Users' Perspectives– Views of U.S. Services Exporters

CHAPTER 5

Service-exporting *firms agree they are generally we// served by U.S. carriers.*

U.S. TELECOMMUNICATIONS FIRMS not only compete successfully in the European market, they support and often provide the competitive edge for other U.S. firms that deliver services to Europe. This chapter captures some of the perspectives of these users of U.S. and European telecommunications networks.[1] Providers of travel and transportation services, financial services, and architectural, engineering, and construction services are given particular attention either because the y contribute strongly to the volume of U.S. services exports, or because they represent sectors where considerable growth in services exports is possible with more intensive use of telecommunications. Exporters of these and other kinds of services provided information for this chapter through interviews, letters, and responses to a written questionnaire.

Many of the corporate officials that responded to inquiries of the Office of Technology Assessment (OTA) argued that the U.S. Government has a role to play in encouraging both the liberalization of European markets and the efforts of U.S. industries to expand the export of services. The themes most commonly expressed were that government should:

- Apply strong and persistent pressure, through trade negotiations and other diplomatic contacts, for further opening of European markets and removal of trade barriers for both services and manufactured goods;
- Pay special attention to reducing restrictions on telecommunications services, since for most of these companies the use of American equipment and American-provided enhanced information services is highly desirable; and
- Encourage both U.S. and European firms to move toward international standards as the most cost-effective way of getting the most out of information technology resources.

In all services-exporting industries surveyed, most firms agreed that they are well served by U.S. telecommunications carriers, **and** that American communications and computer technology gives them a competitive edge in developing innovative services.[2] Accustomed to a geographically expansive domestic market, the firms complain bitterly about the wide difference across European countries in availability of telecommunications services and the difficulties of dealing with many regulatory regimes within what seems to them one natural market. From their perspective, the benefits of an integrated European marketplace seemingly are more

[1] In preparing this chapter, the Office of Technology Assessment (OTA), with the help of contractors, conducted three case studies of the use of international telecommunications by major sectors exporting services to Europe (travel and transport; banking; and architectural, engineering, and construction). Representatives of more than 40 firms and trade associations were interviewed for these case studies. Another dozen firms contributed information in response to mailed inquiries from OTA staff and the chairman of the project's advisory panel.

[2] For example, an energy firm said: ". . .U. S. competence in telecommunications and computer technology provides advantageous information and decision support processing capabilities that are reflected in Improved accuracy, timeliness, analysis, and integration of products that support our objectives for customer service. " (Thomas M. Woods, Vice President for Information Services, the Hall iburton Company, correspondence with OTA, July 30, 1992.)

obvious than the risk that a "Fortress Europe will try to exclude them. Many firms said that if serious regulatory problems can be alleviated there arc good prospects for expanding and diversifying their services exports.

Many of the problems encountered by American services industries in dealing with European public telephone operators (PTOs) are problems just as much for European firms as they arc for U.S. competitors. If U.S. telecommunications firms can gain wider access to the European market, their biggest marketing opportunity will be the challenge to solve these problems not just for American firms but for potential European customers.

Some U.S. firms operating in Europe had a more positive view of their experience than others had. A news firm said, ''On the whole, our experience with European telecommunications operators has been positive. The variety, quality and availability of communications services is, with few exceptions, excellent. (At the same time, the firm noted that services sometimes cost ''5 to 10 times their equivalent in the United States."[3]) A large financial institution said: ". . .we have had little or no difficulty with the financial services regulatory policy bodies or with the telecommunications regulatory authorities in developed countries that already have state-of-the-art information networks infrastructure. These strongly positive comments were not typical. However, many of the business people that contributed to this chapter, anticipating that the move toward deregulation or liberalization in Europe will continue, said conditions in Europe are likely to improve steadily.

The general outline of the community of U.S. services exporters is shown in figure 5-1. Over half of all U.S. services exports are transportation-related services (which include airline fares, shipping and port fees, and all tourist-related services provided in this country and other countries to foreigners).[5] Licenses and royalties (intellectual property earnings such as income from movies and music) are the second largest group, but account for only 12 percent of total services exports. All other services combined account for less than one-third.

Problems with European telecommunications networks

Many serious or frustrating technical problems beset U.S. services providers using telecommunications in Europe. Some of these problems are regulatory or institutional, but many simply result from the necessity for U.S. firms to rely on European technology and services at the far end of their international networks and for their intra-European communications. In some countries the infrastructure is technologically behind that in the United States, in other cases it is not interoperable with U.S. networks, and in all cases it is unfamiliar. U.S. firms must often depend on the very organizations with which they arc competing for

[3] Letter from Martin Fuhr, Director of Telecommunications, *The International Herald* Tribune, to John Diebold, OTA Advisory Panel Chairman, Sept. 25, 1992.

[4] Letter f rom Richard M. Rosenberg, Chief Executive Officer, Bank of America National Trust and Savings Association, to John Diebold, OTA Advisory Panel Chairman, July 9, 1992.

[5] Note that a service delivered in this country to a foreign national, such as medical treatment or education, is counted as an exported service.

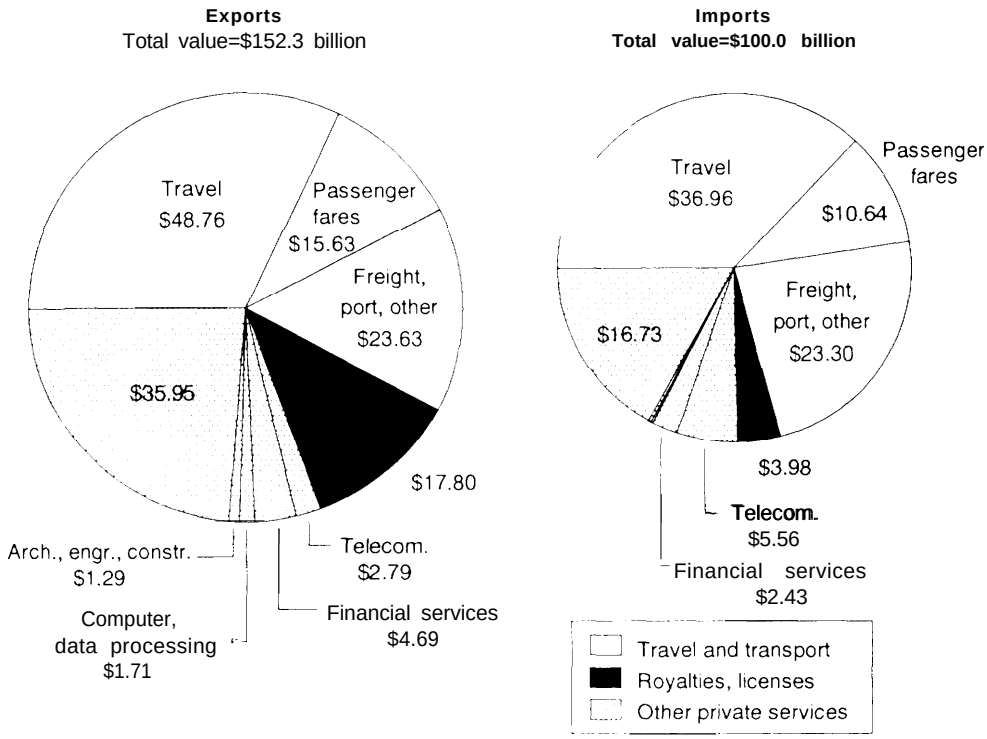


Figure 5-1.
U.S. Services Trade by Sector, 1991
($billions)

SOURCE U S DEPARTMENT OF COMMERCE, BUREAU OF ECONOMIC ANAL YSIS, 1993

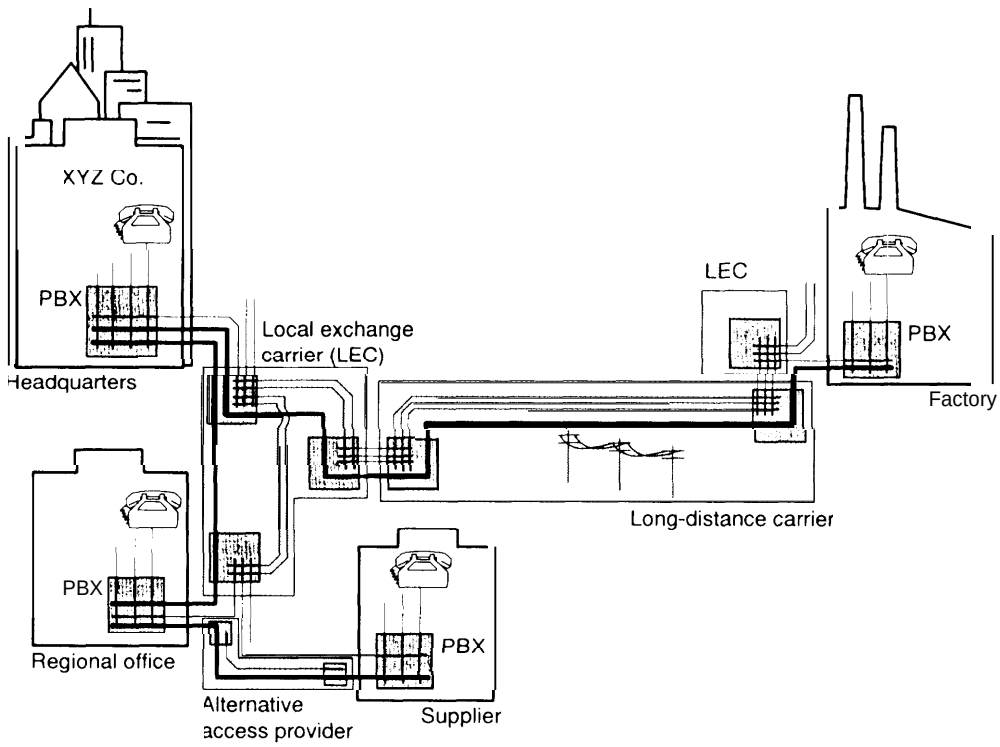
the final delivery of their services, or they must deal with government bureaucracies that have only recently and reluctantly opened their markets to foreigncrs.

The nonavailability of leased lines in some countries and the long delays in installing them in others arc common complaints of U.S. users.[6] Financial institutions, for example, put high priority on the freedom to usc private line services as they choose, and emphasize the need for leased line prices based on costs. They want permission to interconnect private networks with public networks and to connect preferred terminal and network equipment. Several firms complained about the lack of reliability of leased lines. In confirmation, a recent survey conducted by the International Telecommunications Users Group (INTUG) reported that only one-third of all leased circuits was available 100 percent of the 3-month period examined, and 64 kbps circuits had an availability rate of 99.0 percent, Availability of 99 percent means that downtime averaged

[6] This situation should gradually Improve as the result of t he EC Directive on Open Net work Provision, which calls for every member state to make avai l able five categories of leased lines, with no restrictions on their use. (See ch. 3.) Although the Directive called for full Implementation by June 1993, European observers say it may take much longer before this directive is fully Implemented. International Telecommunications Users Group, *INTUG News,* London, October 1992.

Figure 5-2. Leased-Line Private Network

A (dedecated) leased-line private network is preferable for a user requlring the interconnection of several locations with high traffic volumes. The transmission capacity that the user leases from the public earner(s) goes through the earner's(s') facilities, but revolves no switching since the routes are dedicated solely to that user. Note that the user can connect to a long-dstance carrier directly or through either the local exchange company (e. g., a Bell Operating Company) or through an alternate access provider, such as Teleport or Metropolitan Fiber Systems.



SOURCE. OFFICE OF TECHNOLOGY ASSESSMENT, 1993.

1 hour, 40 minutes per week, and is well below recommendations by the Consultive Committee for International Telephone and Telegraph (CCIIT) of a minimum 99.6 percent availability.[7] This is especially disruptive for users of higher bandwidth digital links because such lines handle more traffic than analog circuits.

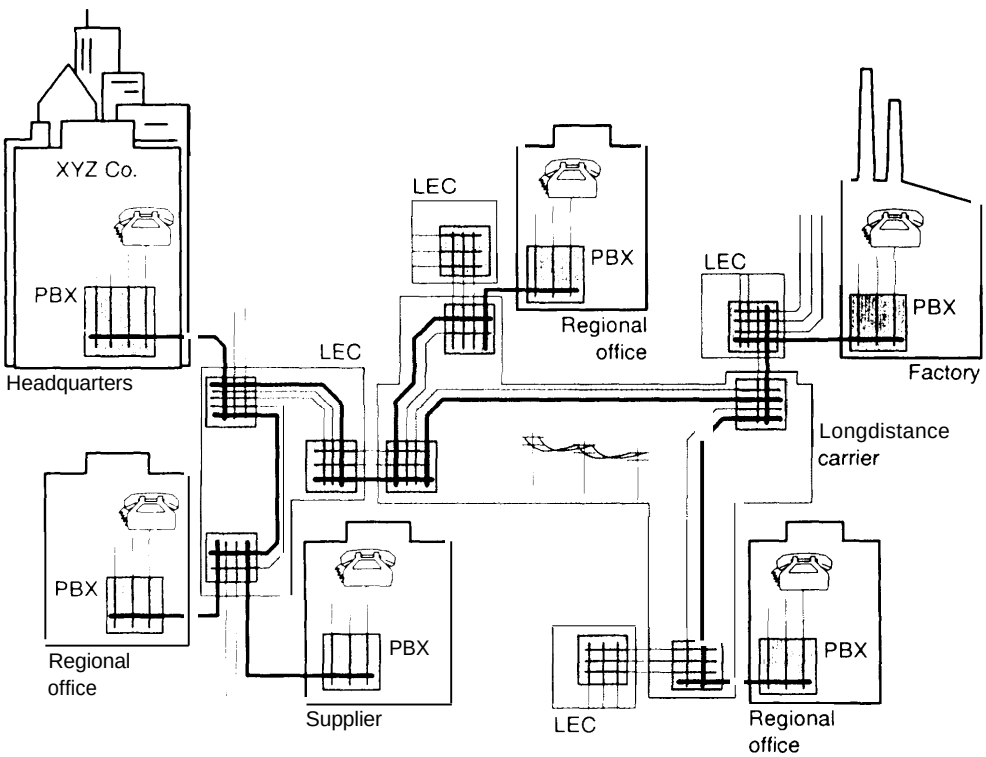
The lack of fast data transmission is a serious problem both for U.S. firms and for their European competitors. A European bank told OTA that in some countries it could not get data transmission as fast as 2 Mbps, or there are problems with getting and maintaining transmission.[8] Said the bank official:

> *This situation has to be compared with the options available to U.S. firms in their domestic market, [where], . . even 45 Mb/s channels can be obtained at prices designed to encourage the experimentation and learning needed to inte - grate new applications with a firm's operations.* [9]

[7] Ibid.

[8] In Spain, a travel services company reported that speed on leased lines in some areas does not exceed .3 kbps or 300 baud.

[9] Comments provided by Ulrich Cartellieri of the Deutsche Bank AG to John Diebold, Chairman of the OTA project's advisory panel, for OTA use, Aug. 19, 1992.



SOURCE OFFICE OF TECHNOLOGY ASSESSMENT, 1993

Figure 5-3. Virtual Private Network

To the user, a virtual private network (VPN) appears to be identical to a leased-line network in terms of functionality-presubscribed bandwidth, abbreviated dialing, etc. However, while the "intellitgence" in a dedicated network resides m the customer's PBX, a VPN relies on the software in the public carrier's(s') switches for routing calls, rather than sending them through preallocated "pipes." As a result, a VPN is more flexible and, therefore, well suited to inferconnect many sites with moderate traffic (enough that direct dial costs become high but not enough to justify a dedicated line). Like a dedicated leased-line network, a VPN can be configured internationally (this illustration does not include an international component).

Enhanced services such as virtual private networks, packet-switching, and interactive very small aperture terminals (VSAT) are not available in some areas at any price. Where they are available from public telephone operators, they are often not interoperable across national boundaries. They may be at different stages of development or there may be differing national standards. As U.S. services producers increasingly move to the use of frame relay technology, they are finding that features and functions available in the United States are not the same as those available in Europe.

Crossborder payments are a special problem for financial services firms. National clearing systems differ in degree of automation, formats, access, and reporting systems.[10] Integrated fault resolution is either not available or requires users to put their own support personnel at both ends of a circuit.[11] Concerns about data security are not addressed by most European carriers and

[10] See U.S. Congress, Office of Technology Assessment, *Trading Around the Clock: Global Securities Markets and Information Technology*, OTA-BP-CIT-66 (Washington, DC: U.S. Government Printing Office, July 1990).

[11] Letter from John M. White, President of the Information Technology Group of Texas Instruments, to John Diebold, Chairman of the OTA project's advisory panel, July 2, 1992.

companies must provide their own engineering and technical support for this purpose.

A nearly univeresal complaint is the high cost of telecommunications. Voice calls from Europe to U.S. headquarters can be 50 to 100 percent higher than calls in the other direction. lntracountry costs are also high. '2 Leased line costs, although they have recently declined somewhat, arc still high. This constrains private network optimization and business operations. Nevertheless, and in spite of complaints. these costs are to a large extent accepted as the price of doing business in Europe. They do not generally discriminate against U.S. firms.[13] (See figure 5-4.)

European PTO high tariffs, billing practices, installation delays, **and other** *problems constrain business use of telecommunications.*

The problems resulting from technological incompatibilities are compounded by institutional inconsistencies and vagaries. U.S. firms complain of excessive variability in European ordering and payment procedures and contracting arrangements, and of uninformative. confusing, and irregularly timed billing. In some countries bills are reported to arrive up to 2 years late, and in other countries firms may be requested to pay for a year's service in advance. At best, planning and pricing new communications-based services are difficult because of the wide variety of billing cycles and formats and currency conversion problems.[14]

Another major complaint is the long time required for PTOs to install circuits. One U.S. travel-related company reports that promised installation dates are not met 85 percent of the time, and very commonly it takes double the estimated time.

American firms are typically impatient with the need to negotiate separately with many countries to install one network. A General European Network (GEN) becomes operational in the spring of 1993, with 16 Mb/s capacity, operating between Frankfurt, London, Madrid, Paris, and Rome. This is to bean infrastructure, not a service, and should shorten time for getting private circuits operating across several countries. GEN was designed by European Telephone Operators to preempt pan-European networks that might be offered by American firms.[16] It is a joint venture by France Telecom, BT, Deutsche Telekom, Telefonica (Spain), and ASST/ STET (Italy).

GEN will not end the coordination problem. A spokesman for INTUG says:

> *Differcnces in rules and regulutions among the various telecom operators make the management of business tele -*

12 American Airlines, for example, says that an average 70 percent of reservation communications costs are in the local loop between the long-distance carrier and the SABRE terminal.

[13] It was reported to OTA, however, that in a few countries high costs and bureaucratic intransigence are compounded by the demand for bribes.

[14] In Germany, a group has been formed to protest the refusal of Deutsche Bundespost Telekom to itemize charges rather than issue blanket statements, as well as to protest its high tariffs. "Providers Band Together," *Communications Week International*, May 1991, p. 3. The group, the Association of Private Telecommunications Providers, includes subsidiaries of AT&T and General Electric (GEISCO).

[15] This company said that it t ypically had a 30 days' wait in the United Kingdom, and a 150 days' wait in Italy and Greece.

[16] Reportedly the fear is that AT&T would be the first to build a pan-European network as regulations are liberalized. "Euro-Broadband Net Set,"*Communications Week International*, July 20, 1992, p. 3.

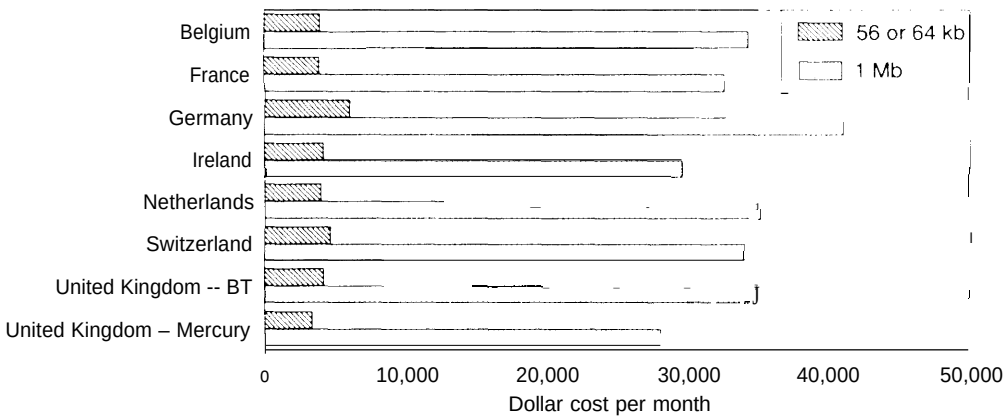


Figure 5-4. MoM/y *Charge for Half of Private Line to the United States From Europe, 1992*

SOURCE *NETWORKWORLD*, VOL 9, NO 10, MARCH 9, 1992, P 32

communications in Europe a frustrating and wearisome experience. This requires network planners to acquire a vast knowledge about bureaucracy, rules, procedures, and tariffs.[17]

To a large extent, these problems merely reflect the fact that the ''European market'' is still made up of many national markets, and the problems will be resolved as the move toward a single market goes forward. They are, in the meantime, problems as much for European firms as they are for U.S. competitors. If liberalization of markets continues and U.S. telecommunications firms gain wider access to the European market, the challenge to offer an alternative to these problems will be their biggest marketing opportunity.

European regulatory problems

Regulatory restrictions are said by some U.S. users to be more troublesome than technical problems. Among the worst of these appear to be restrictions on connecting leased lines to the public-switched networks and on the use of non-PTO equipment. The latter force users to adopt unfamiliar and incompatible equipment, and in many cases to maintain redundant systems in order to deliver services.[18] For example, a U.S. network services provider competing in the United Kingdom was not allowed to use

[17] Ernst Weiss, Vice Chairman of INTUG, Europe, quoted in "Europe's Telecoms Users Speak Out, " *Communications* Week *International*, June 22, 1992, p. 29.

[18] Europeans point out that procurement restrictions are not one-sided. American computer companies (e.g., IBM, Digital, NCR) are usually in the top five suppliers in national markets across Europe including in some countries the government procurement sector. By contrast, according to some Europeans, non-U. S, suppliers to the U.S. Government are rare, as a result of Buy America laws. The E.C.Directive aimed at opening public procurement in telecommunications/com puter equipment to com petition allows preference for European suppliers only if the price differential is not more than 3 percent. On Feb. 1, 1993, the Off Ice of the U.S. Trade Representative prohibited government procurement of many EC products not specifically covered by trade agreements and threatened other actions in response to EC "discriminatory procurement practices. "

AT&T equipment and complains that it had to struggle to adapt BT hardware to its network. '9 When approval to use imported technology is granted, the approval process may take many months or even several years.

There is little that U.S. telecommunications companies can do to solve these institutional problems, which make it difficult to offer the ''one-stop shopping' and ''seamless global networks' that U.S. multinational corporations say they need. For users, these problems add up to greatly increased costs of doing business. Added to tariffs that are very high by U.S. benchmarks, are high equipment costs, maintenance costs, and value-added taxes that U.S. services firms say prevent them from offering services at the lower prices they could otherwise aim for.

Another regulatory issue of particular concern to providers of financial services and data processing services is national legislation aimed at privacy protection. An EC privacy directive that was proposed in 1990 could have disrupted the use of transnational financial data systems by restricting the flow of data across national boundaries or by requiring explicit consent for each use (or processing) of certain personal data. The proposed Directive was strongly criticized by the European Parliament. A new version that reportedly will be much less restrictive was to be issued in October 1992, but has not yet appeared. There is a separate proposed Directive on protection of personal data in the context of public digital telecommunications networks. According to the U.S. International Trade Administration, '' l-J. S. industry believes that the proposed umbrella data protection Directive and the Council of Europe Convention will provide adequate protection. . . . [and] a sector-specific digital services Directive is therefore unnecessary and could create uncertainty and disruption in the provision of telecommunications services. ' '[20]

Various national laws also restrict the flow of data. This is seen as an attempt to keep data processing jobs within the country, by many U.S. firms that want to consolidate their own data processing in a few large centers for greater efficiency. This concentration would have another benefit for the United States, in that large computer systems are most often supplied by U.S. manufacturers such as DEC and IBM.

Representative services export sectors

Travel and transportation services[21]

Travel and transportation accounted for 58 percent of exported services in 1991, but contributed only one-third of the services

[19] Letter f rom Joseph 1. Dione, Chief Execut ive Off ice of McGraw-Hill, Inc., to John Diebold, Chair of the OTA project's advisory panel, July 27, 1992.

20 U.S. Department of Commerce, International Trade Administration, "E.C. Telecommunicate ions," release of Oct. 1, 1991.

2. This section draws on an OTA contractor report: Gligor Tashkovich, "The Use of International Telecommunications Net works in t he Delivery of Transportation and Travel-Related Services," September 1992. Interviews were conducted in, and corporate profiles were constructed for, two major airlines, three network support or computer processing firms serving airlines, two hotel chains, two package delivery f irms, and a diversified travel services firms. Other travel-related firms contributed Information directly to OTA through participation in mail surveys or workshops.

trade surplus.[22] About 10 percent of the total trade surplus came from airline passenger fares.

Airlines depend heavily on satellite communications for navigation, position reporting, weather information, and traffic control (and more recently, for passenger telephone calling). It is, however, their electronic reservation systems that arc considered major factors in intraindustry competition.[23]

Airlines use private leased lines, public switched networks, shared networks and third-party networks, usually with satellitc back up, to connect reservation centers, airports, and travel agencies. They are constantly seeking ways to get higher bandwidth and decreased costs. For example, American Airlines' SABRE travel information and reservations computer system operates in 10.000 locations and has 225.000 terminals, of which 4.500 arc outsidc North America.[24] Of the overseas locations, about 500 arc on a private network and 4,000 arc interconnected through SITA (Societe Internationale de Telecommunications Aeronautiques).

SITA is a network serving the international airline industry. It operates in 187 countries. has 24 hub sites interconnected by three separate communications paths using both cable and satellites, and is one of the worlds heaviest users of international leased circuits. A French company, SITA appears to be recognized not as a competitor but as the critical backbone that holds the entire airline industry together.[25] Other third-party service providers also provide data processing or network support for airlines or handle their reservations and ticketing; most of these are U.S. companies. and some are jointly owned by several airlines.[26]

Freight transport also relies heavily on telecommunications. One of the difficulties here is coordinating and tracking goods movements that may require several travel

Electonic reservation systems *are* *considered a major factor in airline competition.*

[22] In 1991, the large trade surplus in passenger fares ($5 billion), travel services ($1 1.8 billion), and port services ($4.9 billion) was reduced by a deficit in freight transport (-$4.7 billion) .

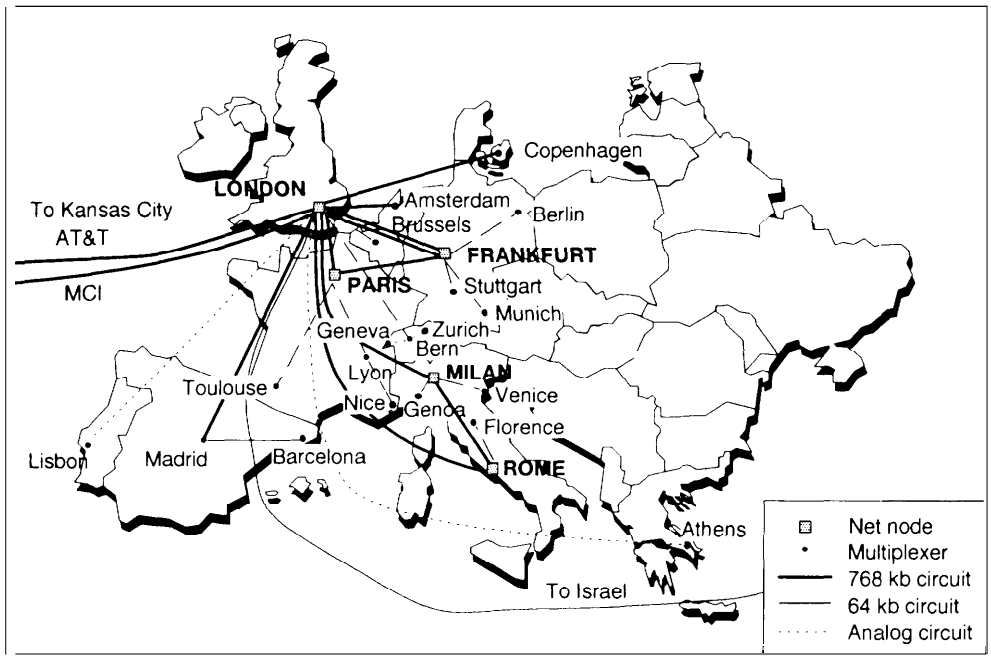
[23] European computer reservation systems, American firms said, are biased; the flights of the sponsoring airlines are booked first. This charge was made against U.S. computerized reservation systems in their early days.

24 During recent "fare wars" in the United States, American Airlines set a record by processing over 3,100 messages in 1 second on its SABRE system, and United Airlines doubled the usual number of reservations transactions on its system to 2,100 per second. It was also reported that AT&T itself set a daily record of 177.4 m Ill ion calls on t hat same day, as compared with an average volume of 135 to 140 m ill ion calls. "Airfare War Strains Data, Voice Nets," *CommunicationsWeek*, June 8, 1992, pp. 1.

25 Tashkovich, op. cit., footnote 21. See also "Freedom of Choice," *Communications Week International*, Apr. 6, 1992, p. 1. In April 1992, SITA's subsidiary International Telecommunications Services BV was renamed Scitor, Ltd., and relocated in Maiden head, England. It will provide value-added network services, including E-mail and electronic data interchange, for 250 customers such as Budget Rent-A-Car Corp. and Hilton International Co., linking t hem into t he SABRE system. SITA is said to have taken t his step "because it sees little room for growth in the airl ine communications sector. ""SITA Broadens Base," *Communications Week International*, Apr. 6, 1992.

[26] For example, PARS Service Partnership provides data processing or network services or both to Trans World Airlines, Northwest Airlines, and some regional carriers. WORLDSPAN, which provides airline schedules and information services to t ravel agents worldwide, is owned by affiliates of Trans World Airl ines, Delta Airlines, Northwest Airlines, and ABACUS Distribution Systems (a computerized reservations systems which in turn is owned by nine airlines in the Far East).

Figure 5-5. The Programmed Airline Reservation System Network



SOURCE PROGRAMMED AIRLINE RESERVATION SYSTEM, JUNE 1992.

modes (sea or air, rail, truck) and may cross several national boundaries and time zones. A triumvirate of U.S. companies has formed Encompass Europe, NV, to offer a data-network tracking service for multinational corporations that send inventory worldwide. This will allow shippers, consignees, forwarders, and carriers to communicate through a single electronic interface regardless of the kinds of computer systems they use.

U.S. package delivery systems operating in Europe are in direct competition with national postal systems, serving primarily business customers looking for speedier services than postal authorities offer.[27] The challenge is to operate ground-based delivery systems that must be fed through an international air network and must delivcr within a tight time frame. Package delivery firms said that telecommunications is the single most critical factor in success in the European market, and U.S. technological know-how gives them a competitive edge,

United Parcel Service (UPS), for example, has four communications systems using both public and private international networks and local packet-switched data networks. These systems are used for package routing and vehiclc/aircraft control; international

27 The Federal Express Corporation in 1992 drastically reduced its operations in Europe, shutting down operations in over 100 cities; it will continue to serve 16 major business centers directly for intercontinental shipments. The company was reported to have lost $1.2 billionin 4 years. "FedEx: Europe Nearly Killed t he Messenger," *Business Week,* May 25, 1992, p. 124.

billing and receivables transmission; electronic messaging for company coordination; and electronic data interchange (ED I) for package tracing, links to financial institutions, and links to other services such as weather reporting. UPS recently got Federal Communications Commission approval to provide common carrier services by acquiring capacity in three transoceanic cables (two of which cross the Atlantic) .28

Hotels, like airlines, depend on international telecommunications to handle reservations, as well as for intrafirm coordination and handling and charging for calls made by guests. U.S. hotels in Europe say that they need, but do not yet have, integrated reservation networks operating across countries and linked to airline reservation systems. They also report that they need better software that can be continually updated for changing area Codes.

The Sheraton reservation network, for example, consists of interconnected star networks with hubs in major European cities, each hub connected by 56 kbps leased lines to hotels and reservation centers. However, the network in fact covers only 10 percent of the hotel chain's properties, because the number of facilities changes rapidly but also because in some countries the telecommunications options are ''very limited. '

Holiday Inn Worldwide has about 150 locations and 14 reservation offices in Europe. The company uses the TAT-8 and TAT-9 transatlantic cables for a 64 kbps link from Brussels to London to New York (its headquarters is in Atlanta). It had been using a conventional terrestrial star network within Europe, with the hub in Brussels, but in 1992 the company began a transition to a VSAT network operated by MCI, using INTELSAT. which will have 120 to 150 Earth stations in the United Kingdom. Belgium, France, Germany. Italy, and the Netherlands.[29] This will connect all of the chain's proper-tics in these countries, but MCI cannot offer a pan-Europe network under existing regulations. It will provide terrestrial links until it obtains licenses needed to operate VSATS in the six countries. Holiday Inn Worldwide says that the reason for the move is to 'circumvent the problem of long (and often unpredictable) service delivery times required for leased lines."[30]

Financial services[31]

About 3 to 5 percent of U.S. services exports are financial services, primarily in commercial and investment banking. In 1991, the United States exported about $4.7 bill ion in banking services, which accounted for 3 percent of total services exports and about 4 percent of the total trade surplus. Less than

29 The UPS application to the FCC was unopposed; the company is thought to be strategically positioning itself to provide a value-added international network for customers, in the future. Tashkovich, op. cit., footnote 21.

29 The network will operate at 19.2 kbps, with the expectation of higher speeds when the TCP/I P protocol is brought *into the* system.

[30] "Freedom of Choice," Communications Week *International*, Apr. 6, 1992, pp. 18-19; also "MCI VSAT Push," p. 1, and "No Turning Back," Editorial, *Communications* Week *International*, Apr. 6, 1992.

[31] The case study on which this section relies has been separately published. See U.S. Congress, Office of Technology Assessment, *U.S. Banks and International Telecommunications*, OTA-BP-TCT-1OO (Washington, DC: U.S. Government Printing Office, September 1992).

a score of U.S. banks actively compete in European markets; middle-sized and smaller banks serve their domestic customers' overseas needs through correspondent banks and the use of shared networks such as SWIFT and CHIPS.

Banks operating overseas use networks in two ways: for intracorporate business support such as might be used by other large multinational corporations-voice, data transmission, fax, electronic mail (E-mail) and voice mail—and as a means to create and deliver financial products and services. U.S. banks say that they have many disadvantages in European markets,[32] but that American computer and communications technology has nevertheless given them offsetting advantages. Their competitive edge has been the ability to create and supply innovative value-added financial services.

U.S. banks maintain a competitive edge *in creating and supplying innovative value-added services.*

During the 1980s, several U.S. banks aggressively developed global networks with packet switches, multiplexer, and multiprotocol bridges/routers to connect local area networks (LANs) and wide area networks (WANs) serving their dispersed facilities. Alternatively they used third-party services providers to interconnect LANs with X.25, TCP/IP, frame relay, or other fast data transmission technologies.[33] Recently there are signs that U.S. international banks are moving toward greater user of public-switched networks or hybrid networks, sometimes outsourcing their own networks. One reason for this move is to reduce the costs of maintaining network management personnel; a more positive driver is the availability since 1990 of virtual private networks, less expensive than traditional leased line networks because they make more efficient use of network facilities by dynamically allocating dedicated lines to customers on demand.

In addition to private networks, banks use several shared networks or third-party networks for credit authorization and validation, and for payments and settlements. These include SWIFT, CEBAMAIL, MasterCard International, VISA International, and payment netting systems. The most widely used is SWIFT (the Society for Worldwide Interbank Financial Telecommunications), which has over 1,800 member banks and links over 3,000 financial institutions in 84 countries. SWIFT is currently being upgraded to offer EDI services, a netting service for banks trading in European Community units (ECUs), and the automatic matching of foreign exchange and money market transactions. CEBAMAIL is a data network established by European central banks.

32 They are generally smaller and less diversified than foreign competitors as a result of U.S. laws and regulations originally designed to prevent monopolistic aggregation of financial capital and power. By U.S. law, national banks can conduct foreign lending operations only through chartered subsidiaries (Edge Act corporations). American banks lack the close corporate ties enjoyed by the banks of Japan, Germany, and some other nations. U.S. corporations increasingly bypass banks to raise their own capital through commercial paper. Moreover, retail deposits have been migrating to nonbank competitors such as mutual funds. U.S. banks have been hurt recently by the large U.S. trade deficit, a low savings rate, and losses on developing countries debts and on commercial real estate. Finally, banks are usually at some disadvantage outside of their own domestic markets because of language and cultural differences.

33 For example, Chemical Bank has a private international network for intrabank messages but outsources all telecommunications related to cash management services, to the General Electric Information System (GEIS). Both U.S. and European banks may use IBM's International Network and DIAL service to communicate with each other and with the Bank of International Settlements in Basel, Switzerland.

Increasingly, international banks want to have access to technologies such as Integrated Services Digital Network (ISDN), frame relay and Switched Multi-megabit Data Services (SMDS), EDI,[34] and electronic document imaging. They want more efficient forms of packet switching to squeeze more out of their existing networks. Frame relay and SMDS are especial] y important for high-speed data transfer and to let financial institutions send bulk data in irregular bursts. Electronic document imaging is a promising way to computerize and use old paper records as well as to store and transmit current documents.

As users of international telecommunications networks, banks are especially concerned about data security and reliability; they are threatened to varying degrees by criminal actions, human error, and systems failure. Yet banks are reported to be laggard in demanding from carriers, or providing for themselves, badly needed security safeguards such as encryption technology, in part because of the costs and in part because of a long-standing dispute with the U.S. National Security Agency about the role of the U.S. intelligence agency in defining standards for this technology.[35]

Financial institutions find, in some countries, that they have special regulatory problems beyond those that affect all telecommunications user groups. In most countries both banking and telecommunications[36] are regulated industries and banks with private networks may run into a double regulatory burden. In some countries, electronic funds transfer, credit card authorization, and switching for automatic teller machines (ATMs) are considered telecommunications services

[34] EDI is both a competitive threat and a technological opportunity. Provided by third-party service providers, ED I Intervenes between banks and their tradit ional clients so t hat the bank provides little or no value-added service and might be able to charge only commodity prices for passing money through its system. A corporate EDI system, or an ED I system operated by a third-party services vendor, can continually net transactions between companies and their suppliers and customers, with consolidated payments to each at the end of the day; this would greatly reduce the role of the banks. However, the banks themselves can move to become ED I hubs, adding this to their existing cash management services and offering the advantage of their abilit y to transfer funds (i.e., make final payment, which nonbanks cannot do) and their com puterized processing capabi I it y. To take advantage of t his, banks wi II have to participate activel y in t he rapidly progressing development of EDI standards.

35 In the 1980s, the Reagan Administration expanded the military/intelligence role in communications and data securit y, and the National Secunt y Agency was given responsibil it y for certifying cryptographic designs for use by U.S. companies. Concerns about costs and availability and about the appropriateness of such a strong role for a military intelligence agency in corporate Information security have persisted.

[36] Computing and communications technology has greatly benefited banks but has also encouraged telecommunications companies and Information services vendors to compete with banks in offering financial services. For example, the AT&T Universal Card provides general consumer credit as well as calling privileges. Telecommunications companies increasingly offer cash management functions for their large business customers and home banking for residential and small business customers. They are also moving to provide electronic trading systems for government bonds, currencies, and derivative financial products. The large customer base and well-developed billing systems of telecommunications companies maket heir competition a strong threat to banks. See U.S. Congress, Office of Technology Assessment, *U.S. Banks and International Telecommunicati inns,* OTA-BP-TCT-1 00 (Washington, DC: U.S. Government Printing Office, October 1992).

Architectural, engineering, and construction services are typically not big users of international telecommunication because of tradition and unintegrated industrial structure.

and are so regulated. Cash netting and cash management services for multinational corporate clients may have particular problems-most such systems accommodate some message transmission in the form of instructions or explanations, but some foreign regulators consider this to be resale, or an unlawful messaging activity by the banks. It may not be clear whether an online transaction is a regulated banking service, a telecommunications service that is regulated in some jurisdictions, or an unregulated data processing service. ATM networks or other shared networks may also be held to violate antitrust regulations or other policies designed to require competition,

While they may face dual regulation in some countries, a few U.S. banks have also used international networks to escape regulation and taxation, by locating offices or branches "offshore '' in countries with few or no regulations. This allows them to engage in '"money laundering' and other forms of illicit or unethical behavior.

Construction services[37]

Not all services exports are at present highly dependent on international telecommunications. Architectural, engineering, and construction services, sometimes called AEC services, show relatively little reliance on telecommunications now, but in the future, information technology and telecommunications networks could lead to significant expansion of exports, which is unlikely to occur otherwise.

This sector is highly fragmented across disciplinary lines: most firms offer either architectural design, engineering design and consulting, construction and construction management, or a combination of two of these.[38] Although referred to as AEC firms, in reality there arc few integrated companies that offer the full range of services. A given facility's construction project almost always is conducted by a number of contractors and subcontractors working for, but usually not closely managed by, a developer.[39]

The pace of internationalization in the AEC industry has quickened since the mid-1970s. The international market for such

37 This section relies on an OTA contractor report: Deborah Workman, "Emerging Applications of Information and Telecommunications Technologies in the U.S. Construction Services Industry," October 1992.

38 Some classifications include facilities management in this sector. The AEC industry is characterized by a few extremely large firms, a modest number of mid-sized firms, and a great number of very small firms. Ninety-seven percent of all U.S. AEC firms employ fewer than 50 people, and 90 percent have fewer than 20 people.

39 In the United States, the AEC sector includes nearly 1 million establishments, employs nearly 10 million people, and accounts for 8 percent of gross national product, with $400 billion in new construction in 1991. Workman, op. cit., footnote 37. Construction value statistics are from the U.S. Department of Commerce, *Industrial Outlook 1992.* Export statistics are from the Bureau of Economic Analysis, Survey *of Current Business,* September 1992. According to Workman there is no single comprehensive source of statistical measures for the U.S. construction industry. The data used in this section is drawn principally from *Engineering News Record's* annual ranking of the top firms and from U.S. Government reports, which, however, also often rely on the *Engineering News Record.*

services, in 1991, was about $130.2 million.[40] About 25 percent of this was in Europe.[41] AEC services accounted for less than 1 percent of U.S. services exports in 1991, producing revenues of $1.3 billion, and contributed 1.9 percent of the U.S. trade surplus, Nevertheless, U.S. firms win 36 percent of all engineering and construction contracts awarded around the world to nonnational firms, and they take 41 percent of architectural design contracts.[42] European firms win 43 and 46 percent, respectively. In the European market, U.S. firms get nearly 44 percent of nonnational awards for construction and 56 percent of design contracts; other European but nonnational firms win 50 and 40 percent, respectively.[43] U.S. firms are strongly competitive in Europe, and European firms are their chief rivals both in Europe and in the rest of the world.[44] The United States leads its closest individual rival, the United Kingdom. by a wide margin. But even though the value of their foreign billings has continued to rise, U.S. firms have lost market share over the last decade.

The AEC industry now makes very limited use of telecommunications networks, and especially of international networks. This is not principally because of costs or band with limitations but because the industry's traditional procedures have not been conducive to wide area networking and because of the peculiarly non integrated structure of work units. Most firms hold to the philosophy that they cannot "compete from home and need a presence abroad. Overseas projects arc typically managed overseas with relatively little dependence on oversight from the home office. Several contractors, providing services ranging from design through procurement to construction, typi-

40 The "international market" is taken to be the sum across countries of the value of contract awards to nonnational firms.

4 The United States was the site for about 12.7 percent of such awards.

42 U.S. firms captured $44 billion in overseas construction services in 1990 and $3.7 billion in architectural design billings. The latter rose in 1991 to $4.2 billion (1991 billings from engineering and construction contracts are not yet available). *Note the apparent discrepancy* between these figures, supplied by the *Engineering News* Record and checked with analysts at the International Trade Administration in the U.S. Department of Commerce, and those given above for total U.S. exports of AEC services ($1.3 billion in 1990), supplied by the Bureau of Economic Analysis. The explanation Is that the figure for billings, provided by the AEC firms, often includes multiyear contract awards, large umbrella contracts in which much or even most of the work is subcontracted to European firms, contracts awarded to multinational consortia led by U.S. firms, etc. The Bureau of Economic Analysis (BEA) figures are more restrictive, representing the money that flows to the United States. However, both sets of figures depend heavily on self-reporting and are subject to many distortions common to all figures dealing with trade in services.

43 In construction, Japanese firms win about 14 percent of international contracts, and 4.4 percent of European contracts. In design services Japan is not, currently, a strong competitor; it takes just over 3 percent of the total international market, none of the European market, and under 9 percent of the Asian international market. "Other" (not European, U. S., or Japanese) firms take 6.6 percent of the total international market for construction and 9.7 percent of the international design market.

44 U.S. AEC services overseas are predominantly concerned with infrastructure, industrial facilities, and environmental work. The largest projects undertaken by U.S. International design firms are probably industrial/petroleum projects, which have an average value of about S300 million. Workman, op. cit., footnote 37.

cally work on a project, but coordination is mostly done on the site to minimize the inefficiencies that result from fragmentation, Sometimes a client will demand that the various contractors create a common technology platform for project communications and information exchange, but this is rare at present. A few firms are now beginning to integrate—that is, to present themselves as full AEC firms with a complete range of services. This integration at the firm level may stimulate demand for integration of information systems that support these varied functions.

Information technology and telecommunications will someday transform this industry. The earliest stages of construction consist almost entirely of generating and sharing information: formulating client goals and plans, creating architectural designs, developing specifications, identifying and communicating legal and budget guidelines, checking standards and codes, making engineering shop drawings, etc. Yet, much of this work is still done by exchanging paper. At the next stage, a major problem is managing procurement and scheduling construction so that there are no delays to cause resources to remain idle. Change in architectural or engineering design during the project requires major changes in material procurement needs, yet supplier input must be current, complete, and quickly accessible. Financial managers must monitor project expenses and release funds on schedule. The technology exists for thoroughly transforming the work through integrated databases, interactive three-dimensional computer assisted design (3-D CAD),[45] and greater use of telecommunications.

But the adoption of advanced information technology in this industry has been very slow because of its costs, its human resources demands, industry fragmentation, and inadequate telecommunications.[46] Five or six of the largest U.S. AEC firms, especially Bechtel, are experimenting with 3-D CAD and have found that even dedicated 56 kbps links produce inferior results; well over 100 kbps or even megabit speeds will be needed. These links may be available in the future between major cities in this country and Europe, but large construction projects such as petrochemical or nuclear plants most often occur in rural, sparsely populated areas where such telecommunications are least likely to be available.

The number of U.S. AEC firms that now use advanced international telecommunications is therefore small. Probably only about 140 U.S. firms are engaged in foreign competition and the top dozen of these account for nearly 90 percent of all U.S.

45 This is three-dimensional imaging of the facility to be constructed. At its most advanced, 3-D CAD would allow continual updating and interactive modification at dispersed computer locations. This 3-D imaging would guide procurement, scheduling, and construction management throughout the project and allow continuing adaptation to or better coping with changes in weather, materials availability, human resource availability, and environmental factors.

46 There are other barriers, even stronger at present, including the lack of suitable software and protocols to support information-sharing in a multivendor environment. The largest firms, perhaps the top 20 U.S. firms, may lead in the adaptation of this technology for the industry; but because together they may have fewer than 150 major project offices in the United States, the market generated by their needs may not be sufficient to drive development. Workman, op. cit., footnote 37.

foreign billings.[47] Currently, small AEC firms require nothing more than one or a few standard voice lines for voice, fax, and low-speed modem communications. E-mail is popular and there is some experimentation with EDI. Sometimes clients install special temporary communications facilities for the duration of the project to connect the client firm, AEC vendors, and the project site. The transfer of 2-D CAD files is usually done by physical delivery of software copies. The firms with European operations tend to connect one major European office, most often London, to the U.S. headquarters for c-mail traffic and data related to financial management and business development. The link may be used occasionally to transfer 2-D and 3-D CAD files in batch mode.

The firms with significant international billings, among the largest U.S. AEC firms, typically need to connect four to six major U.S. locations and two or three foreign locations for exchange of corporate and engineering data. Most of their U.S. sites arc connected with 56 or 64 kbps, sometimes on public-switched networks and sometimes leased lines with bridges, routers, and multiplexers. The networks of the largest firms usually support TCP/IP, SNA, and DECnet traffic. X.25 may be losing ground to these competitors but it remains important as a network access protocol.

Those firms that are subsidiaries of large conglomerates usually have the widest range of technology options; they may have private frame relay backbones, and even 384 kbps videoconferencing.

The competitiveness of U.S. AEC firms in Europe is little affected, at this time, by telecommunications availability or costs; other factors are much more important, including financing of foreign projects, distribution of information about foreign contract opportunities, education of technical personnel, software standards development, and most critically the fragmentation and lack of coordination within the industry. The latter hinders the adoption of modem information technology that would enormously enhance the creation, sharing, and coordination of design and the complex tasks of coordinating and managing the construction process, which in turn would also help lower costs and increase industry competitiveness and profitability. However, as the more immediate problems of financing projects and integrating the industry are addressed, greater information-sharing will result within the industry, leading to greater use of domestic telecommunications networks, and ultimately to more use of international networks, This progression may become significant before the end of this decade if obstacles constraining the usc of advanced information technology within the industry can be overcome.

Information technology will someday transform this industry, as firms see advantages *in sharing information, designs, and schedules electronically.*

Policy issues

U.S. services exporters want more involvement of U.S. telecommunications firms in Europe, and greater availability of U.S. telecommunications and information services. This requires, as they see it, U.S. Government pressure on European countries to further open their telecommunications markets. According to some user firms, it also may require full domestic deregulation of telecommunications so that U.S. carriers will have the incentive to ''maximize information-based services.

47 The 10 largest U.S. firms consistently rank among the top 20 firms worldwide.

Specifically, government intervention is wanted to negotiate the end of restrictive ‘‘homologation’ (equipment approval or certification) practices that inhibit the deployment of U.S. equipment and thereby access to, or the ability to offer, innovative information-based services.

Service providers that rely on international telecommunications networks seem universally to want more international standards. Many favor a stronger role for the U.S. Government in standards development. Some firms see the need for government intervention in standards-setting to discourage European standards organizations from adopting standards that would shut U.S. firms out of European markets, or that would delay network interconnectivity. Some user firms said that government involvement might be necessary to push U.S. manufacturers, as well as European manufacturers, to agree to global standards.

User firms have come to realize that they have interests to protect in the process of standards development, and some arc demanding the right to participate in the process. At the same time, pallicipation incurs significant costs, that relatively few large user firms have been willing to assume. For example, financial institutions increasingly want to be included, yet in many banks senior managers with little understanding of technology are reluctant to approve costly participation in standards development.