Already, many firms are using electronic data interexchange (EDI) networks to place orders, and thus avoid the time and trouble of filling out procurement forms.[94] In fact, some firms even refuse to purchase from suppliers who are not equipped with EDI.[95]

Firms are also using electronic networks to do better and more economic comparative shopping. Using electronic market networks to connect with a number of sellers, businesses can, first, eliminate those suppliers whose products are clearly inappropriate, and second, compare the rest of the offerings quickly and economically.[96] For this purpose, some firms insist on having access to their suppliers' inventory records and prices.

Procurement might eventually even be automated. As James Cash has pointed out, the combination of computers and standard communication protocols facilitates comparison shopping, and hastens the day when manufacturers will use their computers to scan suppliers' computers and automatically place orders for the best deals.[97]

The opportunities for efficiency gains in procurement are especially great when firms are purchasing information services. The use of electronic networks to share databases greatly reduces information costs. Law firms that need immediate access to a wide range of judicial decisions can now secure this information by subscribing to Lexis or Westlaw at a fraction of the cost of stocking a firm law library. And high-speed, high-capacity data links make it possible for firms to have data processing services conducted off-site by firms such as Electronic Data Systems. In this fashion, geographically dispersed firms can share the benefits of a supercomputer for their processing needs. In addition, with access to long-distance suppliers, firms can now treat quality and expertise as more important selection criteria than geographic location.

Marketing and Sales

Efficiency

Rapid, computer-based communication allows for increased efficiencies in both marketing and sales. And, with reduced costs, producers and retailers are able to carry out their operations much more effectively than ever before.

Given cost constraints, for example, producers and retailers try to limit their advertising audiences to those who, on the basis of some preestablished set of characteristics, would be the most susceptible to it. Identifying the appropriate audience requires market research analysis about past buying habits and consumer tastes. The better the data, the more cost-effective the advertisement. Improved storage and reprocessing capabilities make it economical to collect more of these market research data and to combine them with other data for quick and effective analysis.

Manufacturers can also target their advertising using narrowcasting cable systems. For example, advertisers can now reach young people through MTV, the highly educated through Cable News Network, or the sports-minded through the Entertainment Sports Programming Network.[98] And, for advertisers who lament the days of fewer but larger audiences, there is the option of making a single call to make a cross-buy—that is, to place a single message on multiple channels to reach all audiences.[99]

As the penetration of personal computers and modems increases, there will be another way to distribute advertising. Already messages can be sent via electronic mail, but new videotex systems offer opportunities that are much more novel. The Prodigy system introduced by Trintex is an example. Advertisements are included within other messages along the lines of a newspaper ad, but with a number of key

[94] Willie Schatz, "EDI: Putting the Muscle in Commerce and Industry," *Datamation*, Mar 15, 1988, pp. 56-64. See also Michel Ball, "EDI Takes Root." *Computerworld*, Sept. 7, 1988, pp. 23-26; Paul Korzeniowski, "User Push Is on for International EDI," *CommunicationsWeek*, Jan. 9, 1989, pp. 1, 40; and Mitch Betts, "Lawyers Fret Risks Over EDI Growth," *Computerworld*, Jan. 16, 1989, p 17

[95] Ibid.

[96] Wessel, op. cit., footnote 73, pp. 1, 10.

[97] Daniel Bell, "The World and the United States in 2013," *Daedalus*, vol. 116, No. 3, Summer 1987, P. 12.

[98] Joanne Lipman, "Fourteen Cable Networks Form Alliance to offe, Advertising Time in Package," *The Wall Street Journal*, Feb. 19, 1987, p. 12.

[99] Ibid.

differences. First, the ads are presented as "ticklers" that viewers may ignore or pursue further by request. Second, the ads can be stored so that they are only offered to viewers whose personal profiles meet the target requested by the advertiser. Third, the advertiser can be charged based on the number of viewers that actually choose to see the ad.

New communication technologies are also reducing the cost and effort required to produce advertising. Desktop publishing equipment permits manufacturers to create and send printed materials more easily and less expensively. Even more savings can be obtained using automatic-dialer, recorded-message-player machines.

In addition to generating savings in marketing, new technologies also give rise to more cost-effective sales. Computer-based communication permits simple orders to be taken by automated systems 24 hours a day, and more complex orders to be placed and processed more quickly and efficiently. Simple orders, for instance, can be taken by basic audiotext systems that employ branching programs to query customers and, on that basis, create individualized orders. More complex orders, entailing large amounts of data and difficult forms, can be handled using computerized, standardized purchase orders sent via dedicated EDI lines.

Effectiveness

Some commercial information that changes rapidly—such as financial data or information regarding the availability of items in limited supply—is extremely time-sensitive. Moreover, making purchasing choices on the basis of such information often requires simultaneous comparison of data. To deal with such situations, networking technologies are proving very successful because they can be used to create virtual markets.[100] These networks are being established in a number of different ways. In some cases, sellers, such as airlines, are creating their own systems and offering buyers access to their databases.[101] In others, independent third parties are establishing network markets to connect multiple buyers and sellers. Comp-U-Card, for example, connects more than 500 manufacturers, wholesalers, and retailers on one computer database for home shopping.[102]

Manufacturers and retailers are also using transmission and storage technologies to extend the geographic reach of their markets. The increasing number of video transmission channels< able, multichannel multipoint distribution service (MMDS) [also called wireless cable], and low-power television (LPTV)--permits sellers to let buyers browse through products on live or taped home-shopping television programs. However, because these media are not interactive, this form of teleshopping is limited in how responsive it can be to buyers' specific needs. By far, the most effective technologies for storing and accessing large quantities of commercial information are compact disks, floppy disks, video cassettes, and even digital paper. These storage media permit tens of thousands of pages/frames of information to be distributed to consumers, and trends suggest that storage levels will significantly increase over time. With the penetration of VCRs to 53.8 percent of U.S. households, sellers are encouraged to produce full-motion video catalogs or videologs of their products. Although even more advanced storage media are now available, the hardware required for their use is too costly for consumers. One way of decreasing display costs is by information-sharing via an electronic network.

Changed relationships can also lead to improved marketing and sales effectiveness. By offering buyers hardware and software that facilitate electronic data interexchange, the seller can cement his relationship with the buyer because he makes it more expensive for the buyer to switch to other suppliers.[103] Some sellers have gone one step further, helping buyers to determine what orders to place, given their past ordering record and general industry sales. The McKesson drug company, for example, uses such a system to encourage the sale of its drugs to pharmacies.[104]

[100]Robert I. Benjamin, Thomas W. Malone, and JoAnne Yates, "Electronic Market\ and Electronic Hierarchies," Sloan School of Management Working Paper, #1770-86, April 1986.

[101]In fact, airlines are now joining together to share the costs and to facilitate buyers' access. Helen Wheeler, "New Savvy in the Skies," *High Technology*, November 1987, p, 36.

[102]Russell Mitchell, "How Comp-U-Card Hooks Home Shoppers," *Business Week*, May 18, 1987, p. 73.

[103]Schatz, op. cit., footnote 94, pp. 56-@.

[104]"An Electronic Pipeline That's Changing the Way That America Does Business," *Business Week*, Aug. 3, 1987, p. 80.

Innovation

The widespread use of storage and reprocessing technologies in business is creating new sources of marketing data for advertisers. Many businesses initially adopted computers to improve the speed and accuracy of billing as well as coordination. However, given the decline in information-storage costs and the growing value of transactional data, many of these businesses now recognize the market value of their records.[105] Most travel agents, hospitals, banks, universities, insurance companies, and cable television systems, among others, record their marketing data for their own purposes or to sell to others. The development and widespread use of optical scanning technologies by retailers will undoubtedly stimulate this trend.[106] Also, single-source research firms are now monitoring the TV shows people watch, where they shop, the coupons they use, the brands they buy, and even the newspapers they read.[107]

IMPACTS ON ECONOMIC PLAYERS

The deployment of new communication technologies in the past has given rise to uneven effects. Similarly, the uses of communication technologies, as described in this chapter, will entail losses for some and create benefits for others. Commenting on the differential impacts of new technologies with respect to competition among firms, Michael Porter has noted, for example:

> [Technology] is also the greatest equalizer, eroding the competitive advantage of even well entrenched firms and propelling others to the forefront. Many of today's great firms grew out of technological changes that they were able to exploit. Of all the things that change the rules of competition, technological change is among the most prominent.[108]

To determine the structural impacts of new communication technologies and how their costs and benefits might be distributed within the economic realm, it is necessary to identify the players involved in economic activities and describe the basis on which they are they related to, or dependent on, one another. As before, production activities will be treated separately from exchange activities to reflect differences in players, the environments in which they operate, their roles, and their motivations.

Players and Role Relationships in Production Activities

Production entails the acquisition, coordination, and use of labor, capital, and technology to create goods or services. The ways in which people have organized to carry out these activities, and the socioeconomic or philosophical principles that have served to legitimate particular kinds of work relationships, have varied considerably over time and in different historical and cultural circumstances.[109] In preindustrial societies production was carried out, for the most part, within the family system.[110] With industrialization and the expansion of markets, the tasks that comprised the production process became highly differentiated and specialized, requiring that bureaucratic organizations, in the form of corporations, be established to integrate them.[111]

Because most business organizations are formalized and relatively structured, their members' roles and relationships are reasonably well defined. Using the schema developed by Henry Mintzberg, as depicted in the shaded area in figure 5-3, we can identify five major players involved in the internal, productive activities of a corporation. They are the:

1. chief executive officer, who assumes the position at the top of the hierarchy of authority;
2. operators, who are responsible for producing goods and services, and those who provide

[105] Eileen Norris, "Databased Marketing Sets Enticing Bait," *Advertising Age,* Jan. 18, 1988, p. S10.

[106] Stewart Brand, *The Media Lab: Inventing the Future at MIT (New* York, NY: Viking Press, 1987).

[107] Joanne Lipman, "Single Source Ad Research Heralds Detailed Look at Household Habits, "The *Wall StreetJournal,* Feb. 16, 1988, p. 39. Of course, as already mentioned, this information is made more valuable by reprocessing technologies that enable market researchers to analyze the massive amounts of data collected.

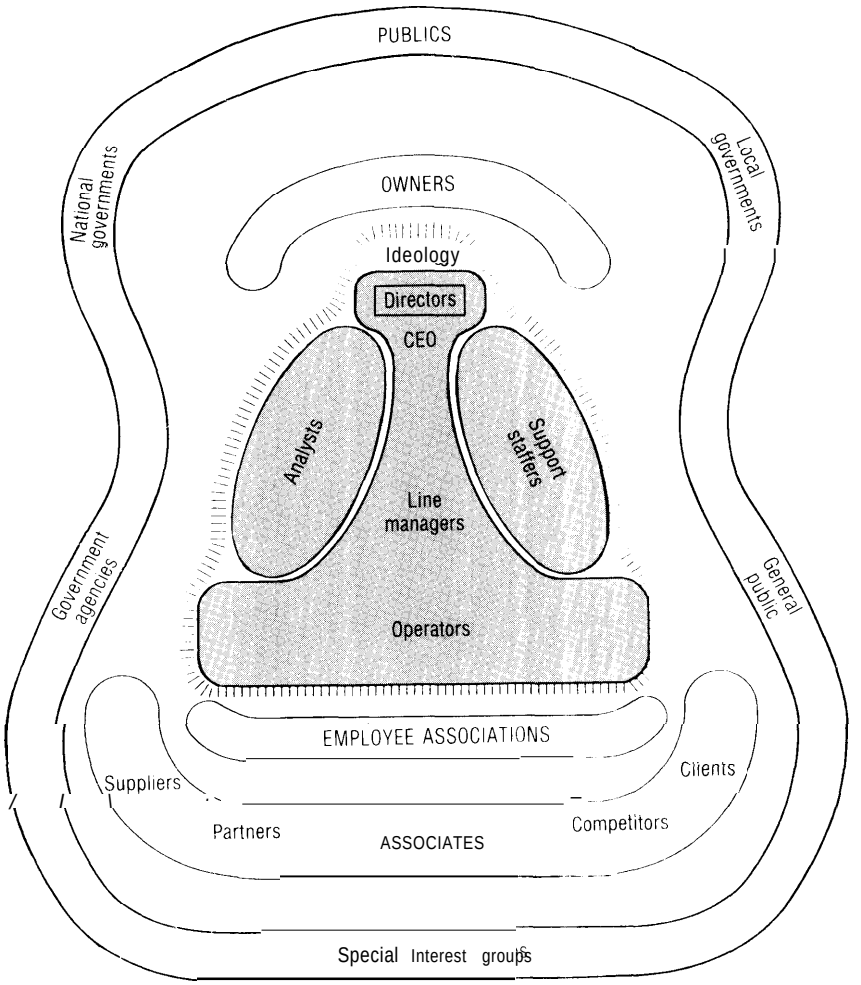
[108] Porter, op. cit., footnote 56, p. 164.

[109] Zuboff, op. cit., footnote 5, pp. 224-244.

[110] For a description of the production of textiles in England both before and after industrialization, see Neil J. Smelser, *Social Change in the Industrial Revolution: An Application of Theory to the Lancashire Cotton Industry 1779-1840* (London: Routeledge & Kegan Paul, rid.).

[111] For a sociological account of the role of bureaucratic Organization in economic developments, see Beniger, op, cit., footnote 11. For an historical account of the emergence of the modern industrial corporation, see Chandler, op. cit., footnote 22.

Figure 5-3--The Cast of Players



SOURCE: Henry Mintzberg, *Power In and Around Organizations,* Copyright 1983, p. 29. Reprinted by permission of Prentice-Hall, Inc., Englewood Cliffs, NJ.

direct support for them;

3. line managers, "who stand in the hierarchy of line authority from the CEO down to the first-line supervisors to whom the operators formally report;"

4. analysts of the technostructure, whose work entails the design and operation of planning and control systems; and

5. support staff, including secretaries, researchers, and legal counsel.[112]

Table 5-2 summarizes the roles and relationships among these five different sets of players in business organizations, and describes how members of each group typically use their influence within different spheres to achieve their primary goals. By examining how the deployment of the new communication

[112]Henry Mintzberg, *Power In and Around Organizations* (Englewood Cliffs, NJ: Prentice-Hall, Inc., 1983), pp. 232-233.

Table 5-2—The Internal Influencers and Their Play of Power

	Their *role* in the Internal Coalition	The *goals* they favor	Their prime *means of influence*	Their main *reasons for displacement* of legitimate power	Their fields *of play* of internal power	Their favorite *political games*
Chief Executive Officer ., .,	Overall management of it.	Survival and growth.	Authority (personal and bureaucratic), privileged knowledge, privileged access to the influential, political skills, sometimes ideology as well.	Maintain personal power.	Decisionmaking.	Strategic candidate, counter-insurgency.
Line managers ., ...	**Management of its individual units.**	**Growth above all (of units and organization), survival,** balkanization.	**Authority (decreasing as descend hierarchy),** privileged information, political skills, sometimes expertise.	**Distortions in objectives, suboptimization, direct** links to external influencers.	**Decisionmaking, advice giving, and execution** (with respect to upper levels).	**Sponsorship, alliance and** empire building, budgeting, line v. staff, strategic candidate, rival camps, sometimes lording, insurgency, and young Turks.
Staff analysts .,.. ,	Design and operation of its systems of bureaucratic control **and adaptation.**	Bureaucratization, economic efficiency, **perpetual but moderate and well-regulated change, professional** excellence.	Bureaucratic controls, expertise.	Means-ends inversion, direct links to external **influencers.**	Advice giving.	Expertise, line v. staff, strategic candidate, **sometimes whistle blowing and young Turks.**
Support staffers	**Indirect support of its operating functions**	**For** professional **staff collaboration, perpetual but moderate change, professional excellence, for unskilled staff: protection of social group.**	**Expertise (for professional staff), Political will (for unskilled staff, when act in concert).**	Suboptimizatlon, **means-ends reversion, direct links to external influencers.**	Advice giving	**Expertise, strategic candidate (for professional** staff).
Professional operators .	Provision of its operating functions,	Autonomy, enhancement of specialty, professional excellence, mission.	Expertise.	Means-ends inversion, direct links to external influencers,	Decisionmaking, execution.	Expertise, strategic candidate, sometimes young Turks.
Unskilled operators	Provision of its operating functions.	Protection of social group.	Political will (when act in concert).	Group means-ends reversion.	Execution.	Insurgency, lording, whistle blowing.

SOURCE: Henry Mintzberg, *Power/n and Around Organizations,* Copyright 1983, pp. 232-233, Reprinted by permission of Prentice Hall, Inc. Englewood Cliffs, NJ.

technologies, as they are applied to create new business opportunities, might affect each set of players' roles, goals, and means of influence-as they are described in this table—we can draw some conclusions about how improvements in efficiency, effectiveness, and innovation might affect those involved in the production process.

Potential Impacts of New Business Opportunities on Players in the Production Process

Chief Executive Officer

In the discussion of business opportunities, we have seen how computer networking and decision-making tools can provide managers with greater control and more timely and convenient information. At the same time, however, if these communication systems are poorly planned and deployed, they can contribute to poor decisionmaking and the deterioration of top management's authority.

Within a business firm, communication has traditionally been channeled and controlled by the people occupying positions in the management hierarchy. The rules governing communication reflect the organizational patterns of authority. Managers up and down the line interpret and pass on messages to those above and below them in the hierarchy. In the process, messages are sorted out, refined, and tailored to the organizational needs of the receiver. In this fashion, the chief executive maintains and supports his privileged position as the most knowledgeable—and, hence, the most powerful-person in the organization.

Bypassing many of these organizational gatekeepers, computer networks open the doors to both unauthorized communication and information overload, making it harder for chief executive officers to perform their roles. The distribution of electronic information is hard to control, and it can be exchanged or destroyed without a trace. Moreover, on computer networks, information tends to be distributed casually, to everyone, so that all receivers have to read each message and determine its particular value for them. Communication over computer networks also tends to be very informal and imprecise.[113] Electronic mail is, moreover, subject to considerable misinterpretation, because it "does not provide the receiver with any contextual clues about the sender's intent. ''114 Given so many possibilities for distortion, the information the chief executive receives through electronic channels may be greatly inferior to that which is filtered through the organizational hierarchy.

Recognizing the linkages between electronically mediated communication and the quality of information received, many top executives are now becoming increasingly involved in the design of corporate communication systems.

Operators

Operators carry out the basic work of a business organization. Being the furthest away from the center of authority, they have minimal personal leverage, especially if they are unskilled.[115] To have an effect on the organizations for which they work, and to be able to influence their roles within them, operators have had to band together to act in concert. Given their lack of personal influence and their dependence on their cohorts, it is not surprising that, of all of those who are involved in production activities, operators identify the least with the organization's formalized goals, and value very highly their established social relationships with peers.

To the extent that operators have no organized base of power, they will have little control over how communication technologies are employed in the work environment. Much will depend, therefore, on how management regards the opportunities presented by new communication technologies. As the OTA report, *Computerized Manufacturing Automation: Employment, Education, and the Workplace,* pointed out:

> Depending on how tasks are arranged and jobs designed, programmable automation has the potential to decrease the amount of autonomy, control, and challenge available to the worker, or it can increase variety and decisionmaking opportunities.
>
> Management's strategies and motivations for introducing programmable automation are key in determining its impacts. In addition, the nature of

[113] Sara Kiesler, "The Hidden Messages in computer Networks," *Harvard Business Review,* January/February, 1986. As Kiesler notes, whereas employees may take great care in composing paper memos accounting for their activities, they are much more inclined to send electronic mail messages in haste and without much reflection.

[114] Ibid., p. 47.

[115] Mintzberg, op. cit., footnote 112, pp. 13 0-13 1.

> labor-management relations will affect the implementation of new technology and its consequences for the work environment [116]

For many who view the new technologies through the lens of an industrialized past, the primary value of communication technologies lies in their ability to reduce costs and to enhance control over operations. While such opportunities surely exist, an approach that is based solely on this perspective is likely to have the most detrimental impact on operators. It could lead, for example, not only to problems of deskilling and displacing workers, but also to increased monitoring of the work force.[117] Moreover, by adhering to such a perspective, businesses may forego other economic opportunities that, in the long run, may prove more productive. For as Paul Strassman has noted:

> The sum of many efficient activities may not add up to an effective information service.[118]

Alternative views, which in no way demean the importance of efficiency, focus on the technology's ability to both restructure and enhance work relationships. According to Michael Piore and Charles Sabel, for example, because new technology allows business to carry out flexible manufacturing, many workers no longer need to be organized on assembly lines; rather, they will be able to work more in accordance with what, in the long run, is a more productive arrangement-that is, an arrangement based on craft principles.[119]

Similarly, from the perspective of Shoshana Zuboff, computer-mediated communication technologies need not be used to undermine or reduce job-related skills, as they have in the past; on the contrary, they can be used to "informate" the operator about the entire productive work process. As she describes it:

> Action-centered skills . . . are built into the technology as it substitutes for bodily presence—that is automation. At the same time, activities are made transparent. They are exposed in detail as they are textualized in the conversion to explicit information-that is informating. In principle, the technological substitute for bodily presence frees the human being from having to participate in the immediate demands of action (and the lengthy investment in the associated skills). However, the technology not only frees individuals "from" but also frees them "to." The automating capacity of the technology can free the human being for more comprehensive, explicit, systemic, and abstract knowledge of his or her work made possible by the technology's ability to informate.[120]

To be successful, such an approach would require investments in human beings as well as in technology. It would, moreover, entail risks for management; for a technology that "informates" is bound to diminish hierarchy. Posing this dilemma for management, one corporate vice-president reflected:

> What has been managerial access to information is not as comfortable a notion as it may seem. There has been a fear of letting it out of our hands—that is why information is so carefully guarded. It could be misused or misinterpreted in a way that cannot be managed. Traditionally, we have thought that such data can only be managed by certain people with certain accountabilities and, I hesitate to say, endowed with certain skills or capabilities. But with the new technology it seems there is an almost inevitable kind of development if you have a goal of maximizing all business variables and maximizing the entire organization's ability to contribute to that effort. I don't think you can choose not to distribute information and authority in a new way if you want to achieve that. If you do, you will give up an important component of being competitive. [121]

Line Managers

Like the CEO, line managers are responsible for executing the formal goals of the business corporation, and they, too, derive much of their authority from their position within the bureaucracy and the access to privileged information that this position affords. In contrast to top management, however, the line manager is concerned not only about the overall growth and survival of the firm, but also about

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116 U.S. Congress, Office of Technology Assessment, *Computerized Manufacturing Automation. Employment,* Education, *and the Workplace*, OTA-CIT-235 (Washington DC: U.S. Government Printing Office, 1985), p. 10.

117 For an analysis of the issues involved in work monitoring, see U.S. Congress, Office of Technology Assessment, *The Electronic Supervisor: New Technologies, New Tensions*, OTA-CIT-333 (Washington DC: U.S. Government Printing Office, September 1987).

118 Paul Strassman, T/w *Information Payoff: The Transformation of Work in the Electronic Age (New* York, NY: The Free Press, 1985), p. 117.

119 Piore and Sabel, op. cit., footnote 3.

120 Zuboff, op. cit., footnote 5, p. 181.

121 As quoted in ibid., p. 289.

preserving his or her own particular department, or sector of responsibility, within the organization.

The widespread deployment of computer-based communication technology within the business corporation may undermine the line manager's position in a number of different ways. Many of the simpler functions that managers perform can be executed electronically, as we have seen with respect to both business operations and procurement activities.[122] Equally, if not more, threatening to the manager's position is the fact that electronic networks may replace him in his role as chief communicator.[123] Communication networks may also weaken the manager's control over his own domain, since one of the benefits of the new technologies is their ability to create flexible interdepartmental arrangements that can be constituted on an ad hoc basis for different tasks.

Not all prognoses of the manager's future role are so bleak, however. Paul Strassman, for example, argues that the business opportunities afforded by new communication technologies do not necessarily entail losses for middle management. In fact, he predicts that future organizations will need more, not fewer, managers.[124] In his scenario, however, the role of management will be completely overhauled. Instead of acting as coordinator and information intermediary, the future manager will devote him/herself to staff development, training, and guidance.[125] Similarly, Ralph H. Kilman, professor of business administration and director of the program on corporate culture at the Graduate School of Business, University of Pittsburgh, anticipates that the successful corporation of the future will be a network organization built around a hub of people and information, each acting on the other. Under these circumstances, each company:

> . . . will have to nurture its own unique culture and develop the quality of its human resources [since] competitive advantage will rest increasingly on the way each network organization gathers and accesses information, makes its decisions and then carries out those decisions.[126]

Reflecting some of these developments, we find, for example, that the General Motors parts plant in Bay City, MI, recently dismissed one-quarter of their middle managers. Characterizing the organizational changes that followed their dismissal, Patricia Carrigan, plant manager, notes that:

> [Before the cuts] the production manager. . . sort of stood over the factory and cracked the whip. Now, hourly workers are monitoring their own time, authorizing their own payroll and setting their own vacations . . . Some managers have had to change their style. '27

Analysts of the Technostructure

The analysts of the technostructure include professionals such as planners, accountants, budget analysts, operation managers, and MIS analysts.[128] Although analysts have no bureaucratic authority of their own, they have influence in the firm, given their expertise. As a reflection of their professionalism, their primary goals are:

> . . . professional excellence, perpetual but moderate and well-regulated change in the organization, ever increasing bureaucratization, and, as the criterion for choice, economic efficiency.[129]

As we move forward into a knowledge-based society, it is the analysts of the technostructure who have the most to gain from the organizational changes taking place within the business firm. According to Drucker, it is the knowledge worker who will replace the mid-level manager in the firm, giving rise to organizations that are much less

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122 See also Eliezeer Geisler, "Artificial Management and the Artificial Manager," *Business Horizons,* July/August 1986, pp. 17-21.

123 Peter Drucker predicts, for example, that in future organizations "both the number of management levels and the number of managers can be sharply cut. The reason is straightforward: it turns out that whole layers of management neither make decisions nor lead. Instead their main, if not their only, function is to serve as 'relay s'--human boosters for the faint unfocused signals that pass for communication in the traditional pre-information organization. ''Peter Drueker, "The Coming of the New *Organization, ''Harvard Business Review,* January/February 1988, p. 45. For a discussion of how these changes are taking place, see Sally Lehrman, "Middle Managers Face Squeeze as Firms Try New Structures, " *The Washington Post,* Sept. 4, 1988, p. H2.

124 Strassman, op. cit., footnote 118, pp. 196-199.

125 Ibid.

126 Ralph H. Kilman, "Tomorrow's Company Won't Have Walls," *The New* York *Times,* June 18, 1989, p. 3.

127 Lehrman, op. cit., footnote 123.

128 Mintzberg, op. cit., footnote 112, p. 136.

129 Ibid., p. 137.

hierarchical than they are today.[130] The technical analyst will also benefit from the increased opportunity for professional contact and collaboration that electronic networks provide.

One group of analysts that is playing an increasingly important role in business is the information systems managers.[131] Responsible for integrating and controlling corporations' distributed databases, the manager is becoming more and more involved with issues involving corporate strategy at the highest levels of management.[132]

Support Staff

The support staff includes members of all groups who provide services in support of the basic operational function of a business firm. Including both skilled and unskilled workers, they range from cafeteria workers and secretaries to public relations specialists and legal counsels.[133] Because new communication technologies allow many of their services to be easily purchased outside of the corporation, members of the support staff are among the most vulnerable to technological change. Moreover, with a worldwide communication system, there is a much larger pool of potential workers to draw on, reducing the leverage of U.S. workers even more. In this situation, as in the case of operations workers, the unskilled are at the greatest disadvantage.

Given the growing importance of the service sector of the economy, one group that could suffer disproportionately from the widespread deployment of computer-based communication systems is office workers. A 1985 OTA study on office automation found, for example, that there will be a significant reduction in the hours associated with a given volume of information-handling. This will entail a reduction of jobs primarily in clerical/support occupations, but also in low-level supervisory or management jobs.[134] Moreover, because women and minority groups are disproportionately represented in these kinds of jobs, they are likely to be affected most. For those who retain their jobs, automation may have more beneficial effects, reducing the more trivial aspects of work and requiring workers to acquire broader, more process-oriented skills.[135]

Communication technologies will also allow workers more freedom and flexibility in determining the time and location of their work. Much office work, for example, can be done in the home using an electronic network. The work-at-home option is not without controversy, however. To date, there have been a number of failed experiments, which illustrate some of the problems that might arise.[136] Many fear that working at home may create a growing pool of contingent workers who will have neither job security nor benefits.[137] Moreover, trade unionists have pointed out that an increase in the supply of contingent labor will depress the wage rates and reduce the bargaining power of the full-time employed.

Roles and Relationships in Market Activities

Exchange activities entail the transfer of goods and services, either as inputs or outputs of production. In capitalist societies these activities are regulated by the mechanism of the market. Thus, to understand the roles and relationships involved in such exchanges, it is necessary to begin by looking at the dynamics of the marketplace.

In the most general sense, the market is the entire web of interrelationships that comes into play in the buying and selling of products.[138] For a market to exist and for an exchange to take place, two roles are essential: those of the producer and consumer. More often than not, however, other players perform the role of intermediaries, facilitating the exchange.

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[130] Drucker, op. cit., footnote 123.

[131] R. Orazine, "Why MIS Managers are Becoming Network Experts," *Telecommunications*, January 1988, pp. 103-104.

[132] Ibid. See also Rockart, op. cit., fOOtnOte 90.

[133] Mintzberg, op. cit., footnote 112, p. 137.

[134] U.S. Congress, Office of Technology Assessment, *Automation of America's Offices*, OTA-CIT-287 (Springfield, VA: National Technical Information Service, 1985), p. 15.

[135] Ibid.

[136] For a discussion, see Barbara Tzivanis Behham, "There Is No Place Like Home," *Best's Review*, May 1988, pp. 33-38.

[137] Richard S. Belous, The Conference Board, "The Telecommunications Industry, Contingent Workers, and the House of Labor," paper presented at The George Washington University Conference on Telecommunications: An American Industry Under International Pressure, Airlie, VA, May 9,1988.

[138] Steiner, op. cit., foomote 11, p. 575.

Intermediaries include, for example, wholesalers, retailers, advertisers, and media-owners.

In contrast to a business organization in which roles are hierarchically structured and relatively stable, the relationships in a market are dynamic, changing in accordance with the specific set of circumstances in which economic actors come together. These circumstances can be classified as those of monopoly, oligopoly, competition, or monopsony, depending on five basic forces:

. threat of entry by new firms,
• threat of substitution,
. bargaining power of buyers,
. bargaining power of suppliers, and
• the rivalry among current competitors. [139]

The structure of the market, and hence the relationships between producers and consumers, can be significantly altered by the introduction of new technologies. The deployment of a new technology may give rise to significant economies of scale and scope, providing a producer with a quasi-natural monopoly. Thus the mom-and-pop electronic stores that set up community antennas in areas where broadcast television reception was poor enjoyed near-monopoly status in their markets. On the other hand, new technologies can also undermine an existing monopoly; for example, VCRs, MMDS, and direct broadcast satellites (DBS) may have this effect on cable television's monopoly on delivery of commercial-free movies to the home.

Consumers

To make "optimal" buying decisions—and hence to maximize their leverage vis a vis producers—consumers require perfect information about products and their costs. However, they generally depend on producers and retailers for the information they need to make purchases. Such information, which is designed primarily to promote sales, is often incomplete and biased. The search costs of obtaining accurate information about all competing products, in terms of time and travel costs, are often so high that consumers rarely pursue such searches. Instead, they accept a choice that is satisfactory but suboptimal.

New technologies can greatly reduce the consumer's information and transaction costs.[140] By making it possible for producers and retailers to deliver large amounts of commercial information directly to the home or office, new communication technologies may benefit consumers in a number of different ways. These include allowing them to make purchases without traveling; helping them to locate the specific products they want; providing them with more timely, and more perfect, comparative information about their choices; and facilitating the ordering process.

The new technologies will also reduce the consumer's dependence on traditional intermediaries, such as advertisers and retailers. At the same time, however, the consumer will become more dependent on the media companies that control the new pipelines through which commercial information flows.

The kinds of benefits that the consumer derives from the new technologies will depend on several factors. Incompatibility may limit their usefulness. Moreover, the cost and complexity of equipment and services may limit their availability. Those without the technology could suffer badly, if exits from the traditional retailer market led to increased travel time, decreased service, and higher prices based on lower volumes. In addition, all consumers may be worse off, to the extent that the cost of the service exceeds previous travel and transaction costs.

Consumers may also have mixed feelings about unsolicited advertisements. Some may find them valuable as sources of commercial information, and some may find them entertaining. Others, however, will find unsolicited commercial messages intrusive. Those most offended by this kind of advertising can, to some extent, evade it by using technologies such as the remote control devices for TVs and VCRs and telephone services such as Customer Local Area Signaling Service (CLASS). CLASS indicates whether or not incoming calls are from numbers the customer has previously stored in a computer

Consumers may also have concerns about their rights to privacy and the data that are collected as a result of their economic transactions. On the other hand, some may be concerned if data about them are not collected and stored, in that they might, as a

[139] Porter, op. cit., footnote 57, ch. 1.

[140] For a more detailed account of the opportunities for consumers, see ch. 8.

result, be excluded from certain economic opportunities. 141

Producers

The new technologies will provide producers with more pathways to access consumers directly, substantially reducing their dependence on retailers and perhaps even advertisers. These technologies will, moreover, help producers to collect, store, and analyze market data in a much more cost-effective way. To the extent that the delivery of tangible items is facilitated by communication technologies, it will be easier for producers to promote teleshopping.

At the same time, however, producers may experience much greater competition. Consumers will have much more information, and markets will be much broader in geographic scope.

To defend against consumer cost comparisons, producers might use incompatible catalog systems, as a number of them are presently doing in the area of business-to-business sales. 142 If pursued to considerable success, however, such a strategy might come into conflict with antitrust law as it is embodied in the "essential facilities doctrine."

Intermediaries

Local retailers manage the forums through which a considerable amount of product information passes. One of their key functions in the exchange process is a selective one. Because the space used to display products is not without costs, retailers must choose carefully what they sell. Thus, they reduce the range of products available to consumers. As intermediaries, however, they are dependent on both producers and consumers. Their success depends on their ability to both attract the right products and correctly anticipate consumer needs.

With the development of electronic shopping centers and malls, local retailers will face much greater competition both in terms of the number of their competitors as well as prices. Their ability to succeed will depend on the popularity of electronic shopping, the extent to which they can reduce costs, and/or their ability to differentiate their products and enhance the value of traditional shopping. For example, retailers might use their knowledge of market demand to select the most likely big sellers and secure cost-justified volume discounts from producers. Or they might offer enhanced services such as an entertaining environment or salespeople with special expertise.

Large, national retailers that collect transactional data-like credit-card and telephone companies, banks, and airlines-and local retailers employing scanning technologies will gain market power by virtue of their data. Producers and retailers wanting that data will become more dependent on these retailers, and, to the extent that laws of privacy and property permit, they may seek greater access to it either by sale, joint agreement and joint ventures, or by acquisition. Access to this kind of data can constitute significant barriers to entry.

Owners of real estate used by retailers have also played an intermediary role in the process of making and executing purchasing decisions. They serve as a physical "pipeline" through which product information passes. In much the same way as the retailers, owners of shopping centers are vulnerable to the development of electronic shopping.

The new technologies are significantly decreasing the dependence of producers, retailers, and advertising agencies on the traditionally dominant *communication media* such as newspapers, television, radio, and magazines. As new communication media such as VCRs and tapes, videotex, and cable television gain larger audiences, the traditional media will lose a share of the total. Similarly, as improvements in the use of market research data permit personalized contacts via the mails and electronic media, and the use of desktop publishing and automatic-dialer and recorded-message players become more economical, the position of the traditional media will deteriorate even further.

141 For a discussion of how this kind of economic segmentation might reinforce class segmentation, see Terry Curtis, "The Information Society: A Computer-Generated Class System?" Vincent Mosco and Janet Wasko (eds.), *The Political Economy of Information* (Madison, WI: University of Wisconsin Press, 1988), ch. 5.

142 For example, one of most important reasons why McKesson Drug and the airlines established their purchasing systems was to cement their relationships with their buyers. If these proprietary systems are economically impractical to duplicate, and yet are essential to effective participation in a market, then competitors would have a legal right to reasonable access under the "essential facilities doctrine." This doctrine prohibits firms with monopoly control over an essential facility from using this control, without a legitimate business reason, to foreclose competition in a market in which they participate. For a discussion, see Peter Marx, "The Legal Risks of Using Information as a Competitive Weapon," *International Computer Law Advisor*, vol. 2, No. 5, February 1988, pp. 18-24.

The electronic media will also be favored over **traditional** media to the extent that consumers shop on electronic networks rather than by traveling to stores. Since those who supply storage and transmission will have so much to gain, there is likely to be greatly increased competition between existing cable and telephone companies for the right to provide these services. Such traffic will allow suppliers to collect and compile valuable marketing research data.

Advertisers have traditionally helped producers to identify the most likely buyers, create presentations to attract them, and identify the most efficient media for sending these messages. To the extent that producers use new technologies to execute these functions and to link themselves directly to consumers, advertiser may be displaced.

As already mentioned, new technologies also allow consumers to evade advertising. The loss of television audience resulting from consumers using remote control devices for zipping, zapping, and flipping is still being investigated, but advertisers have expressed considerable concern. 143 One approach they might adopt is to produce short mini-ads that are difficult to zap, or ads that are incorporated into entertainment programs. Absent an effective strategy, advertisers may be unwilling to pay the media as much for delivering audiences, and producers may be induced to deal directly with consumers.

Another intermediary to be affected is that of *delivery services. This* area will experience increased demand if more buyers use communication technologies to make purchase decisions and place orders, rather than traveling to retailers.

KEY FACTORS AFFECTING OUTCOMES

Notwithstanding the numerous business opportunities that new communication technologies afford and the extensive publicity they have received, most corporations have been slow to adopt these new technologies, or to employ them in strategic ways. Instead of viewing the new technologies as a way of rethinking and restructuring their activities, most firms still regard technology primarily as a means of reducing costs and expanding markets.[144] Not surprisingly, large companies that can afford to develop their own networks, as well as service companies whose primary activities entail data-processing and data exchange, are the most advanced and sophisticated in their use of communication and information technologies.[145] As Margie Semilof has described the situation:

> When it comes to communications, the country's largest users vary widely in levels of expertise.
>
> For example, there's the fortunate few who aren't on the same technological learning curve as the rest, because their business is in computers and/or communications. This group includes IBM, AT&T, Digital Equipment Corp., Hewlett-Packard Co., Unisys Corp., and the regional Bell holding companies.
>
> A second class is comprised of stellar users—companies with strong engineering departments that for years have been using communications to solve their business problems. This group includes such well known technology leaders as General Dynamics Corp: Eastman Kodak Co.; Ford Motor Co.: and Sears, Roebuck and Co.
>
> But many Fortune 100 companies have no in-house expertise and—as does the rest of the user community-rely on pluck and luck to solve their networking problems. This class of users, analysts say, typically lags about three to five years behind the rest of the Fortune-sized pack. These companies generally develop other aspects of their businesses.[146]

The full impact of new technologies in the business arena will depend on how and under what circumstances they are deployed. Just as these technologies give rise to benefits, so they may also create a number of new social problems for policymakers. These problems can be summarized as:

- worker displacement and retraining, a problem that will no longer be confined to the lower levels of the employment scale, but will extend to the realm of management as well;
- defining the privacy rights of individuals in an environment-in which information about individuals can be easily compiled and distributed,

[143]These actions have been referred to as "video grazing." For a discussion, see Peter Ainslie, "Confronting a Nation of Grazers," *Channels*, September 1988, pp. S4-62; and "Zapping the TV Networks," US. News *and World Report*, June 1, 1987, p. 56.

[144]Stephen Boyd, "Telecom's Quest," *CommunicationsWeek*, CLOSEUP, Feb. 29.1988, PP. 14-15 -

[145]*Datamation*, Sept. 1, 1987, p. 47.

[146]Margie Semilof, "Communication Gap," *CommunicationsWeek*, CLOSEUP, June 13, 1988, p. C9.

and in which the value of personal data has a high market value;
- equity for small businesses, given the growing strategic value of communication systems in the business arena, and the economies of scale entailed in developing, deploying, and operating such systems; and
- maintaining and modernizing the public communication infrastructure, as more and more businesses find it to their advantage to develop their own communication networks as part of their competitive strategies.

OTA identified a number of key factors that, over the long run, will determine whether or not, how, and with what effects U.S. businesses will exploit the opportunities afforded by new technologies. These include:

- the compatibility and interconnectivity of information systems,
- the laws concerning the use of information,
- economic and technical resources,
- corporate culture and organizational structure,
- developments in international trade and international telecommunication regulation,
- domestic regulatory policies, and
- the availability of a skilled work force.

Compatibility and Interconnectivity of Information Systems

Electronic mail, local- and wide-area networks, programmable manufacturing, and relational databases all require interconnection. Hence, one of the most significant factors determining whether businesses can take advantage of new communication technologies is the degree to which the various systems being developed and used by businesses can communicate effectively with one another. Thus, as depicted in table 5-3, we see that in a recent survey of large-business users the lack of standards was cited as the most critical factor inhibiting the strategic deployment of new communication technologies. 147

Table 5-3-Main Obstacles to Effective and Strategic Use of Internetworking

	Percentage of respondents mentioning problem
Obstacles	
Lack of unifying standards	90.1
Vendors' inadequate understanding of users' needs	83.5
Service limitations	82.6
Product limitations	82.2
Total Responding: 568	

NOTE: No other "obstacle" was mentioned by more than half the survey respondents.

SOURCE: *CommunicationsWeek's* Fifth Annual Communications Managers Survey, *CommunicationsWeek*, CLOSEUP, Sept. 12, 1968, p. Cl O. Copyright 1986 by CMP Publications, Inc., 600 Community Drive, Manhasset, NY 11030. Reprinted from *CommunicationsWeek* with permission.

To obtain the kind of communication required by business will necessitate more than simple physical interconnection; it will:

> . . . require the logical interconnection of a corporation's dispersed information processing assets—hardware, systems software, user applications and data bases. [148]

With this kind of connection, users will find it easy to negotiate their way through the entire corporate communication system-which will appear to be a single, integrated whole—accessing a wide array of resources and data.[149]

Perhaps the most important reason why many businesses have been unable to achieve this state of interconnectivity is the lack of some key technical standards. A number of these standards, such as those for Open Systems Interconnection (OSI) and Integrated Services Digital Networks (ISDN), are now being negotiated in international standards-making fora. Other more or less de facto standards, such as IBM SNA, are evolving in the marketplace. [150] However, because standards significantly affect competitive relationships, the process of establishing them can be long and contentious. Thus, a number of gaps in the area of technical standards still exist, some of the most critical of which are:

147 For a discussion, see Steven Titch, Margie Semilof, and John Berrigan, "Missing Links," *CommunicationsWeek*, CLOSEUP, Sept. 12, 1988, pp. C6-C7; and Christine Bonafield and Paul Korzeniowski, "Neither Standards, Nor Understanding," *CommunicationsWeek*, CLOSEUP, Sept. 12, 1988, pp. C10-C11.

148 Larry DeBoever, "Trek Toward Connection," *Computerworld, Nov. 16, 1987*, pp. S1S13.

149 Ibid.

150 Ibid., p. S2.

- protocols supporting cooperative processing applications in peer relationships;
- standards for local area networks, which to date are still relatively immature;
- broadband ISDN standards;
- network management standards;
- document interchange standards; and
- standards for electronic data interexchange.[151]

This issue of network interoperability affects not only the realm of business, but also all other realms of communication. It is analyzed in depth in chapter 11.

Legal Framework for Employing Information in the Business Environment

Just as a commercial and legal infrastructure was required in the 19th century for businesses to exploit the economic advantages afforded by the railroad and the telegraph, so too will new information laws be required if corporations are to employ information and communication technologies as part of their competitive strategies. As Peter Marx has noted, the use of new technologies for business gives rise to considerable legal uncertainty, since:

> . . . the legal system has yet to generate a body of law capable of resolving the legion of questions posed by information--questions that have only recently surfaced as user capabilities, expectations, and use of information and information technologies have dramatically changed.[152]

One major area of uncertainty is that of privacy law. When Congress passed the Privacy Act in 1974, it declined to include the private sector within its provisions.[153] With more and more businesses seeking to package and distribute transactional data, the pressure to extend to corporations the rules regulating government's use of personal data, or to create new rules, is likely to mount.[154]

Another gap in information law relates to product liability and the negligent use of information. The courts will need to determine, for example:

- Who has rights to damages incurred because of inaccurate information?
- What responsibility does a corporate-user have to ensure the reliability and accuracy of the data that it uses, even when they are supplied by someone else?
- When should information be classified as a service and when as a product? and
- Should the standard of liability be negligence, and or might strict liability apply? [155]

Other areas that are likely to require legal attention include antitrust law, tax law, intellectual property law, as well as laws governing electronic filings for regulatory purposes. In a global economy, moreover, these gaps will need to be filled in, not only with respect to domestic law, but also, and increasingly, with respect to international law as well.

Economic and Technical Resources

Whether or not businesses will be able to make strategic use of new technologies will also depend on the extent of their financial and organizational resources. One D3 circuit, for example, which provides a transmission pipeline that operates at the rate of 45 megabits-per-second, costs approximately $1 million per year. Thus, the costs of operating a large-scale telecommunication system can be great. It has been estimated, for example, that the annual expenditures of the top 100 communication users range from between $1 billion at the top of the list to about $20 million at the bottom, with the average expenditure falling between $50 million and $100 million. [156] Moreover, as can be seen in figure 5-4, by 1993, telecommunication expenditures are likely to constitute approximately 10 percent of the Fortune

[151] Ibid., pp. S9-S1O.

[152] Marx, op. Cit., footnote 142, p. 19.

[153] The Privacy Act of 1974 was designed to address the tension between the individual's interest in personal information and the Federal Government's collection and use of that information. For a discussion, see U.S. Congress, Office of Technology Assessment, *Federal Government Information* Technology: *Electronic Record Systems and Individual Privacy*, OTA-CIT-296 (Springfield, VA: National Technical Information Service, June 1986). See also Deborah G. Johnson and John W. Snapper, *Ethical issues in the Use of Computers* (Belmont, CA: Belmont Publishing Co.), part 3.

[154] In an effort to forestall such an occurrence, some companies, such as Warner-Amex, have worked toward developing voluntary standards with which businesses might comply.

[155] Marx, op. cit., footnote 142. See also Johnson and Snapper, op. cit., footnote 153; and Jaap H. Spoor, "Database Liability: Some General Remarks," International *ComputerLaw Adviser, vol. 3, No. 7*, April 1989, pp. 4-9.

[156] Jim Foley, "Our First Look at the Top 100 Communication Users," *CommunicationsWeek*, CLOSEUP, May 1, 1989, p. C3.

1000 companies' budgets, up from 8 percent today.[157]

Given such costs, it is clear why it has been primarily the largest companies that have made the greatest use of the new communication technologies.[158] As can be seen in table 5-4, all of the top 50 telecommunication-users in the United States earn annual revenues of more than $3 billion. In this context, it is clear why a number of companies, citing cost as well as the lack of technical expertise as the reason for their decisions, have given up their efforts to deploy and operate their own private communication networks.[159]

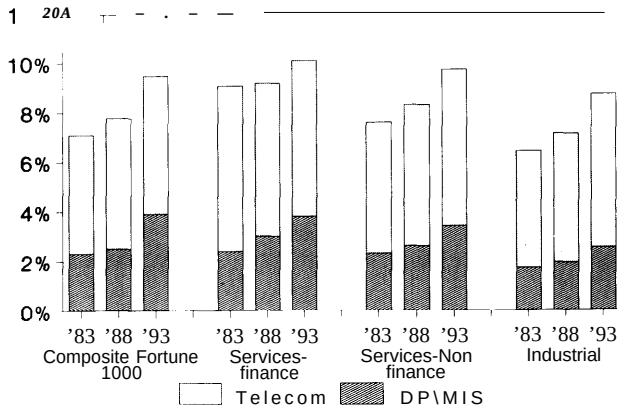
Large businesses have a number of advantages over small companies in deploying new technologies. By buying in much greater quantities, they are often able to negotiate higher-quality service and lower prices either from the traditional telephone companies or from others. As the Chief Executive Officer of one network management company has noted:

> Here is where large companies and their fat contracts have two key advantages over a smaller user. Small companies are often stuck with buying vendor vanilla. Nothing can set them apart from the competition, strategically. Large companies, however, can do some substantial tailoring, which can give them an edge. This is a distinct reversal of the concept that says smaller companies can be more innovative than big companies.[160]

The same is true with respect to gaining access to market data and strategic information. Large conglomerates, which are able to aggregate multiple data sets from multiple sources, are better off than smaller fins. If, as in the past, new communication technologies increase the minimum efficient scale of operations generally, the large multinational enterprise may have the most to gain. Large users also have more clout than smaller companies in negotiating standards.

Small manufacturers, moreover, are confronted by a number of problems that are unique to them. For example, it is much harder for them to obtain financing for new technologies. And while large manufacturers may be able to absorb the cost of $70,000 for computerized tools, it is much more difficult for any of the 200,000 small manufacturers in the United States who view $10,000 as a major investment. Even more important is the fact that small companies rarely have the know-how required to take full advantage of the new technologies.[161]

Figure 5-4-Spending for Communications by Large Users, 1983-1993 Comparison (Percent of Total Operating Budget)



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Corporate Culture and Organizational Structure

Existing corporate culture and organizational structure may also inhibit the use of communication technologies for strategic advantage.[162] For, as Howard Anderson of the Yankee Group has noted, the strategic use of telecommunications is:

> . . . not a hardware issue; it is a mind-set issue. The communications user today has a wide range of technical options from which to choose solutions. The problem is that there is a pattern of corporate behavior based on repeating certain established ways of doing things that can be a real impediment to

[157] Candee Wilde, "Analysts See Happy New Year: Budgets Up," *CommunicationsWeek,* Jan. 2, 1989, pp. 1,29.

[158] Peter Cowhey, "The Globalization of Telephone Pricing and *Service,* "*Telecommunications*, January 1988, p. 30. See also Semilof, oP. cit., footnote 55, pp. C6-C8.

[159] For a discussion, see John Foley, "Problems Force Users to Retrench," *CommunicationsWeek, Nov. 7, 1988,* pp. 1, 62; and John Foley, "Merrill Shifts Gears; Solicits Network Bids," *CommunicationsWeek*, Oct. 31, 1988, pp. 1,55.

[160] Semilof, op. cit., footnote 146, p. C13-C14.

[161] Kochen, op. cit., footnote 67; see also Kirk Victor, "Help Wanted, Badly," *National Journal*, Mar. 25, 1989, pp. 730-734.

[162] See Clinton Wilder, "Corporate Culture Is Key to IS Success," *Computerworld*, May 22, 1989, p. 61.

Table 5-4-Top 50 U.S. Communication Users

Rank	Company	Primary business	Employees (in thousands)	Revenues ($billions)
1.	General Motors Corp., Detroit, MI	Automotive	813	1 01.78
2.	General Electric Co., Fairfield, CT	Manufacturing	302	40.52
3.	Citicorp/Citibank N.A., New York, NY.	Banking	90	119.56
4.	IBM, Armonk, NY	Computer	389	54.22
5.	American Express Co., New York, NY	Finance	84	17.77
6.	Westinghouse Electric Corp., Pittsburgh, PA	Manufacturing	112	10.68
7.	McDonnell Douglas Corp., St. Louis, MO	Aerospace	112	13.34
8.	Sears Roebuck and Co., Chicago, IL	Retail	500	48.44
9.	Ford Motor Co., Dearborn, MI	Automotive	350	71.64
10.	Boeing Co., Seattle, WA	Aerospace	136	15.36
11.	Rockwell International Corp., El Segundo, CA	Manufacturing	116	12.12
12.	Prudential Insurance Co. of America, Newark, NJ	Insurance	66	14.05
13.	Lockheed Corp., Calabasas, CA	Aerospace	99	11.32
14.	Xerox Corp., Stamford, CT	Manufacturing	99	15.13
15.	United Technologies Corp., Hartford, CT	Manufacturing	190	17.17
16.	ITT Corp., New York, NY	Manufacturing	120	19.53
17.	Unisys Corp., Blue Bell, PA	Computer	93	9.71
18.	Union Carbide Corp., Danbury, CT	Manufacturing	43	6.91
19.	Texas Air Corp., Houston, TX	Airline	70	8.48
20,	United Parcel Service of America Inc., Greenwich, CT	Transportation	192	9.68
21.	BankAmerica Corp., San Francisco, CA	Banking	65	76.29
22.	E.I. du Pont de Nemours & Co., Wilmington, DE	Manufacturing	140	30.47
23.	Raytheon Co., Lexington, MA	Manufacturing	77	7.66
24.	Allied Signal Inc., Morristown, NJ	Manufacturing	115	11.12
25.	Caterpillar Inc., Peoria, IL	Manufacturing	54	8.18
26.	Chase Manhattan Corp., New York, NY	Banking	42	68.58
27.	J.P. Morgan & Co. Inc., New York, NY	Banking	164	3.99
28.	General Dynamics Corp., St. Louis, MO	Aerospace	105	9.34
29.	Chrysler Corp., Highland Park, MI	Automotive	141	26.28
30.	USX Corp., Pittsburgh, PA	Manufacturing	54	13.90
31.	First Interstate Bancorp., Los Angeles, CA	Banking	36	37.57
32.	Honeywell Inc., Minneapolis, MN	Manufacturing	79	6.68
33.	Digital Equipment Corp., Maynard, MA	Computer	111	9.39
34.	AMR Corp., Dallas/Ft. Worth, TX	Airline	65	7.20
35.	Eastman Kodak Co., Rochester, NY	Manufacturing	124	13.31
36.	J.C. Penney Co. Inc., Dallas, TX	Retail	181	15.33
37.	Pepsico Inc., Purchase, NY	Manufacturing	225	11.49
38.	Metropolitan Life Insurance Co., New York, NY	Insurance	36	13.96
39.	Chemical New York Corp., New York, NY	Banking	29	55.51
40.	Amoco Corp., Chicago, IL	Oil	47	20.17
41.	May Department Stores Co., St. Louis, MO	Retail	143	10,31
42.	Minnesota Mining & Mfg. Co. (3 M), St. Paul, MN	Manufacturing	82	9.43
43.	Merrill Lynch & Co. Inc., New York, NY	Finance	43	10.87
44.	Texaco Inc., White Plains, NY	Oil	50	34.37
45.	Cigna Corp., Philadelphia, PA	Insurance	48	16.91
46.	UAL Corp., Chicago, IL	Airline	66	8.29
47.	Federal Express Corp., Memphis, TN	Transportation	41	3.20
48.	R.H. Macy & Co. Inc., New York, NY	Retail	54	5.21
49.	First Union Corp., Charlotte, NC	Banking	20	17.43
50.	Mobil Corp., New York, NY	Oil	121	56.72

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using technology to solve, not aggravate, business problems.[163]

Explaining why U.S. managers have had difficulties reaping the advantages of new technologies, Robert Hayes and Ramchandran Jaikumar echo this same point of view. They note:

> For years, manufacturers have acquired new equipment much in the way a family buys a new car. Drive out the old, drive in the new, enjoy the faster, smoother, more economical ride-and go on with life as before. With the *new* technology, however, "as before" can mean disaster. Executives are discovering that acquiring an FMS [flexible manufacturing system] or any other advanced manufacturing system is more like replacing that old car with a helicopter.[164]

All too often, senior managers tend to view communication technologies merely as operational tools, or as a means for improving productivity.[165] The tendency to see technology from this narrow perspective stems in part from budgetary practices that look for benefits within a 2-year payback period.[166] Organizational resistance to deploying new technologies may also emerge as traditional titles and roles are redefined, skill-mix requirements are broadened, and the traditional bases for measuring performance are reevaluated.[167] As Anderson has pointed out, in the future, communication managers are going to have to become chief network officers, and as such they will need to have a much greater grasp of basic business objectives.[168]

Compounding the problems of organizational adjustment is the fact that taking advantage of new technologies will require interorganizational as well as intraorganizational changes. Turf problems are likely to emerge insofar as technological developments serve to favor some jobs over others. For example, one group that has benefited from the enhanced role of information and communication in business is the management information systems (MIS) manager. As one industry observer describes:

> The 1980s are seeing the rise of a new breed of computer managers. The new MIS managers capitalize on the mystery surrounding the computer as an advantage to maintain their positions. The new MIS managers are more expansionist; they are more willing to take risks than their data processing predecessors.
>
> These managers have also discovered a new and powerful tool to further their positioning-the local area network.[169]

International Trade and Foreign Communication Policies

Foreign trade policies and the telecommunication policies adopted in other countries will also be a factor determining the extent to which U.S. businesses can take advantage of the global opportunities presented by new communication technologies.[170] As described in chapter 12, many countries throughout the world are, like the United States, reevaluating the strategic role of communication in their societies and, in that light, their telecommunication policies as well. One change that is likely to have a significant impact will be the development of a single European market by the year 1992.[171]

Depending heavily on their own private networks, many international business-users have a considera-

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l@ Howard Anderson, "Using Telecommunications Strategically," *Telecommunications*, January 1989, p. 41.

163 Howard Anderson, "Using Telecommunications Strategically," *Telecommunications*, January 1989, p. 41.

164 Robert H. Hayes and Ramchadran Jaikumar, "Manufacturing's Crisis: New Technologies, Obsolete Organizations," *Harvard Business Review*, September/October 1988, pp. 77-85.

165 John Poulos and Fritz Ringling, "Communications As a Strategy Tool," *CommunicationsWeek*, Feb. 29, 1988, p. 6; see also Michael L. Sullivan-Trainer, ''The Push for Proof of Information Systems Payoff," *Computerworld*, Apr. 3,1989, pp. 55-57; and Stephen Boyd, "Telecom's Quest," c o*mmunicationsWeek*, CLOSEUP, Feb. 29, 1988, pp. 14-15.

166 Boyd, op. cit., footnote 165, p. 50.

167 John Poulos and Fritz Ringling, "Seeking an Organizational Fit," *CommunicationsWeek*, CLOSEUP, Feb. 29, 1988, p. 18.

168 Anderson, op. cit., footnote 163, p. 42.

169 Orazine, op. cit., footnote 131.

170 For one discussion, see Leland L. Johnson, "International Telecommunications Regulation," Paula R. Newberg (cd.), *New Directions in Telecommunications Policy, vol. 1, Regulatory Policy: Telephony and Mass Media* (Durham, NC: Duke University Press, 1989), pp. 92-122.

IT 1For one discussion, see Henry Goldberg, "A U.S. Observer's Vi$_{ew}$ of the Green paper, "*Telematics*, May 1988, pp. 1-8; see also Oswald H. Ganley, International Communications *and Information in the 1990s: Forces and Trends, Program* on Information Resources Policy, Center for Information Policy Research, Harvard University, Cambridge, MA, 1988; and N.P. Costello, "The Green Paper and the Regulatory Environment," *International Computer Law Adviser, vol. 3. No. 6,* March 1989, pp. 13-18.

ble stake in the outcome of these international developments.[172] Ideally, these big users would like to have access to these dynamic markets and be able to configure their networks on an international basis to suit their own particular needs. To achieve this they will need to have the freedom, for example, to create their own mixture of synchronous and asynchronous data traveling at different speeds, using the best codes and protocols.[173] Moreover, American businesses want to be able to freely choose their customer-apparatus and value-added network services, and to have access to the public network when their own systems are overloaded. Under present circumstances, it is unlawful in many countries to exercise such freedom.[174] As one industry observer has noted:

> . . . there's almost no end to the interference by European governments. Private microwave networks, which are all but taken for granted in the U. S., are virtually outlawed all over Europe. Satellite networks are O.K.—if you use the PTT's equipment and let the International Telecommunications Satellite Organization (Intelsat), which is jointly owned by the U.S. and 113 countries, perform the transmission . . .
>
> In the meantime, it can take years just to get approval from a government phone authority such as the Deutsche Bundespost to hook equipment such as modems or data multiplexer to the public network. 175

American businesses will also be affected by international trade and communication policies. These rules and regulations are now being negotiated in a number of international fora such as the General Agreement on Tariffs and Trade (GATT),[176] the International Telegraph and Telephone Consultative Committee (CCITT),[177] and the World Administrative Telephone and Telegraph Conference (WATTC). One event that bodes well for American business, for example, was the recent meeting of WATTC in Melbourne, Australia, whose purpose was to establish new rules for international telecommunication. After intense negotiations among the participants, a compromise was reached that-while allowing foreign telecommunication administrations to continue to authorize international services offered to the public—also permits private network operators to be exempted from all coverage through special arrangements.[178]

Domestic Communication Regulatory Policies

Domestic communication regulatory policies affect business users in many ways. Pricing decisions, for example, will affect not only the costs of purchasing services, but also decisions about whether or not to establish a private telecommunication network. Regulatory decisions about tax policies, depreciation rates, and R&D support will affect the rate of modernization within the public communication infrastructure, and hence the availability of advanced services for small as well as large businesses. These and similar kinds of issues are discussed and analyzed in detail in chapters 9 through 13.

Human Resources

Whether or not U.S. businesses will be able to fully exploit the numerous opportunities that communication technologies now afford will depend, in the final analysis, on the quality of its work force. As many labor analysts have noted, skill requirements in a knowledge-based or information society will be much higher than ever before. At the present time, it would appear that the prospects for meeting these

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[172]For a discussion, see John Foley, "Border Crossings," *CommunicationsWeek*, CLOSEUP, Aug. 29, 1988, pP. C3-C5.

[173]George McKendrick, "International Telecom Users Seek the Tools to Address Their Special Needs and Problems," *CommunicationsWeek*, May *16, 1988,* p. *21.*

[174]Ibid. For example, *at* present, the CCITT D-series recommendations *on* the use of international leased circuits are very restrictive, preventing the competitive provision of many services. For a discussion, see John J. Keller, "A Scramble for Global Networks," *Business Week,* Mar. 21, 1988, pp. 140-148.

[175]Ibid., pp. 143, 146.

[176]GATT is presently moving ahead t. develop a draft agreement on trade in services. For such an agreement to actually materialize, however, may require a substantial revision of existing national and international regulatory practices. One question that negotiators will have to wrestle with, for example, is which services and facilities might reasonably be designated national monopolies. See *Graham* Finnie, "GATT Moves Center Stage," *Telecommunications*, March 1989, p. 11.

[177]See Graham Finnie, "Which Way Next for the CCITT?" *Telecommunications*, November 1988, pp. 77-79.

[178]G. Russell Pipe, "WATTC Agrees on New Telecom Rules," *Telecommunications*, January 1989, pp. 19-20. See also Michael Nugent, ''WATTC-88: Global Harmonization, or Entirely New International Law," *Telematics*, February 1988, pp. 1-6; Graham Finnie, "The World According to WATTC," *Telecommunications,* November 1988, pp. 73, 88; and Parker W. Borg, "On the Eve of WATTC—the U.S. View," *International Computer Law Adviser,* November 1988, vol. 3, No. 2, pp. 11-14.