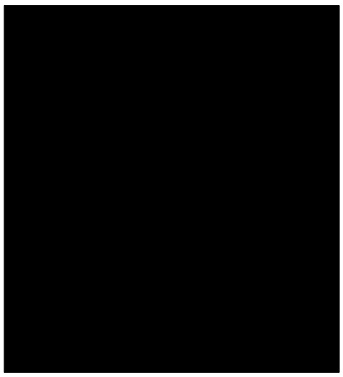
Technological Change and Employment Location

4

Advanced industrial economies are in the midst of a technological revolution, driven in large part by rapid advances in microelectronics technologies. These digital electronic technologies permit information in a myriad of forms to be generated, routed, and transmitted cheaply, instantaneously, and at high volumes virtually anywhere. There has been much speculation about the impacts of the "information superhighway," "digital society," and emerging "cyberspace," on society in general, but surprisingly little is known about the potential effects of this technology revolution on human settlement patterns broadly, or on urban conditions in the United States specifically.[99]

Today, economic activities are increasingly shaped through continuous and real-time interactions facilitated by information technologies. Because these interactions differ so markedly from past interactions that were more heavily burdened by space and time constraints, they have, through their impact on industries and jobs, the potential to significantly reshape American's metropolitan areas, and to bring about significant growth for some kinds of places and decline for others. In fact, some argue that these technologies underpin the transformation of metropolitan



[1] For a discussion of these trends in the OECD nations, see Organization for Economic Cooperation and Development, *Cities and New Technologies* (Paris: OECD, 1992); also, John Brotchie, Mike Batty, Ed Blakely, Peter Hall, and Peter Newton, *Cities in Competition: Productive and Sustainable Cities for the 21st Century* (Melbourne, Australia: Longman, 1995). For a discussion of trends in Australia see Patrick Troy, ed., *The Impact of Technological Change on the City*, unpublished manuscript, 1995. See also "City vs. Country: Tom Peters and George Gilder Debate the Impact of Technology on Location," *Forbes ASAP*, January 1995.

areas,[100] and that the conceptual and policymaking frameworks built up since the beginning of the 20th century to deal with the physical, social, and economic aspects of the industrial city are largely outmoded.[101] Clearly, technology is not the only force working to reshape metropolitan economies; other factors such as changing industrial organization, demographics, and social conditions (including crime in central cities), also play a role. However, because of the magnitude of technological change, technology will play a central role.

Because the form of cities and metropolitan areas is largely shaped by patterns of commerce and industry, this chapter examines the likely impact of the information technology revolution on the location of employment.[102] It first discusses the information technologies that facilitate electronic information generation and transfer. It then presents an overview of how information technologies are affecting the spatial distribution of economic activities, and finally, it examines the likely impact of these technologies on metropolitan form.

The analysis in this chapter is based on a case examination of the impact of technology on a number of industries, including telecommunications, banking, insurance, securities trading, and professional services (chapter 5); and freight transport, wholesale trade, and manufacturing (chapter 6). These industries were chosen because much of their function involves "exporting" products or services to places other than the area where they are located, and as such determine the economic growth of regions or metropolitan areas, and to a lesser extent, parts of metro areas. In contrast, growth or decline in industries that serve local customers (e.g., barbers, repair shops, grocery stores) is largely a response to economic growth in other sectors that export their output outside the region. For example, local insurance agents are a residentiary function, since they are located near their customers, but a nationwide insurance customer service center is an export function, since the jobs are not dependent upon demand from the local economy. Analysis in this chapter is also based on the examination of three cross-cutting technological issues in chapter 7, 1) telecommuting of individual workers, which has the potential to affect where individual workers live and work; 2) the effect of Intelligent Transportation Systems (ITS) on urban form; and 3) the spatial distribution of the telecommunications infrastructure, which some argue limits where information-intensive industries can locate.

TECHNOLOGICAL UNDERPINNINGS OF THE NEW PERIOD OF METROPOLITAN GROWTH

To understand better how this next wave of technologies is likely to recast industrial and residential locational patterns, it is important to understand first the key technologies being adopted by industry. Many of the early applications of information technology (IT) were to improve internal operations (e.g., first mainframe computing and then desk top computing) and often created "islands of automation" with little interconnection between components. As a result, their impact on the location of activities was limited. It is only recently that technologies facilitating linkages and communication between operations have begun to be widely adopted. These technologies are falling in price while increasing in performance, and as a result, will continue to be adopted throughout the economy. For the purposes of this report, these technologies can be grouped into three categories: technologies to transfer informa-

---

[2] Paul Knox, *Urbanization: An Introduction to Urban Geography* (Englewood Cliffs, NJ: Prentice-Hall, Inc., 1994).

[3] Stephen Graham, (University of Newcastle upon Tyne) "Cities in the Real-Time Age," paper presented at the Information and Telecom Tectonics conference, Michigan State University, Mar. 21, 1995.

[4] People may want to live in bucolic rural settings, and IT may enrich those settings, but as long as people depend on their livelihood through work, they live near were work locates.

tion into electronic form, to distribute and route information, and to transmit this information to different locations. What makes these technologies revolutionary is their ability to capture, store, and transmit information in digital form, which makes electronic, and therefore instantaneous, transmission possible. Rapid adoption of these technologies is being driven by the significant increases in productivity they make possible.

Transforming Information Into Electronic Form

Generation and consumption technologies transfer information into electronic form or allow it to be used (read, heard, etc.). For example, image technology digitizes and stores images of physical documents, such as checks, forms, and letters. High-resolution monitors allow information to be easily viewed. Other technologies include fax; video conferencing and video phones; computers, including portable and laptop computers; optical scanning technology; bar code readers; graphics software; knowledge-based software systems; electronic storage technologies, including floppy and hard disks and CD-ROMs; database software systems; voice recognition; remote sensors; and robotics and CAD/CAM.

Electronic Data Storage and Retrieval Technologies

Electronic data storage capacity and access speed have increased while costs have gone down. Moreover, database software has become more sophisticated. As a result, a large share of information is stored and accessed electronically. The development of laser-based CD-ROMs and CDs that can both be read and written to make data storage even cheaper and faster. These technologies allow users to obtain information without having to handle paper records.

Scanning and Imaging Technology

Image technology, such as faxes, converts images on paper to electronic form that can then be reproduced in original form. Optical character recognition (OCR) technology converts images of text into digital code that can then be processed by computers. For example, new check encoding machines recognize some check amounts and automatically magnetic encode them; for images that are unrecognizable, the machine transfers the image of the check to a terminal at which a person manually encodes the amount.

The use of imaging and OCR technology was initially limited by three factors—the relatively high cost of digital transmission of complex images, the cost of imaging equipment, and the high error rates involved in imaging certain types of documents. However, with the growth of fiber-optic networks and rapid progress in data compression technology, costs of transmission have gone down. Also, equipment costs have fallen significantly, and error rates have declined.

Searchable Databases

Database software systems accessible through PCs allow information to be obtained according to selected search criteria. These systems facilitate distributed work by allowing remote access to data files. For example, work is underway to establish an information network for realtors that would allow automated online title searches, eliminating the need for title search firms to go to courthouses for searches. Similarly, online legal research has reduced the need to be near law libraries.

Electronic Files/Distributed Computing

Electronic folder management, an offshoot of imaging and database applications, consists of whole files of documents that are stored and retrieved electronically. Digital pictures of documents, rather than pieces of paper, are moved through the system. Such file folder imaging allows all information about a client or project to be collected and handled electronically. Combined with distributed computing that links personal computers together into a system, workers are able to share access to the same information, including a wide variety of information from offsite and distributed locations if desired. For example, some insurance firms are using this technology to store all information about clients and policies.

Law firms are also increasingly using image technology to enter legal documents into a computer format. Similarly, US West produces Yellow Pages by using shared folders so that everyone, including sales reps, graphic artists, and the collections office, can access work electronically.

A similar version of this is groupware that enables distributed teams to work together. Groupware, such as Lotus Notes, is based on client/server systems that allow users (or clients) to communicate securely over a local area network or telecommunications link with a document residing on a shared computer (or server).

Video Transmission

In spite of being invented in the 1930s and being touted at the 1964 New York World's Fair as the wave of the future, video telephony has been slow to be adopted. In the 1980s, an increasing number of companies purchased dedicated video conferencing equipment. Yet these systems were costly and cumbersome to use.[103] However, newer systems utilizing video modems are less expensive and more portable, and thus much more useful. Video modems translate and digitize data and send it over high-capacity lines. In fact, some expect desktop video conferencing will become commonplace for many users with access to advanced telecommunications. The cost is equivalent to two long-distance phone calls.

Personal Computers

Advances in speed, storage capacity, and ease of use have increased the utility of personal computers. In addition, new graphical user interface software (e.g., "Windows") makes computing easier for non-technical personnel, allowing more functions to be put on computers. Portable computing has become more powerful and cheaper in the last five years, better enabling distributed work. For example, the IRS is experimenting with the use of laptops for its field agents, who can then access a taxpayer's records via modem. The IRS expects agents will be able to do the job with only one field visit and not have to go back for further information and followup.

Smart Cards

Financial institutions, telephone companies, software firms and other businesses in the U.S. are getting ready to take another step in the continuing convergence of information and finance—the expanded use of "smart cards" to perform a variety of financial functions. Smart cards differ from conventional credit or ATM cards in that they can carry large amounts of information, using an embedded microchip.[104] A smart card could be used, for example, to download funds from the cardholder's bank account directly onto the card itself. Because this in effect makes the card a new form of cash, authorization of individual point-of-sale transactions would not be necessary. The same card could also carry detailed information about the holder's health insurance coverage; for most routine procedures, health care providers could be paid directly from the card. The Smart Card Forum—a 115-member consortium of financial institutions and others with an interest in applications of smart card technology—are now working to develop common standards and protocols.

Smart cards have the potential to reduce the need for branch banks to deliver services; they also reinforce the importance of central processing facilities. Customers would be able to download "cash" at home via a screen phone or a PC. The midnight trip to an ATM would no longer be necessary. Pension payments, Social Security, and unemployment and welfare benefits could also be transmitted electronically onto smart cards.

---

[5] Companies could pay as much as $100,000 for dedicated systems, not counting the cost of office space for the rooms. There were other disadvantages as well. Users had to schedule time in the rooms. In addition, cameras were not controlled by the viewers, which limited their ability to participate.

[6] "Smarter Yet and Smarter," *New Scientist*, October 1994, pp. 41-43.

Distributing Electronic Information

Distribution technologies allow electronic information to be switched and routed to particular places or uses. For example, electronic data interchange protocols allow documents or other data to be transmitted between users. Other technologies include Internet communications and e-mail; modems, including high-capacity cable modems; store and forward technologies, such as call forwarding systems; local and wide area networks; data compression technologies; voice mail and answering machines; pagers; wireless communications and computing; and automatic call routing systems.

Electronic Data Interchange

Broadly defined, electronic data interchange (EDI) involves the transmission of data and information electronically from one computer to another.[105] This information can be in a variety of forms, including data sets, forms and applications, funds, and letters. For example, in the insurance industry most transactions use standard contracts with the unique policy information summarized on one page. Electronic exchange of this information could streamline underwriting and issuing policies. In banking, electronic funds and invoice transfers are increasing. For example, EDI Banx is an electronic payment system developed recently that allows companies to transfer payments and remittance data electronically to vendors and suppliers. Similarly, the need to read utility meters may be eliminated with technology that transmits meter information directly to computers, which in turn could debit customer bank accounts.

Telephone Technologies

Development of new software and hardware applications in telecommunications have created a number of new uses for telephones, enabling more distributed work. For example, new digital call distribution systems and distributed computing make it possible to distribute phone service functions that previously had to be in more central locations. Call routing technologies allow calls from a wide geographic area to be routed to available offices, enabling companies to centralize service facilities and better manage the flow of calls. Remotely accessed voice mail and call forwarding better enables remote work. In recent years, innovations such as digital call distribution systems, telephone keypads, and screen phones have enabled banks, brokerage firms, and mutual funds to broaden the range of services that clients can access by phone. In addition, new number assignment technologies allow temporary assignments of Internet and other addresses to people who are on the road, making it easier to work off-site. Software-defined phone networks enable much wider adoption of dedicated lines, enabling easier access for interoffice calls.[106] Finally, the rapid growth in toll-free 800 service has meant that an increasing number of companies can inexpensively serve customers throughout the country or even the world. In the late 1980s, AT&T included about 60,000 numbers in its nationwide 800 service "public" listings directory.[107] In 1995, so many companies have 800 numbers there is a looming shortage of available new numbers.

Internet and Online Applications

New systems that allow information to be easily transmitted and obtained remotely by computer

---

[7] U.S. Congress, Office of Technology Assessment, *Electronic Enterprises: Looking to the Future* (Washington, DC: U.S. Government Printing Office, 1994).

[8] Leland Johnson, "Advances in Telecommunications Technologies That May Affect the Location of Business Activities," Rand Note N-3350-SF, Rand Corporation, 1991.

[9] Ibid.

are growing. Electronic mail systems have grown significantly, as has Internet use. Some companies use these and other systems to maintain close linkages among personnel. In addition, recently a number of firms have begun offering merchants software that will allow customers to make online credit-card purchases via the Internet.

Transmitting Electronic Information

Transmission technologies facilitate transmission of electronic information between two places. Atmospheric transmission includes: satellites, cellular systems, microwave relay systems, and radio and TV transmission. Terrestrial systems include cable, fiberoptics, and Integrated Services Digital Network (ISDN).

Wireless Technologies

Radio-frequency-based wireless technologies, including phones, computing, faxes, and other electronic devices are becoming more widespread.[108] Cellular telephones use switching and coded radio broadcast to localized cells, offering mobility in densely populated areas. The proposed low-earth-orbit satellite systems now in development would use switching and satellite broadcast, expanding mobility to remote areas of the world.

Telecommunications

The U.S. telecommunications infrastructure is international in scope and is evolving as both the delivery system and applications advance. In the last decade, there has been widespread deployment of a nationwide and international system of high-speed, high-capacity fiberoptic cable. Moreover, prices of telecommunications have fallen dramatically in inflation-adjusted dollars. For example, from 1972 to 1986 ordinary telephone service (MTS) rates fell between 44 and 36 percent when adjusted for inflation.[109] Similarly, revenues per minute for international calls fell from $2.25 per minute in 1975 to $1.18 in 1988 in real dollars.[110] As a result of falling prices and increasing quality, usage has increased significantly. For example, between 1975 and 1988, international telephone minutes from the United States increased by an annual average of 23 percent.[111]

In addition, within most major metropolitan areas, advanced telecommunications technologies, including fiberoptic lines, are available to most large users (see chapter 7). Advanced packet switching, ISDN, and other services allow transmission of digital signals. Broadband services to the home will allow increased work to be done from home, in part by enabling instant access to remote computers.

INFORMATION TECHNOLOGY AND SPATIAL PATTERNS

Historically, cities have arisen and grown as centers of transactions and commerce, largely because of the need for physical proximity among firms, suppliers, and customers. Agglomerations of people, infrastructure, and industry allowed for efficient production, transport, and distribution of goods and services. By allowing activity to be physically farther apart, yet functionally still close, advances in technology, particularly new transportation modes (e.g., train, electric trolley, cars and trucks), helped shape the first industrial city and the mass production metropolis. Today, new technologies, particularly information technologies, are creating closer connections between economic activities, enabling them to be physically farther apart. As a result, these technol-

---

[10] U.S. Congress, Office of Technology Assessment, *Wireless Technologies and the National Information Infrastructure*, OTA-ITC-622 (Washington, DC: U.S. Government Printing Office, July 1995).

[11] Johnson, op., cit., footnote 8.

[12] Ibid.

[13] Ibid.

ogies are central to the reshaping of the post-industrial metropolis.

Three factors determine the extent to which widespread diffusion of these advanced technologies will alter the location of industry and employment: 1) the degree to which functions can be cost-effectively transformed into electronic flows facilitated by telecommunications; 2) the degree to which these new activities still require spatial proximity to suppliers, customers, competitors, and other units in the firm, and 3) the degree to which other urban advantages remain important.

There are a number of factors that determine the degree to which functions can be conducted through telecommunications and information technology (IT). Because many services involve some transmission or manipulation of physical things (machines—auto repair; food—restaurants; hair—barbers), their location continues to be bound by the location of their customers. Some functions may be automated, for example, by technologies allowing self-service check-in and check-out in hotels. In these cases, the services would remain close to the customer, but employment would drop.

However, even for functions that involve production of goods or exchange of physical items with the customer (e.g., wholesaling, check processing), the information share of these functions is increasing, enabling many of these functions to be enhanced or carried out by IT and telecommunications. For example, 30 years ago information in most offices was on paper and transferred physically, requiring filing clerks, messengers, and even sometimes operators of pneumatic tubes to shift paper around in large offices. Today, a small but growing number of offices are moving to computer-based systems for virtually all information. Electronic imaging allows data to be transmitted electronically rather than by paper. For example, by using PC-based databases, analysts at the Internal Revenue Service expect to be able to respond more effectively to irregularities in claims without searching out physical files and seeking advice from managers. Similarly, in some insurance companies, centralized customer information files containing the history of customer interactions with the company allow one customer service representative to see the customer's entire history with the company.

Developments in computing technologies, database access, and telecommunications have increased the share of services that can be conducted without the direct involvement of customers, or at least without requiring their physical presence. For example, the rise in use of credit cards and 800 telephone service means that a growing number of customer service functions are now conducted over the phone from centralized customer service centers. On the whole, information technology appears to be leading to a shift from transactions and learning based on both face-to-face communication and goods shipment to one based on cheaper electronic forms of communication (see table 4-1 .)

The effect of greater numbers of electronic transactions appears to be a loosening of spatial linkages between firms and their suppliers, customers, competitors, and other units within the firm. Historically, because of the need to exchange goods, information or people cheaply and easily, many firms located in cities, creating what econo-

TABLE 4-1: Types of Linkages Between Business Operations

Linkage	Means
Face-to face	In-person meetings and interaction
Voice and video	Video conferencing and video phones
Voice	Telephone, voice mail
Electronic data	E-mail, fax, electronic data interchange
Physical mail	Postal service, overnight mail
Goods shipment	Conventional freight movement

SOURCE: Office of Technology Assessment, 1995.

mists term agglomeration economies.[112] The cost and difficulty of cooperation and communication increased over distance. Now industries performing routine functions but located in urban areas because of the need to transport or display physical goods (for example, back-office operations of some wholesale banks) might, through application of IT, be freed of the need for proximity. Similarly, industries requiring frequent face-to-face contact (for example, architects in design teams) might now be able to communicate through electronic means such as e-mail and video telephones, and be able to locate in suburban rather than central city locations.

This new wave of technology also enables greater economies of scale, particularly in the service sector, and these are reordering the spatial distribution of activities This is true in part because of the adoption of ever larger and more complex equipment in sectors such as freight transportation and wholesale trade. More importantly, information technology reduces the constraints of distance on business operations, letting business serve a wider number of locations and an increased number of customers from a single location. By removing the production of the service from a large number of local sites, each with limited output, these applications offer many companies increased economies of scale in production.[113] As a result, the communities in which these functions locate enjoy more employment, often at the expense of other areas.

For example, in some financial services, such as credit card payment processing and international money transfers, automation has created new economies of scale, with dominant providers concentrating routine activities in a few very large processing centers. American Express, for example, does all of its credit card processing in three large facilities, and has announced plans to consolidate into just two. Similarly, in rail freight, new information technologies allow rail control operations to be centralized in one facility that controls a company's trains throughout the nation. In wholesale trade, information technology and new practices reduce order transmittal and processing time and provide a larger window for transportation time, allowing facilities to consolidate and serve a larger area from one location.

Although these technologies are leading to consolidation, they also allow many of these operations to act more like switching centers than centralized production centers, and could permit workers to do the work from a widely distributed number of cites. In large part this is because, just as information technology reduces the importance of distance between the company and its customers and suppliers, it also reduces the importance of distance in links between the workforce and the company.

There are several examples of this. Computers and telecommunications enable people to telecommute from home or at a telecommuting center, even though the company they work for is in a centralized location. Similarly, new phone routing technologies allow phone operators and other customer service representatives to work at home and have calls automatically routed to their numbers. In Phoenix, Arizona, customer calls for transit route information go to a central number and are routed to workers at their homes, who access transit schedules from home terminals. In another example, in the last decade a major midwestern bank centralized all customer service calls to individual branches to its facility in the downtown of a large city. By using sophisticated call distribu-

---

[14] Agglomeration economies refer to the advantages gained by firms from spatial concentration in places with other firms and workers. Two types of agglomeration economies are noted: 1) localization economies, which refers to advantages to a particular industry through locating near other similar industries (e.g., auto makers in Detroit); and 2) urbanization economies, which refers to advantages across a number of industries due to spatial proximity (e.g., access to larger labor pools).

[15] Between 1977 and 1991, the average firm size in the service sector increased 19 percent, while average firm size in the goods sector declined 20 percent (U.S. Department of Labor, Bureau of Labor Statistics, unpublished data, 1994). Some individual service sectors increased even mor—efor example, financial services, 34 percent; airlines, 38 percent; and legal services, 49 percent.

tion technologies, even though the calls still come to one central number, they are now routed to the first available representative, and all the representatives are back in branches. The wholesale trade and distribution industry is evolving from a stock system where warehouses hold large amounts of goods, to a flow system, epitomized by cross-docking, where distribution centers hold goods only for minutes or hours before sorting them and reshipping them to new destinations. Broadly defined, these systems are consistent with distributed work, where work is not necessarily performed at one location.

Finally, where localization economies are weakened by advanced information technologies and telecommunications operations are, at least in theory, free to locate virtually anywhere, including in rural locations. Regional economic theory suggests that as the localization type of agglomeration economy becomes less important, firms will move to areas where land and labor are cheaper. These models, according to most scholarly work on technological change and location, have been largely applied to the manufacturing sector. Yet, there is reason to expect that they should also apply to services. Because IT enables them to maintain closer contact with others (e.g., suppliers, customers) over a greater distance, we would expect to find that many service activities disperse from centralized, high-cost locations.

However, many operations may still locate in high-cost metropolitan areas. Large metros continue to provide advantages for industry, including large and varied labor markets, frequent and cheap air transportation, large consumer markets, and availability of repair and technical services—what economists call urbanization economies. For example, metros like Phoenix, Atlanta, and Kansas City are home to a large number of back-office operations of banks and insurance companies that formerly were located in places such as New York and Los Angeles. And though the variation in telecommunications infrastructure is rapidly diminishing between metropolitan areas as mid- and small-size metros get widespread fiber-optics and other advanced telecommunications services, these services are not likely to be widely available in rural areas in the next 10 years.

Yet, to a great extent, how technological change will spatially reorder economic activity will depend upon the type of function involved. Because the nature of linkages differ depending on what is being done (e.g., moving goods versus moving information, face-to-face contact versus electronic contact), the next sections of this chapter examine several different functions. These are front office (customer interaction), routine back office (no direct customer interaction), goods production and distribution, and complex back office.

Front Office Functions

Historically, the location of a large share of service employment was dictated by local market demand. Branch banks, retail stores, customer service centers, and other consumer functions were widely distributed to serve local demand. For example, retail stores and many personal services (e.g., barbers, auto repair) usually located where their customers were, although mail order catalogues allowed customers in remote locations to buy goods. Developments in computing technologies, database access, and telecommunications have increased the share of services that can be conducted without physical proximity to the customer, although functions involving some transmission or manipulation of physical things are likely to be bound by the location of their customers.

These customer access technologies have allowed a number of functions to be centralized out of neighborhood or local sites. For example, many banks have moved loan processing and other functions out of local branches to centralized customer service centers, often without face-to-face contact with the customer.[114] Telephone technologies have also made it increasingly possible to locate

[114] In the 1970s, many banks sorted and sent checks to their customers. Now this function is done in centralized check processing centers.

telemarketing and other phone functions in distant locations. For example, Omaha and San Antonio are centers for a large number of telemarketing firms.[115] Similarly, when residents of London call to inquire about processing city parking ticket fines, the calls are processed in a small city in Northern England.

Many of these functions will now be accessed by consumers directly, often from home. Thus, major banks, software companies, and information service companies are all gearing up for what they expect to be a major new market in distribution of financial services via the information superhighway. The transition away from traditional local retail structures and toward direct customer access seems likely to continue, as customers grow more comfortable handling a wider range of financial transactions without face-to-face contact.

Routine Back Office Functions

The functions that can be farthest apart spatially are generally those that are the most routine, the most information-based (as opposed to involving the physical transfer of goods or paper), and the least customer-oriented. Back office work, or routine work not directly dealing with customers, makes up a large share of this work. Historically, large-scale back office functions were behind the front office, usually in the central business district (CBD). This was true for several reasons. First, the CBD was the best place to assemble a large number of workers because of public and private transportation advantages. Second, the large volume of paper and personal transactions required proximity with both front office and back office managerial and professional functions. The back office was like an assembly line where paper was processed and information added at certain places (the way parts are added to a car during assembly).[116]

Because the linkages between routine back office functions and customers and other firms are relatively limited, they have been somewhat more footloose than front office or managerial and professional back office work. Moreover, the routinized nature of the work has meant that information technologies were applied early, facilitating the spatial decentralization of work. The growing share of information in digital form able to be easily transmitted electronically, along with effective intrafirm communications, has meant that many back office functions can more easily be physically separated from front office and complex back office work with small losses in overall efficiency. In addition, information technology is one factor in the growth of average firm and establishment size in the service sector, making it easier for companies to split off routine functions from more complex functions and put each in its optimal location.[117]

Information technologies are enabling a larger share of back office work to be physically separated from where paper is processed or people interact. For example, the U.S. Postal Service is testing optical character readers (OCR) to read addresses on mail, which is then bar coded and automatically sorted to its appropriate substation. Addresses the reader cannot recognize are digitally photographed and transmitted to a computer screen where a person manually types the address into a terminal.[118] In Washington, D.C., OCR sorting takes place at the central mail facility, but the manual address entry is done in Greensboro, North Carolina, where wage rates are lower.[119] Workers view images of letters as they are sorted

---

[115] "Business Services," *Business Facilities*, Febuary 1995, pp. 18-22.

[116] Mitchell L. Moss, "The Information City in the Global Economy," paper presented for the Third International Workshop on Innovation, Technological Change and Spatial Impacts, Cambridge, England, 1990.

[117] U.S. Department of Labor, op. cit., footnote 15.

[118] Bill McAllister, "Automated Sorter Wins Letter Carriers' Praise," *Washington Post*, April 1994.

[119] "Neither Rain, Nor Snow, But Bad Info?," *Washington Post*, July 22, 1994.

in Washington and enter correct addresses, which are in turn electronically transmitted back to be bar coded on the piece of mail.[120]

Goods Production and Distribution

Processing goods involves four main components: production, transportation, distribution, and sales. Within production, it is worthwhile to distinguish between technologically advanced, complex production and more routine production. The development of mass production technologies has allowed decentralization, both within this country and overseas, of a considerable share of routine production. Many manufacturing firms have spun off low-skill assembly and warehousing functions to low-cost regions, in part because telecommunications facilitates communication between physically distant headquarters and these branch facilities.[121] In contrast, as manufacturers shift to more flexible production and move further back on the product cycle, localization economies become more important, favoring core locations closer to markets, suppliers, and a skilled, adaptable workforce.[122] In addition, high-technology industries are more likely to locate in metropolitan areas.[123] The creation of these technologically-based production complexes, referred to by some as "technopoles," is driven in part by the increasing need for technologically-based manufacturers to interact on a close basis with suppliers, customers, competitors, and other institutions (including universities and research institutes).[124] This need for agglomeration economies means that most are in metropolitan areas.

Within wholesale trade and distribution, information and telecommunications capabilities allow firms to deliver goods much faster than before, allowing in turn a consolidation of distribution facilities. These larger distribution facilities tend to locate outside the core of large metropolitan areas in areas with lower land and labor costs. Similarly, technological change allows freight transportation functions to consolidate and serve wider markets from fewer areas.

Complex Office Work

Even though information technology builds linkages in "cyberspace" that at least weaken, if not substitute for, physical space, not all functions are amenable to such ethereal linkages. Many functions, though supplemented by information technology linkages, still depend upon face-to-face proximity. These are more complex functions that are non-routine in nature, and are usually largely undertaken by managers, professionals, and executives in industries such as accounting, law, consulting, R&D, and corporate and regional headquarters offices. In addition, innovation and development of new products and services is a non-routine function that in most industries is predominately a metropolitan function—in many cases, an urban core function. Information technology appears to be bringing about an increase in the share of more complex functions and

---

[120] These facilities can also located in distressed urban areas if the costs of living are low enough, and if, in some cases, incentives are provided. For example, the City of Gary, Indiana, is using HUD funding to construct a 20,000-square-foot building to be leased to the Postal Service for use as such a remote encoding facility.

[121] Allan J. Scott, *Metropolis: From the Division of Labor to Urban Form* (Berkeley, CA: University of California Press, 1988).

[122] Ann Markusen, "Sticky Places in Slippery Space: The Political Economy of Postwar Fast Growth Regions," paper presented at the Harold Innis Centenary Conference on the Spatial Constitution of Economic Activity, University of Toronto, Sept. 1994; also David L. Barkely and Sylvia Hinschberger, "Industrial Restructuring: Implications for the Decentralization of Manufacturing to Nonmetropolitan Areas," *Economic Development Quarterly*, vol. 6, No. 1, 1992.

[123] In addition, manufacturing sectors traditionally classified as market-oriented, that reduce costs by locating near customers, are also likely to locate in metropolitan areas. These include, for example, newspaper printing, sand and gravel production, and recycling operations.

[124] Manuel Castells and Peter Hall, *Technopoles of the World* (New York, NY: Routledge, 1994).

employment by changing labor requirements, product and service offerings, the product (and service) cycle, and the innovation process.[125]

Traditional localization economies of clusters of firms in similar industries continue to be important for these non-routine and more innovative functions. Although information technology is increasingly being used in these activities, it does not substitute for close physical proximity or face-to-face contact, but supplements it due to the complex and highly varied nature of the interactions and information being transferred. Face-to-face interactions are still critical in many industries and functions. In some industries, such as accounting and consulting, professionals usually meet in the offices of their clients. In contrast, in industries such as banking and legal services, which still tend to be concentrated in urban cores, clients usually meet in the service provider firms.[126]

IMPACTS OF NEW TECHNOLOGY ON RURAL, URBAN, AND SUBURBAN ECONOMIES

Predicting the future is difficult. New and powerful information and telecommunications technologies continue to be developed and their impacts on industrial and residential location are still evolving. However, based on the analysis of individual industries (chapters 5 and 6), and individual worker telecommuting (chapter 7) and the location of telecom infrastructure (chapter 7), it is possible to see how advanced technologies are changing the locational patterns of individuals and industries, and, on the basis of this, to predict how these changes are likely to affect metropolitan economies in the United States over the next 10 to 20 years.

Urban/Rural Growth

Information technology and telecommunications are making the location decisions of an increasing share of the economy less dependent upon face-to-face contact and close proximity with customers, suppliers, and competitors. In large part, this reduced dependence and concomitant rise in a company's ability to be "footloose" with respect to location invites speculation about the radical decentralization of jobs out of metropolitan areas.

Indeed, there are many examples of either back office or consolidated front office functions locating overseas. For example, several U.S. insurance companies have followed New York Life's lead in establishing life insurance processing operations in Ireland. They benefit from relatively low wage rates for well-educated workers with mathematical and computer skills, and a lower employee turnover rate.[127] Some have proposed that shopping malls and office complexes have their closed circuit TV cameras monitored in real time by low-cost labor in Africa.[128]

Some argue that higher skill functions will also be increasingly conducted electronically from overseas locations. Yet so far this appears to be confined to a few specific functions, particularly computer programming. For example, Motorola has established computer programming and design centers in India, China, Singapore, Hong Kong, Taiwan, and Australia.[129] Similarly, the number of computer programmers working in India for companies located in the United States has

---

[125] National Academy of Sciences, *Information Technology in the Service Sector* (Washington, DC: National Academy Press, 1994).

[126] William B. Beyers and David P. Lindahl, "Competitive Advantage and Information Technologies in the Producer Services," paper presented at the American Association of Geographers meeting, 1994, San Francisco, CA.

[127] Richard McGahey, Mary Malloy, Katherine Kazanas and Michael Jacobs, *Financial Services, Financial Centers: Public Policy and the Competition for Markets, Firms and Jobs* (Boulder, CO: Westview Press, 1990), p. 231.

[128] N. Bannister, "Networks Tap Into Low Wages," *The Guardian*, Oct. 15, 1994.

[129] Keith Bradsher, "Skilled Workers Watch Their Jobs Migrate Overseas," *New York Times*, Aug. 28, 1995, p. A-1.

grown. This is consistent with locational patterns in programming, which has been done off-site for a large number of industries. As discussed below, however, this does not signal the beginning of an overseas migration of skilled U.S. jobs.

In addition, some functions locate in smaller towns of the United States. For example, Rosenbluth Travel, one of the largest travel agencies in the nation and headquartered in Philadelphia, moved its reservations center (which employs 200 people) from downtown Philadelphia to Linton, a small town in North Dakota, largely to save on labor costs but also because of concerns about labor quality. Functions that require relatively lower skills and a high percentage of clerical workers, such as telemarketing, where operating costs must be kept to a minimum, and which have limited travel needs and limited needs for other services, are more likely to locate in smaller places.[130]

Yet, in spite of the notable examples of some jobs going overseas or to rural areas, technological change is not likely to lead to widespread export of jobs or to a rural renaissance like that of the 1970s. There are several reasons why. First, much of the work that goes overseas is relatively routine and low-skilled and is most amenable to elimination by automation. For example, much of the manual processing of grocery store coupons is conducted in Mexico. However, new technologies and bar coding on coupons may allow coupons to be scanned and the information automatically sent electronically to the manufacturer for reimbursement, eliminating these manual data entry jobs. Similarly, in 1981 American Airlines moved its ticket processing center from Tulsa to Barbados. However, if ticketless travel becomes widespread, many of these jobs would be eliminated.

Second, firms may not want to lose control of operations and may worry about security of operations. This is especially true in banking and credit card operations. Realistically, the range of functions that can be transferred overseas is probably limited. It would not make sense, for example, to send domestic payment transactions overseas simply to reduce labor costs. Indeed, representatives of a major U.S. bank interviewed indicated that the bank is planning to consolidate in the U.S. certain data processing activity it now performs overseas.

Third, customer service is becoming more important. For example, in insurance, most companies want to co-locate claims processing and customer service.[131] As a result, firms are hesitant to place these functions overseas where there may be problems with language, accents, cultural attitudes, and skills, all of which would make it harder to establish a rapport with customers.

Even though information technology is making it easier for work to be done at a distance, at least in the foreseeable future many operations will locate in metropolitan areas, albeit usually suburbs and mid-size metros. There are a number of important reasons why.

1. Technology allows many service functions to gain greater economies of scale. Many companies are establishing "central utility" offices, each of which carries out specific functions. In the past, many service companies created separate profit centers where each product had its own center. Now many firms are trying to consolidate operations, in part to be able to "cross-sell" and get better staff and equipment utilization rates. The recent increase in integrated data systems that contain complete customer records accessible by customer name or ID number increases the ease of cross-selling. In addition, as firms reduce middle managers, remaining managers have increased spans of control

[130] Ranald Richardson and Andrew Gillespie, University of Newcastle upon Tyne, "Advanced Communications and Employment Creation in Rural and Peripheral Regions: A Case Study of the Highlands and Islands of Scotland," paper presented at the Information and Telecom Tectonics conference, Michigan State University, Mar. 21, 1995.

[131] "Trends in Insurance Company Location — and Relocation," New York: Moran, Stahl, and Boyer, 1994.

and are responsible for more operations. Dispersing these operations spatially makes it more difficult to manage them. Similarly, new technologies are allowing freight transportation and distribution functions to consolidate in smaller numbers of sites.

These consolidated centers are usually located in metropolitan areas. For example, when Aetna Insurance consolidated its 55 claims adjustment centers to 22, virtually all of the 23 closed offices were located in smaller cities, and the remaining 22 were in larger metropolitan areas. Similarly, a major bank that currently does loan processing out of 92 local branches plans to establish two central loan processing centers, both in large metropolitan areas. A credit card company is considering consolidating from eight locations for credit card processing, including credit analysis and marketing, into one center in a major metropolitan area. Mergers also stimulate consolidations and closures. For example, a major East Coast insurance company recently selected a site for a new data center that would consolidate operations now located at a half-dozen sites around the country—several of them facilities the company had inherited when it acquired a number of smaller carriers in smaller cities. Nike's distribution centers are located in Portland, Oregon, and Louisville, Kentucky.

As a rule, larger offices and facilities are in larger cities, while smaller cities house smaller offices.[132] In deciding which branch facilities to close in a consolidation, firms are often hesitant to close larger branches, since they would need to lay off large numbers of valued employees and hire and train others in the smaller, expanding office. As a result, the more common pattern is to close smaller offices in smaller cities and towns, and build up larger offices in metropolitan areas. In addition, because of downsizing, many firms have excess space in metropolitan areas that can be filled through consolidation. For example, an East Coast insurance company located its new data center in a midwestern city because the largest of the several data processing facilities it planned to consolidate was already located in this city.

2. Metropolitan economies have larger, more diverse, and more skilled labor markets, which gives firms access to a sufficient number of qualified personnel.[133] Many firms attach as much importance to the availability of qualified personnel as they do to cost, for both non-routine and routine functions. Indeed, one leading relocation consultant says, "Workforce availability is the number one factor in locating back offices. Cost is number two." However, these factors do not remain fixed over time. For example, because of the rapid growth in back office jobs in Wilmington, Delaware, by the late 1980s, banks that had built new back office facilities there were expressing concern about their ability to find qualified personnel.[134] In addition, as technology restructures work

---

[132] The larger the metropolitan area, the larger the size of the producer service firm. Andrew J. Kremenec and Roger Cohn, "Business Services Within a System of Cities," paper presented at the 22nd annual meeting of the Mid-continent Regional Science Association, Chicago, May 31, 1991, cited in William Testa, "Producer Services: Trends and Prospects for the Seventh District," *Economic Perspectives*, Federal Reserve Bank of Chicago, vol. XVI, No. 3, May/June 1992.

[133] A number of large corporations have moved their information services departments out of expensive central city or large metropolitan locations to medium-sized metros. A major reason for not moving to smaller or rural areas is the difficulty of attracting highly skilled information technology employees. Jim Daly, "How To Staff IS" *Forbes ASAP,* 1995, pp. 26-29.

[134] Gi-Yong Gang, Corporate Restructuring and Urban Economic Development Policy: Delaware Back Office Strategy and the Wilmington Metropolitan Area (University of Delaware, unpublished Ph.D. dissertation, Fall 1993), p. 125.

and automates many routine jobs, many jobs are becoming more skilled.[135] In fact, managerial and professional employment grew from 22 percent of total employment in 1972 to 30 percent in 1994.[136] As a result, the increasing share of services with information-based employment means that metropolitan locations are important.

3. Since there are more customers in larger metropolitan areas than in smaller ones, firms choose to expand in larger metros to minimize distance from the customers. The delivery of services through face-to-face contact from a large central place is more economically efficient than from a smaller place. Similarly, even though goods distribution is undergoing consolidation, the need to be near large numbers of customers means that it is not going to rural areas.
4. Many firms are reluctant to locate back office operations in places with poor access. As one bank executive noted, they want to keep operations within a two- or three-hour drive, since they want to be able to drive out and back in a day to "kick the tires." This is part of the reason for the rise of back offices in places like Albany, New York, Wilmington, Delaware, and other cities close to large metros such as New York and Philadelphia. Access is also a factor leading to many back office functions locating in places with good air travel. Staff, in particular sales staff, need to travel to customers, while corporate management needs to be able to fly in to inspect facilities. Because corporate decisionmakers fly so much, air access is often important in location decisions. Metros have an advantage because they are usually served by more and cheaper flights and by more jets and fewer propeller planes. Many firms, for example, have limited their search to metropolitan areas to which major airlines offer direct, point-to-point jet service from their headquarters. Airline deregulation appears to have strengthened air transportation from large metropolitan areas hosting hub airports. Similarly freight transportation and distribution relies on infrastructure (ports, intermodal facilities, air express) usually located in metropolitan areas.
5. A firm might want to locate an operation that processes large volumes of paper or collects funds, rather than just data—processing credit card remittances, for example, or mailing monthly statements to mutual fund shareholders—near a major regional postal facility, most of which are located in metropolitan areas. However, if electronic commerce becomes widespread this factor will become less important.
6. Metropolitan areas offer an environment conducive to innovation and learning, which, as technology increases the importance of continual product and service development, is an advantage to many more firms. Innovation is also more likely to occur in communities or regions marked by vigorous competition among a multiplicity of local firms than in places where one or just a few firms are dominant; and in places where large numbers of sophisticated, demanding buyers are concentrated.[137] Moreover, rapidly changing technologies and markets mean that interfirm cooperation is increasingly important, and this cooperation is enhanced by locating in large and mid-sized

---

[135] Thierry Noyelle, *Beyond Industrial Dualism: Market and Job Segmentation in the New Economy* (Boulder, CO: Westview Press, 1987). p. 81.

[136] U.S. Department of Labor, Bureau of Labor Statistics, unpublished data, 1995.

[137] Michael E. Porter, *The Competitive Advantage of Nations* (New York: Free Press, 1990), pp. 154-157; Annalee Saxenian, *Regional Advantage: Culture and Competition in Silicon Valley and Route 128* (Cambridge, MA: Harvard University Press, 1994).

metropolitan areas.[138] This is just as true of the financial community in Wall Street as it is of the microlectronics industry in Silicon Valley. Such competitive conditions have long been characteristic of major financial centers like New York and Chicago. The concentration of wholesale banking and investment banking firms in New York City, for example, has helped make New York the leading center of innovation in global finance.

Inter-Metropolitan Differences

Consistent with historical patterns, new information and telecommunications technologies are making more economic functions footloose, at least with respect to the choice of metropolitan areas in which to locate. These technologies are making it easier to locate many operations in any region of the country, which is likely to lead to increasing factor-price equalization between regions. Historically, some regions had monopolistic advantages stemming from agglomeration economies, location near natural resources, transportation, and most recently from an advanced telecommunications infrastructure. However, as information technology allows more functions to be done at a distance or to be consolidated, these competitive advantages are likely to lessen, and lower-cost regions, providing they have sufficient external economies (e.g., air travel, transportation, labor force) are likely to grow. Moreover, as discussed in chapter 7, widespread diffusion of an advanced telecommunications infrastructure, at least to the top 50 to 100 metros, will further reduce the inherent advantages of the largest places. The advantages once held by some higher-cost metropolitan areas is likely to decline and lead to concentrated dispersal to a larger number of metropolitan areas. However, this dispersal is highly selective and uneven, and not all places will be able to succeed, particularly those places that have not managed the transition to the post-industrial metropolis. Places whose economic base remains in declining activities, particularly older manufacturing and traditional services, are likely to continue to experience economic hardships.

Once technology enables more locational freedom, the search by firms for lower-cost locations is likely to continue to reshape regional employment patterns, in part leading to higher rates of growth for many lower-cost smaller and mid-size metros.[139] For example, wages are almost one-third (32 percent) higher in large cities over 500,000 inhabitants than in smaller places.[140] According to one study in 1991, locating a 300,000-square-foot facility that employs 1,000 clerical and operating personnel in the Phoenix area rather than San Francisco would save $6.35 million annually—just in space and payroll costs. Between New York City and Tampa the differential is even greater—$11.25 million per year (see table 4-2). Such cost differences were a significant factor in Salomon's choice of Tampa as a site for its new back office complex. The average annual salary of Salomon's back office staff in New York City was $39,000, compared to $23,600 in Tampa.[141] Consistent with these patterns, some Sunbelt areas that have grown rapidly during the past decade, such as Phoenix and Dallas, have seen some of their cost advantage disappear.

---

[138] Saxenian, ibid.

[139] For example, Beyers found that there was a relative shift of professional service employment toward more medium-sized places and away from the largest metro areas. William B. Beyers, *The Producer Services and Economic Development in the United States*, (Washington, DC; Economic Development Administration, 1989).

[140] Edward Glaeser and David C. Mare, "Cities and Skills" unpublished manuscript, Harvard University, 1994.

[141] Columbia Business School, "Salomon Brothers," unpublished case, 1994.

TABLE 4–2: Cost Comparison Among Selected Metropolitan Areas

Metro area	1992 population (million)	1991 office lease rate (per s.f.)	Average clerical salary 1991
New York City	19.7	$39.25	$22,500
Los Angeles	15	28.00	22,200
Chicago	8.4	34.50	19,700
San Francisco	6.4	24.50	22,800
Dallas-Ft. Worth	4.2	18.00	19,500
Miami-Ft. Lauderdale	3.3	30.00	18,400
Phoenix	2,3	20.00	17,800
Tampa-St. Petersburg	2.1	21.75	16,500
Kansas City	1.6	19,00	18,100
Columbus	1.4	20.50	17,600
San Antonio	1.4	13.50	16,600
Salt Lake City	1.1	18.00	16,700
Albany	0.9	16.50	21,500

SOURCES. U.S. Department of Commerce, Bureau of the Census, Metropolitan *Area Data Book, 1994;* and *Fortune, Nov* 4, 1991

This means that many operations that seek to reduce costs will not locate in historically high-cost metros such as New York, Boston, Los Angeles, and San Francisco, but instead will locate in less expensive metros, many in the mid-parts of the country. In fact, geographic centrality aids operations, by reducing average air travel distance, and enjoying a central time zone. Geographic wage and other cost differentials will continue to encourage office relocation to low-cost regions until an equilibrium is reached or approached.

Finally, if localization economies are weakened by advanced information technologies and telecommunications, urbanization economies and diseconomies may become more important. Large metros continue to provide advantages for industry, including large labor markets, frequent and cheap air transportation, and availability of repair and technical services. Advantages for individuals include high-quality medical care, cultural and educational institutions, and a large and diverse labor market. At the same time, the diseconomies of urbanization include high costs of living and doing business, crime, pollution, traffic congestion, and lack of access to open spaces. The interplay between economies and diseconomies of large metros may play a more important role in shaping the future of metropolitan areas.

As, or perhaps because, technologies allow more locational freedom, development may be becoming more uneven, with places that made the transition to the post-industrial metropolis (see chapter 3) doing well, while places that have not, continuing to decline.[142] Places with the advantages described above—including a skilled, moderately priced labor force; low diseconomies (e.g., crime, congestion, and environmental pollution); an industrial base of advanced innovative companies; and high quality of life—will continue to do well. In contrast, places without these advantages are likely to continue to lose out, and risk a continuing cycle of decline as reduced advantages (both public and private) lead to reduced economic

[142] IT and telecom appear to be leading to similar patterns of uneven development in the United Kingdom as well. See John Goddard, "New Technology and the Geography of the UK Information Economy," in John Brotchie, Michael Batty, Peter Hall, and Peter Newton, *Cities of the 21st Century: New Technologies and Spatial Systems* (London: Longman, 1991).

growth, which in turn reduces advantages even more.

In an era of rapid technological change, metropolitan areas and cities that succeed—grow in population, jobs and incomes—will be places that have successfully managed to adapt to the new technology system. In contrast, metros, cities, or parts of cities that will not or cannot adapt run the risk of being left behind to face stagnation or decline. Adaptation of people, institutions, and the built environment will be important to urban core survival (see chapter 9).

Central City Prospects

Many core city economies have grown in the last 15 years, but others have either stagnated or lost employment. As discussed in chapter 3, much of the revival of central cities in the 1980s was due to dramatic growth in producer services on the one hand, and increased foreign immigration on the other. Yet, the perception has grown that American cities, particularly the urban cores of many large metropolitan regions, are in trouble, and may not be sustainable over the long term, drifting downward in spirals of joblessness and business failure, revenue shortfalls and declining services, crime, racial strife, and ungovernability, with middle-income families leaving while the wealthy wall themselves off in protected enclaves.

Technological change is likely to continue to impact urban cores. By letting more of the economy be operated at a distance, it threatens the economic well being of many central and inner cities, and inner, older suburbs of metropolitan areas. The historic dominance of the central city is giving way to a much more dispersed pattern of growth in which economic activity is spread throughout the metropolitan areas in other nodes and centers (what some term "edge cities"). Yet, this growth is uneven in most places. Some parts of the metro, usually a select group of outer suburbs and even exurban locations, are growing fast and becoming home to fast-growing companies, while other parts, particularly many parts of the central city and inner suburbs, are suffering from job loss, disinvestment and poverty. Nevertheless, there are a number of important changes that are facilitated by technology.

The New Metropolitan-Wide Economy

First, it is clear from looking at urban settlement patterns in the late 20th century that the model of the core city as home to most of the productive capacity in the metropolitan area no longer describes most metropolitan areas. Today, as industry has become spread throughout the metro region in large agglomerations, the metropolitan area as a whole is the functioning economy (see table 3-4).

One result of, and cause of, the rise of metropolitan-wide economies is that technology is enhancing the locational freedom of firms within metropolitan areas. At one time, most core cities had historic advantages stemming from agglomeration and reduction of travel that compensated for their high costs. However, technological change and other factors are reducing the privileged position of the core, in some sense making it one of several "edge cities" within the metropolis.[143] By making the spatial location decisions of firms less relevant, technology has accentuated the tendency of many industries for jobs to follow people. Quality of life as well as cost become more important factors. As a result, the traditional monopoly of center cities as the location for many firms is likely to evaporate. Central cities increasingly have to compete on other factors, including cost, niche markets (such as tourism), and amenities.

Weakened Central City and Inner-Suburb Economies

There are a number of technological factors that will put the economies of central cities, particularly outside the central business district, and inner

[143] For example, see Aydan Kutay, "Effects of Telecommunications Technology on Office Location," *Urban Geography*, vol. 7, No. 3, 1986, pp. 243-257.

suburbs at risk. First, as discussed above, technology is reducing the importance of distance for many functions, particularly more routine functions. As a result, firms have the freedom to find lower-cost locations with cheaper land, buildings and labor. These are often in outer suburban or exurban locations or in mid- and smaller-size metros. Moreover, such locations provide firms an opportunity to avoid the diseconomies of crime, traffic congestion, and air pollution endemic in many urban core areas. In addition, because technology also leads to consolidation in larger facilities, and in some cases requires new and larger facilities, many routine goods and services industries are locating in the outer suburbs or exurban and satellite areas at the edge of metros, where larger and cheaper parcels of land are available.

Technology also enables a greater share of "non-traded" or "residentiary" functions to be centralized and moved. As a result, many of the jobs that cities and inner suburbs could rely on because of local spending (e.g., branch banks, local phone service centers, insurance agents), are likely to disappear, having been centralized and located either in other regions or in outer suburban jurisdictions. In large part this is caused by the shift from local service delivery to distribution of products from regional or even national service centers, a practice that favors lower-cost locations outside older urban areas. Places that cannot capture these or other new functions will be at risk of decline.

These technological and economic trends suggest that the non-central business district portions of many central cities and their inner suburbs will continue to be the weakest part of metropolitan economies for at least the next two decades, and that their relative competitive position will get worse without economic development policies.

Core Specialization: Innovative and Complex Service Functions

In addition to weakening many core economies, technological change and other factors contribute to a restructuring of urban core economies, particularly in the central business district, as places containing more specialized functions employ people with higher skill and education levels. As routinized work moves out of central cities, the economic base is increasingly shaped by more complex, higher-end office work, including managerial and professional functions. There are several reasons for this.

First, while technology allows work to be routinized, and hence moved, it also supports, especially in the services, the continuous creation of new products. For example, beginning in the late 1970s, U.S. financial institutions began to move beyond the automation of routine processes and to use computer technology to create new products and services—a process that continues to this day. This is important because, if product cycle theory applies to services, it suggests that innovative functions tend to be done where they were developed. Just as manufacturing establishments producing new goods tend to be located in more urbanized areas,[144] innovative functions in services tend to be located in the larger urban areas. Innovative activities in established centers usually have greater access to the specialized skills, detailed market knowledge and support services needed for the development and introduction of new products and services. Many innovative firms continue to need the kind of stimulating and supportive environment in which they first arose.[145] In addition, established service centers may also provide the best location from which to access potential customers for new services.

---

[144] R.D. Norton and J. Rees "The Product Cycle and the Spatial Decentralization of American Manufacturing," *Regional Studies*, vol. 13, 1979, pp. 141-151.

[145] This is not to say that there are no innovative small firms in rural areas, but rather that within companies that are multi-locational, innovative functions tend to be located in metropolitan areas.

Second, the rise of globalization, in both manufacturing and services,[146] has meant that a larger share of the U.S. economy is devoted to command and control functions. These include headquarters of multinational companies as well as large producer service firms (e.g., legal service, consulting, engineering) with clients across the globe. These high-level functions are naturally attracted to a small number of global cities, including New York, San Francisco, and Los Angeles.

Finally, even though managerial and professional offices continue to disperse throughout the metropolitan area, many are still concentrated in central cities because these locations facilitate face-to-face communications. As Richard Meier wrote: "The need for face-to-face contact offers perhaps the best explanation for the strong attraction retained by the urban center."[147] For example, functions such as law, corporate banking, securities trading, and professional services (e.g., accounting, advertising) are more concentrated in central areas of large metropolitan areas than other firms (see table 3-4). These operations have a high percentage of managerial and professional workers and require the support of large banks, law firms, accounting, advertising, and courier and postal services on a regular basis.[148] Their need for frequent outbound and inbound travel nationally and internationally reinforces their presence in large metropolitan areas.

In spite of the importance attached to face-to-face contacts in binding offices to the central business district, little empirical work has been done. One study, now 15 years old, of firms in downtown Toronto sheds some light on differences in contact between sectors.[149] The sectors with the greatest number of face-to-face linkages were corporate banking and legal services. In contrast, life insurance had a very low level. These data are consistent with locational patterns of these industries in the last 20 years (see chapter 3).

Yet, as discussed above, a number of new technologies at least conceptually have the potential to reduce the importance of spatial proximity in communication. For example, portable computing and phones, e-mail and Internet connections, fax, and video phones all make communication over distance easier. Potential new technologies such as ubiquitous computing, high-definition displays, and high-speed and high-capacity communications will accelerate this trend. While these technologies make it easier and cheaper to communicate over distance, there are at least two reasons to think that these technologies may not substitute for a large share of face-to-face needs.

First, the extent to which these technologies can replicate face-to-face communication is not clear. Such communication has not only richness and contextual advantages, but also includes informal, "water cooler" conversations, and meetings over lunch. Technology developers are working on devices to overcome these limitations, such as video phone systems that randomly call other group members for informal, spontaneous chats, and ways to allow users to enter "hallways" for conversation on e-mail. As work groups gain more comfort with these systems, they may be willing to use them over a distance. However, to date, the ability of these systems to foster productive relationships at a distance has not been proven. In addition, relatively little is known about how organizational learning occurs. As more functions and sectors in the economy adopt flexible production modes and continuous innovation strategies, organizational learning becomes in-

---

[146] U.S. Congress, Office of Technology Assessment, *International Competition in Services*, OTA-ITE-328 (Washington, DC: U.S. Government Printing Office, July 1987).

[147] Richard L. Meier, *A Communication Theory of Urban Growth* (Cambridge, MA: MIT Press, 1961), p. 64.

[148] Thomas Black, *The Changing Office Workplace* (Washington, DC: Urban Land Institute, 1990).

[149] G. Gad, "Face-to-Face Linkages and Office Decentralization Potentials: A Study of Toronto," in P.W. Daniels (ed.) *Spatial Patterns of Office Growth and Location* (New York: John Wiley, 1979, pp. 277-323).

creasingly important. The extent to which this can occur in distributed settings is not clear.

Second, some industries and functions may be more willing to use these systems and decentralize than others, probably depending upon the extent, nature and criticality of communications, and the extent of cost competition in the industry. Professionals such as doctors, lawyers, architects, engineers and scientists, who depend upon face-to-face communications, may be especially resistant. One anecdote illustrates that proximity may continue to be important. An attorney in a mid-sized Washington, D.C., law firm recently moved to a more spacious and plush office at the other side of the building, requiring a short walk to the rest of her colleagues. After about two weeks of feeling "isolated" the attorney asked to return to an office next to her colleagues. It is not likely that any kind of technology advance, at least in the next decade, will overcome the need for proximity in these situations.

These technologies do appear to facilitate communications between groups located in different central locations. For example, Xerox is using an e-mail and video conferencing system to facilitate cooperative R&D efforts among groups of scientists and engineers around the world. Similarly, consulting firms such as Arthur Anderson use Lotus Notes to communicate and work cooperatively among its offices worldwide. In both these cases, the workers involved are in central locations (e.g., Palo Alto, New York).

Core Specialization: Industrial Niches Based on Flexible Specialization

The predominant effect of technological change is toward dispersion of activities, particularly the more routinized ones. However, technologies may also create specialized niche functions, which, if they do not give urban core areas an edge, at least may help compensate for their disadvantages of cost, congestion, etc. Many of these niche functions are related to innovation, flexibility, speed of delivery and response, and other factors, often described as flexible specialization. Yet, even if these opportunities become economically and technologically feasible, they are likely to remain a niche function, targeting specific markets.

Within manufacturing, there are several important developments that could help urban cores at least retain manufacturing employment. First, increases in recycled products, in part brought about because of better technologies for recycling and reuse, can provide urban areas with markets for some processes. By locating in cities, recycling industries are locating close to the natural resource because urban areas already produce large amounts of recyclable waste. Second, the increasing importance of design and innovation can provide important niches for some urban manufacturing. For example, New York's role as a center for arts and design spawns customized manufacturing that relies heavily on the design component. Finally, the growth of computer- integrated manufacturing (CIM) and other flexible technologies appears to reduce optimal facility size, allowing smaller sites to be profitably used (see chapter 6). This reduces land and building costs, reducing pressure to migrate to areas with lower-cost land; thus, locating within the confines of urban factories and warehouses becomes more feasible.

Within distribution, some specialized opportunities are emerging. For example, there may be opportunities to develop smaller distribution facilities serving more concentrated markets in central-city locations. Hospitals in some cities, for example, have moved to a "stockless purchasing system" —one of the more aggressive applications of just-in-time distribution. As more businesses and institutions implement just-in-time and direct-replenishment supply programs, opportunities to locate relatively small, specialized distribution centers in or near central cities should increase.

In freight, the next decade could see smaller facilities in or near central cities that are designed to handle short-haul and specialty cargo. In intermodal rail and truck freight, the short-haul economics will make sense only if the truck trips at either end are short as well. This argues for keeping termi-

nals as close as possible to customers—and if short-haul service attracts enough volume to justify them, for multiple terminals, which may be located in central or inner city rail yards.

Urban Economies and Skills

Technology will likely continue to lead routine work and goods-related work to disperse from the core, and at the same time concentrate highly skilled professional and managerial jobs in the core. In addition, technology is creating many more skilled jobs regardless of location. As a result, there is a growing mismatch between the location of the new skilled economy and the large and rapidly growing population of lower-skilled and often minority residents in urban cores.

In many industries future jobs will on average be more skilled. For example, as the insurance industry uses more technology and less labor, the skill requirements of their labor force increase. Not only are organizations leaner, they must respond faster and they must complete tasks correctly the first time. In flat organizations there is no place to refer difficult questions, catch errors, or develop successors through on-the-job training. Employers expect technical proficiency in operational aspects of the business. Moreover, in many service sectors, many lower-skill office jobs are disappearing and in their place are more complex customer service and back office jobs. Customer service employees are increasingly required to have the right personality to respond to customers, have the right speech patterns, be able to solve problems on the spot, and have a lot of product knowledge. In addition, perceived or actual work ethic differences can play a role.

Business responses echo this change. One bank executive from a large midwestern city noted: "We are thinking about moving more routine work out of the city since labor costs are high, and getting good-quality labor is hard. The graduates of the public schools are very bad, and as a result, we need to retrain people to read, write, and communicate." In a 1991 survey of financial services CEO's conducted for the New York City Partnership, 82 percent of those surveyed said that the quality of entry-level workers was either "extremely important" or "somewhat important" in their choice of locations for their operations—and 71 percent said they believed the quality of entry-level workers in New York City was worse in 1991 than it had been five years earlier.[150]

As a result, cities face a challenge in how to bridge what appears to be a growing gap between the skills required for employment in advanced services concentrated in urban cores, and the limited skills that many young big-city residents bring to the job market.

Urban Infrastructure and Buildings

Because new technologies are changing the organization of work and the nature of production processes, the potential for a mismatch between infrastructure developed for the mass production metropolis and the infrastructure needs of the post-industrial metropolis is significant (see chapter 9).[151] Much of the urban redevelopment efforts undertaken by core cities in the 1980s was to adapt urban infrastructure and buildings designed for industrial and goods-handling functions to fit the needs of an information-based services economy. However, these mismatches are likely to continue for two reasons. First, because technological change threatens to reduce economic activity in some urban cores, there is likely to be increased vacancy and underutilization of the built environment, including infrastructure and buildings. In part, this is driven by the fact that fast-growing industries in both manufacturing and services are increasingly located in the suburbs. Moreover,

---

[150] Price Waterhouse, "Survey of New York City Executives in Six Industry Sectors," (New York: *New York City Partnership, Growth Strategies Project*, December 1991), p. B:4.

[151] Richard Barras, "Technical Change and the Urban Development Cycle," *Urban Studies* 24, 1987, pp. 5-30.

while the practice of office "hoteling" is unlikely to be adopted for more than a small share of office functions, it could serve to reduce office demand, particularly in urban cores (see chapter 7).

The changing nature of demand for infrastructure is also likely to lead to underutilization. For example, one reason for the high rates of business suburbanization is that facilities in the suburbs are usually more readily adapted to current technology. In some service sectors, buildings that can easily be reconfigured, especially to accommodate fiberoptics and other wiring, are increasingly important. In many older buildings it is difficult to wire for computers and telephones and to change wiring. Similarly, old retail downtown stores with narrow fronts and deep backs make less sense with today's greatly reduced inventories. Just-in-time delivery (JIT) allows for different store shapes. Many new back office "transaction factories" in the services require a large floor plate in large horizontally laid-out buildings, in contrast to the high-rise office complexes in the core. Freight transportation and distribution facilities increasingly require larger facilities, which are more available in the suburbs. Also, the move to a flow system in wholesale trade through practices like cross-docking, requires new configurations of buildings quite different from older, smaller, multi-level, urban warehouses (see chapter 6). Manufacturing increasingly requires smaller facilities, continuing the trend that makes many large factories obsolete. Physical infrastructure also sometimes does not accommodate new technology. For example, the trend toward larger trucks will further erode the already-tenuous position of many older cities as regional or national distribution centers. Bridges, tunnels, and arterial highways in these cities were in many cases not designed to accommodate trailers as large as those in use today, let alone even larger vehicles.

Outer Suburban and Exurban Prospects

Over the next two decades many outer suburbs of metropolitan areas will continue to be the healthiest part of the metropolitan economy and the strongest parts of the national economy. Job growth is likely to continue, in part driven by relocations out of the central city and inner-suburbs, but also by faster rates of expansion. Suburban jurisdictions housing this growth will by and large enjoy fiscal health. However, they may be hard pressed to find the resources to pay for the expansion, especially if they do not make new development pay all the associated public costs (e.g., roads, schools). (See chapter 9.) These will be places that will need little or no assistance from state or federal governments to promote development. Residential development is likely to continue to expand at the peripheries of most metropolitan areas, leading to increased urban sprawl and lower-density developments. These trends in business and residential location, as discussed in chapter 8, are likely to exacerbate a number of problems, including outer suburban traffic congestion, consumption of open space, and increased gasoline consumption.

Business Suburbanization

The locational freedom gained by advances in intrafirm communications technology will likely lead to a further dispersal of firm activities, with an increasing share of routine and even non-routine back office activities in the suburbs. There are a number of factors that lead business to choose suburban locations.

First, though rent gradients may have declined in the last two decades, in most cities central city office rents, land costs, and parking costs are still higher than in the suburbs. For example, in Philadelphia, base rents for class A office space in Center City are about $20 per square foot, compared to $12 to $15 in the suburban edge cities of Great Valley, King of Prussia, or Conshohocken. Yet, this cost differential appears to be evening out as demand for central city space slackens. In some cities, costs in the central city are cheaper than many premium suburban locations. For example, the preferred office locations for many companies in Atlanta are those on the north side side, even though they command premium rents. Suburban sites also often offer campus-like rural environments.

Second, taxes are often higher in central cities. For example, in Philadelphia, taxes and maintenance costs are at least $1 per square foot higher in Center City. Moreover, some cities levy a wage tax. Philadelphia's current wage tax is 4.96 percent for city residents and 4.31 percent for suburban residents. Suburban employers routinely recruit workers by mentioning that even at the same salary they will have more take-home pay from the new job than from their old job in the city.

Third, as many core cities adjusted to a more service-oriented economy, the demand for skilled office workers increased, driving up wage rates in the city. Often city residents, and particularly minority residents, accustomed to blue collar jobs did not have the skills needed for the white collar jobs available. The suburbs, on the other hand, provided a pool of college-educated women interested in returning to work, particularly to jobs with more flexible hours and shorter commutes.[152] By moving offices to the suburbs, employers could fill positions faster and at lower wages. Increasing suburban labor force participation rates narrowed this differential during the 1980s, but many employers did relocate during that time. Now, the issue is not labor cost, but labor quality, as employers continue to question the performance of many center city schools and doubt that the essential skills can be found among city residents. As technological advances continue to raise the skill requirements in many industries, employers are more likely to find suitable employees in the suburbs. Moreover, many service workers already live in the suburbs and therefore prefer suburban office locations as well. Location in the suburbs minimizes commutes for many workers, especially middle- and higher-level workers.

Fourth, there has also been a shift in what real estate means to corporate images, and suburban locations have become more amenable to administrative functions. Historically, many companies used large office buildings as a way of projecting corporate image. At the turn of the century, many banks and insurance companies built monumental, imposing office towers to convey to customers images of security and financial soundness. Later, office towers became images of modernity and prosperity. Transamerica's corporate headquarters is the well-known pyramid building in San Francisco. At 527 feet, the Traveler's Tower in Hartford was visible from much of the Connecticut countryside. I.M. Pei's design made the still-taller John Hancock Tower in Boston a famous building even without the notoriety of its collapsing windows. However, such considerations seem to have lessened considerably. For example, one reason for Sears' decision to build the Sears Tower, the tallest building in the world at the time, was to enhance its corporate image and obtain the advertising good will from it. However, when the Sears Merchandise Group moved to a campus-like location in suburban Hoffman Estates, it abandoned the Sears Tower.

Residential Dispersion

Residential dispersion to the outer suburbs and exurban areas is also likely to continue, if not accelerate. Forces driving this include cheaper land in these peripheral locations, which means more affordable and larger houses and allows more Americans to live in low-density residential settings. Technological change is facilitating this.

Because technology is enabling increased business suburbanization, greater numbers of workers can live even further out in exurban locations and still commute to jobs at the edge of metropolitan areas. As the number of workers telecommuting increases, residential dispersion is likely to increase even more (see chapter 7). Most of these telecommuters, however, will not be telecommuting from home five days a week. Rather they will be telecommuting perhaps two to three days a week from home, or from telecommuting centers

[152] For example, see K. Nelson, "Labor Demand, Labor Supply, and the Suburbanization of Low-Wage Office Work," in *Production, Work, and Territory,* Alan Scott and Michael Storper (eds.) (Boston, MA: Allen Unwin, 1986).

at the edge of metropolitan areas. As a result, workers will still have to live in or near metropolitan areas so as to commute to telework centers or to their offices in metros. Thus, reduced work time in central offices is not likely to lead to significant deconcentration of population to rural areas far from metropolitan areas. However, because an increasing proportion of workers will commute fewer days to central locations, they can choose to live in houses farther from urban cores.

Another force affecting dispersal will be the length of the work week. If productivity significantly improves because of new information technologies, the work week might drop to four days a week. Already, many companies let workers work four days per week, with longer hours per day. Commuting only four days a week to central locations would slightly increase the ability to live farther out. Finally, advances in intelligent transportation systems should reduce congestion and commuting times, allowing even more residential choice (see chapter 7).