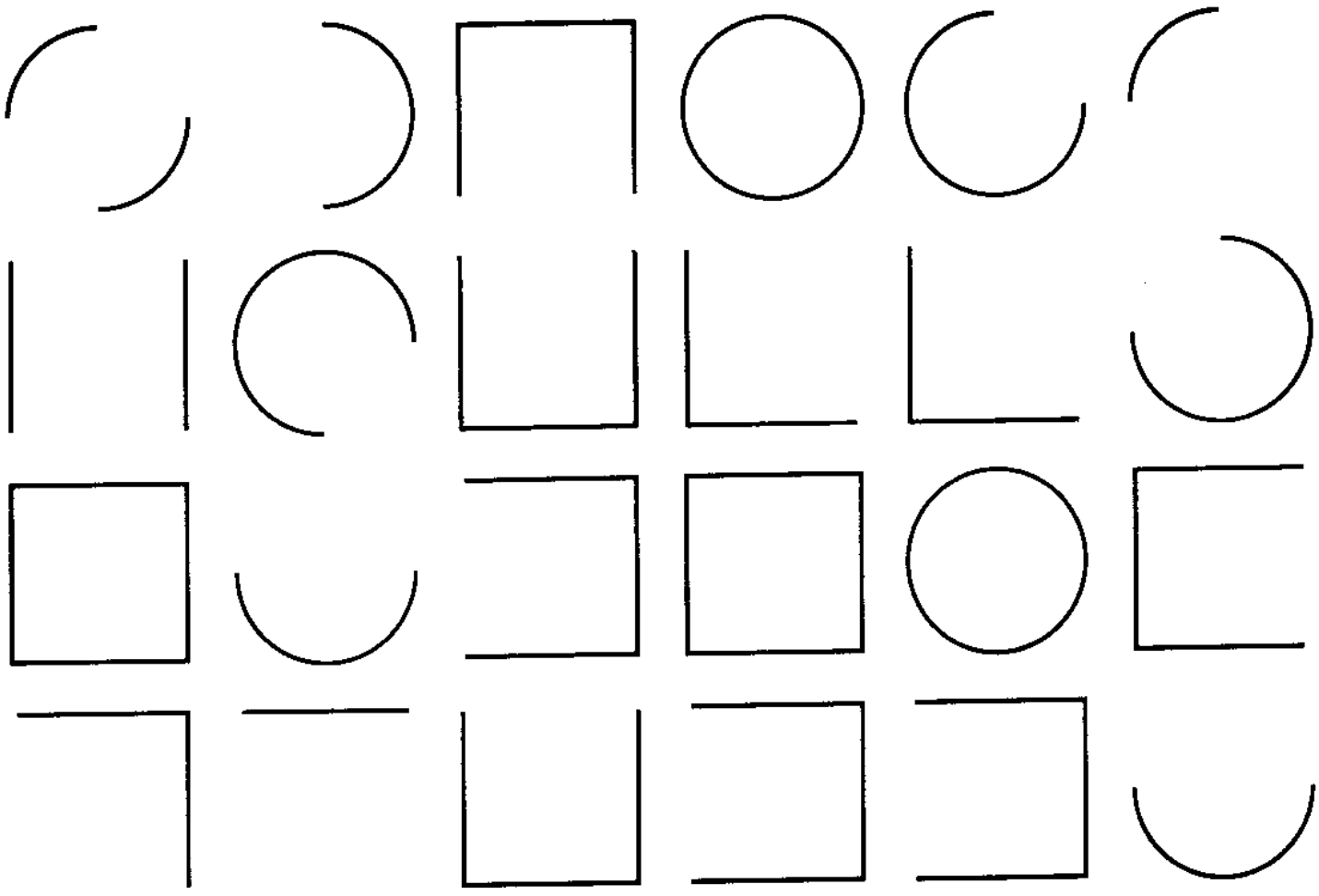
Information Resources Policy

Arenas, Players and Stakes

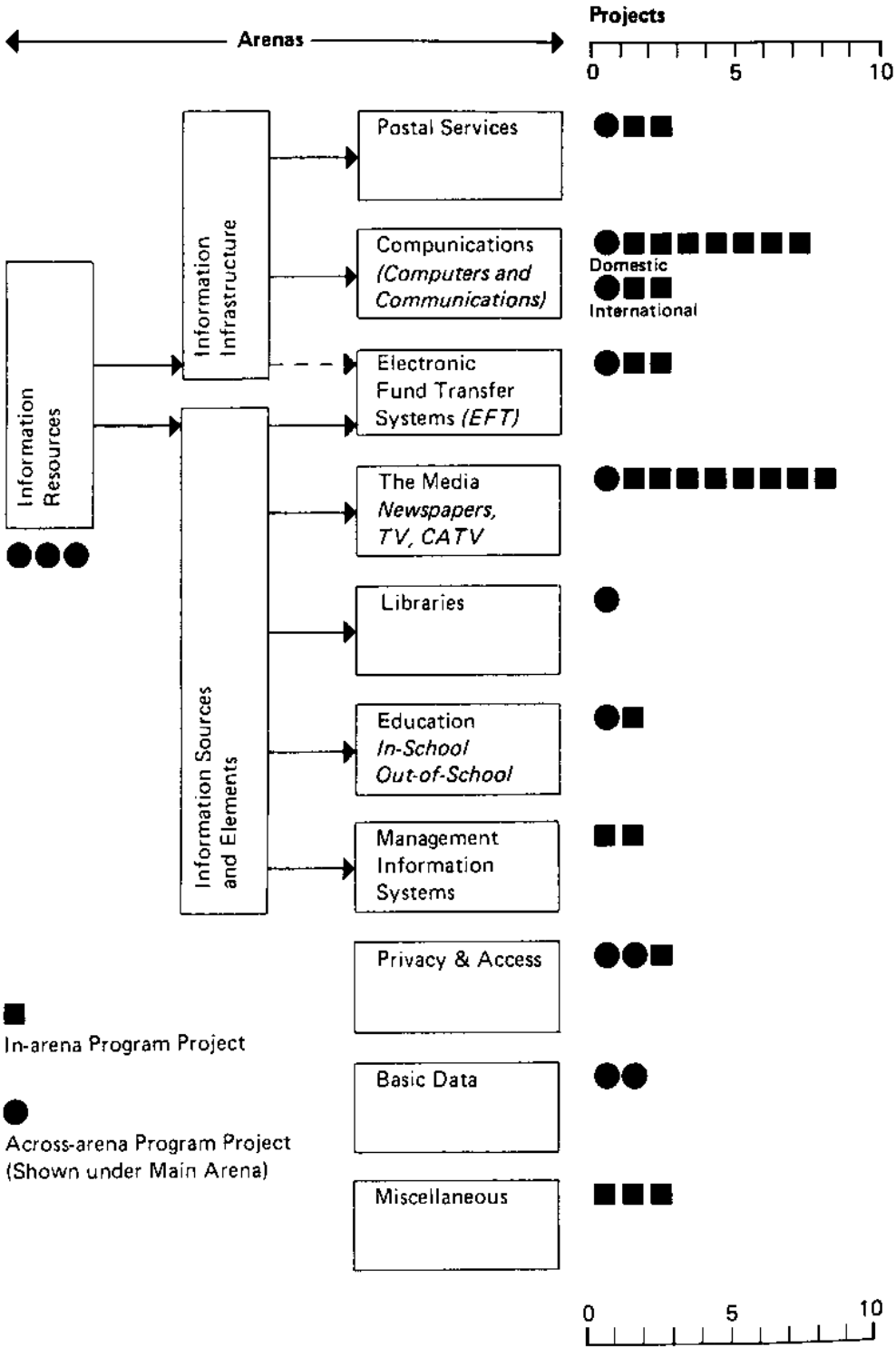


Annual Report 1975-1976
Volume One

Program on Information
Resources Policy

Harvard University

THE PROGRAM HAS CONDUCTED STUDIES IN THESE ARENAS:

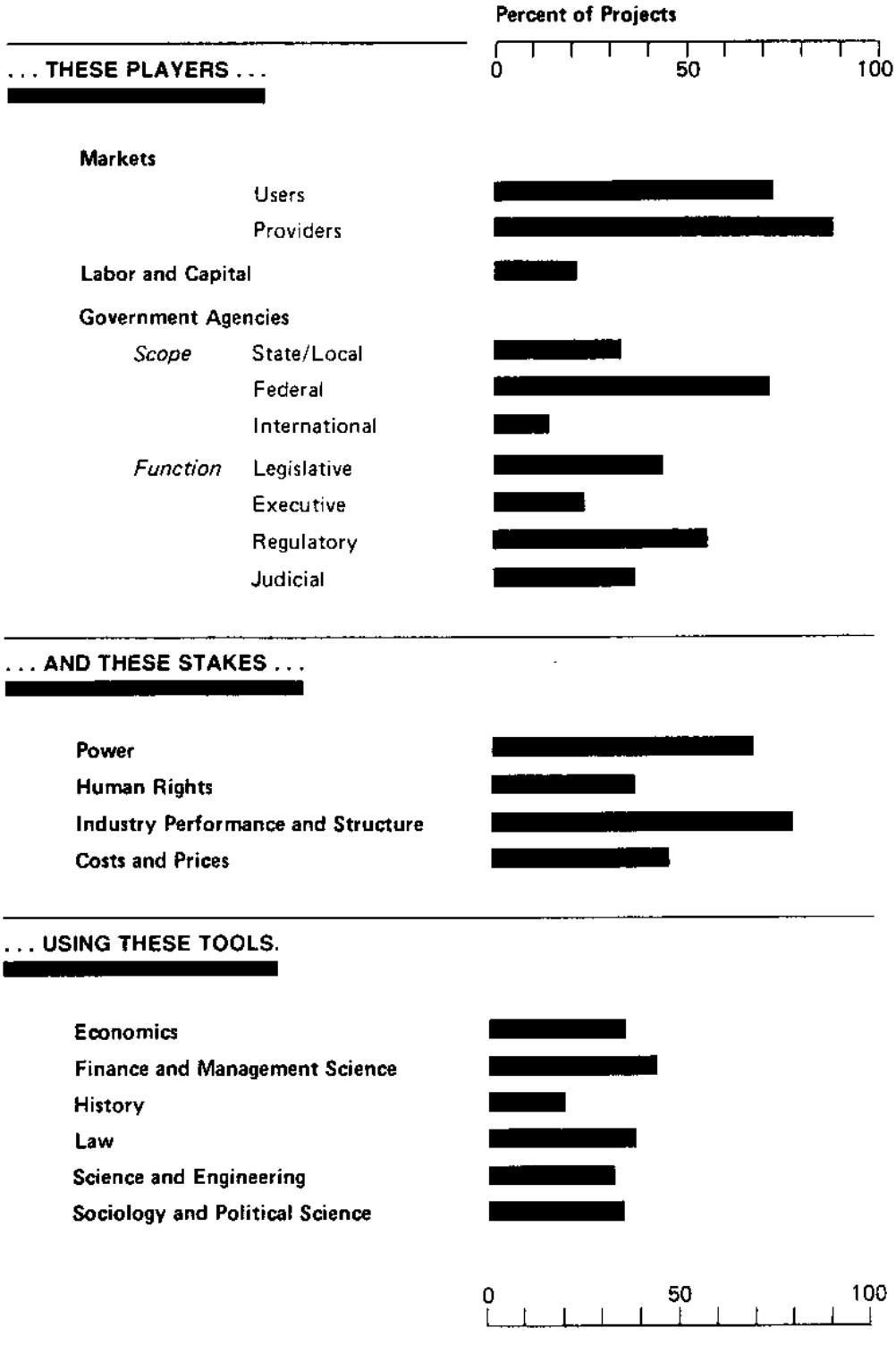


The Program on Information Resources Policy at Harvard University is a research center now in its fifth year of operation.

It is a major public forum on information resources with the goal of usefulness to industry, government and the general public through intellectual independence and quality work.

The Program's field of study and approach are presented here.

THESE STUDIES DEAL WITH . . .



CONTENTS

Act as men of thought. Think as men of action. — Henri Bergson

AFFILIATES

American Can Company
American Telephone and Telegraph
Arthur D. Little Foundation
Booth Newspapers
Bunker Ramo Corporation
Codex Corporation
Computer and Communications Industry Association
Data Transmission Company
Donaldson, Lufkin & Jenrette
L.M. Ericsson (Sweden)
Federal Communications Commission
Federal Reserve Bank of Boston
First National Bank of Boston
General Electric Company
Harte-Hanks Newspapers
IBM Corporation
International Data Corporation
International Paper Company
Lee Enterprises
Lockheed Missiles and Space Company
John & Mary R. Markle Foundation
Mead Corporation
Minneapolis Star and Tribune Company
New York Times Company
Nippon Electric Company
Norfolk & Western Railway Company
Pitney Bowes, Inc.
PRC Information Sciences Company
RCA Global Communications
Rockefeller Brothers Fund
Rockwell International
Salomon Brothers
Seiden & De Cuevas, Inc.
Systems Applications, Inc.
Time Incorporated
Transamerica Corporation
United Telecommunications, Inc.
U.S. Department of Commerce:
National Technical Information Service
Office of Telecommunications
Western Union Corporation
Western Union International, Inc.
Zenith Radio Corporation

STUDENT ASSISTANTSHIPS

William Bingham Foundation

INFORMATION RESOURCES POLICY: ARENAS, PLAYERS AND STAKES
ANNUAL REPORT
VOLUME 1

The Program on Information Resources Policy is the new name of the Program on Information Technologies and Public Policy at Harvard University. Available on request is Volume 2 of the annual report for 1975-76, *Information Resources Policy: Program Projects*, describing the Program's research, teaching and dissemination activities.

PROGRAM ON INFORMATION RESOURCES POLICY

200 Aiken Computation Laboratory
Harvard University
Cambridge, Massachusetts 02138
617 495-3986

THE INFORMATION SECTOR TODAY ACCOUNTS FOR MORE THAN 20% OF THE U.S. GNP . . .

Figure 1.
THE INFORMATION INDUSTRIES

	Approximate Gross Revenues (in billions of dollars)					
	1970	1971	1972	1973	1974	1975
Broadcast television	2.8	2.8	3.2	3.5	3.8	NA
Cable television	0.3	0.3	0.4	0.5	0.6	0.7
Broadcast radio	1.1	1.3	1.4	1.5	1.6	NA
Telephone	18.2	20.0	22.6	25.5	28.3	31.3
Telegraph	0.4	0.4	0.4	0.5	0.5	0.5
Specialized common carriers	0.0	0.0	0.0	0.0	0.0	0.0
Satellite carriers	0.1	0.1	0.1	0.1	0.1	0.1
Mobile radio systems	2.0	2.2	2.4	2.6	2.9	NA
Motion pictures	3.8	3.8	2.9	3.8	NA	NA
Organized sports, theaters, etc.	4.4	NA	NA	NA	NA	NA
Computer software suppliers Computer service suppliers	1.5	1.7	2.0	2.5	3.0	3.6
Postal service	6.3	6.7	7.9	8.3	9.0	10.0
Private information delivery services	0.7+	0.8+	1.0+	1.2+	1.3+	1.6+
Newspapers; wire services	7.0	7.4	8.3	8.9	9.4	9.7
Periodicals (including newsletters)	3.2	3.2	3.5	3.9	4.0	4.2
Business consulting services	0.9	1.1	1.1	1.5	NA	NA
Advertising	7.9	7.6	8.0	8.6	NA	NA
Marketing and sales	32.4	37.7	41.3	43.4	45.5	NA
Brokerage industries	40.6	47.4	55.3	61.0	NA	NA
Book publishing and printing	3.4	3.6	3.8	4.2	4.6	4.9
Libraries	2.1	NA	3.6	NA	NA	NA
Schooling	70.2	76.7	83.1	89.1*	98.8*	110.4*
Research and development	26.0	26.7	28.4	30.4*	32.0*	34.3*
Federal information institutions						
Census Bureau	0.1	0.1	0.1	0.1	0.1	0.1
National intelligence community	4.0+*	NA	NA	NA	7.0*	10.0+*
National Technical Information Service	0.0	0.0	0.0	0.0	0.0	0.0
Social Security Administration	1.0	1.2	1.3	1.4	1.9	2.2
County agents	0.3	0.4	0.4	0.5	0.5	0.6
Banking and credit	61.1	68.9	77.6	101.3	NA	NA
Insurance	92.6	103.5	113.8	123.6	NA	NA
Legal services	8.5	9.6	10.5	12.2	NA	NA
U. S. Gross National Product	977.1	1,054.9	1,158.0	1,294.9	1,406.9	1,498.9

*estimated

The information industries are those where creating, storing, processing, distributing or using information are *primary* functions. Elsewhere, these functions are incidental to some other primary role. The massive information processing performed by railroads or supermarkets puts them within the information sector but not the information industries. Approximate annual gross revenues shown here for 1970-1975 provide a rough index of the relative sizes of the information industries. Double counting has not been eliminated.

There is no such thing as information resources policy. Yet information resources policy affects national power and personal privacy, individual freedom and corporate power, jobs and entertainment, money and messages.

Both these statements are true: Information policy is everywhere and nowhere. This paradox defines the interests and purpose of the Harvard University Program on Information Resources Policy.

Decisions of vital importance — national, international, corporate and personal — are being fought out in dimly lit arenas under rules that are not clear even to the lawyers, engineers, economists and bureaucrats who devised them. Rosters and scorecards are rare. Some of the players are unnumbered; others wear the wrong numbers. And no one is watching.

But the stakes are very high.

A glance at the list of information industries in Figure 1, their functions and their revenues, gives a rough indication of some of the stakes. These are industries whose fundamental production lines are information processing lines. They employ nearly half the labor force in the United States and account for more than 20 per cent of the Gross National Product. The money system is an information system. An information system gathers and transmits the news. The education system is an information system. Sports and entertainment come through an information system. Business and marketing are information systems. Much of government is an information system.

Yes, and tigers and tabbies are both cats, but so what?

There are many kinds of cats, and there are many kinds of information technologies, but it is becoming clear that there is really only one information system, no matter how disconnected the parts may seem. Information is a basic resource, fully as important as materials or energy. While materials and energy have not lacked for public scrutiny and policy attention, information resources have developed willy-nilly, their potency overshadowed by their technical details, their pervasiveness so complete they are taken for granted, like the clean air we used to breathe.

Alterations in the relations between oil and coal in the energy industries, or between steel and aluminum or wood and concrete in the materials industries have obviously large implications for public policy, ranging from military strategy to traffic control, from some nation's power to somebody's job. Alterations in the relations between the computer industry and the telephone industry — between IBM and Bell — also have large implications for public policy. The Program is trying to make them equally obvious.

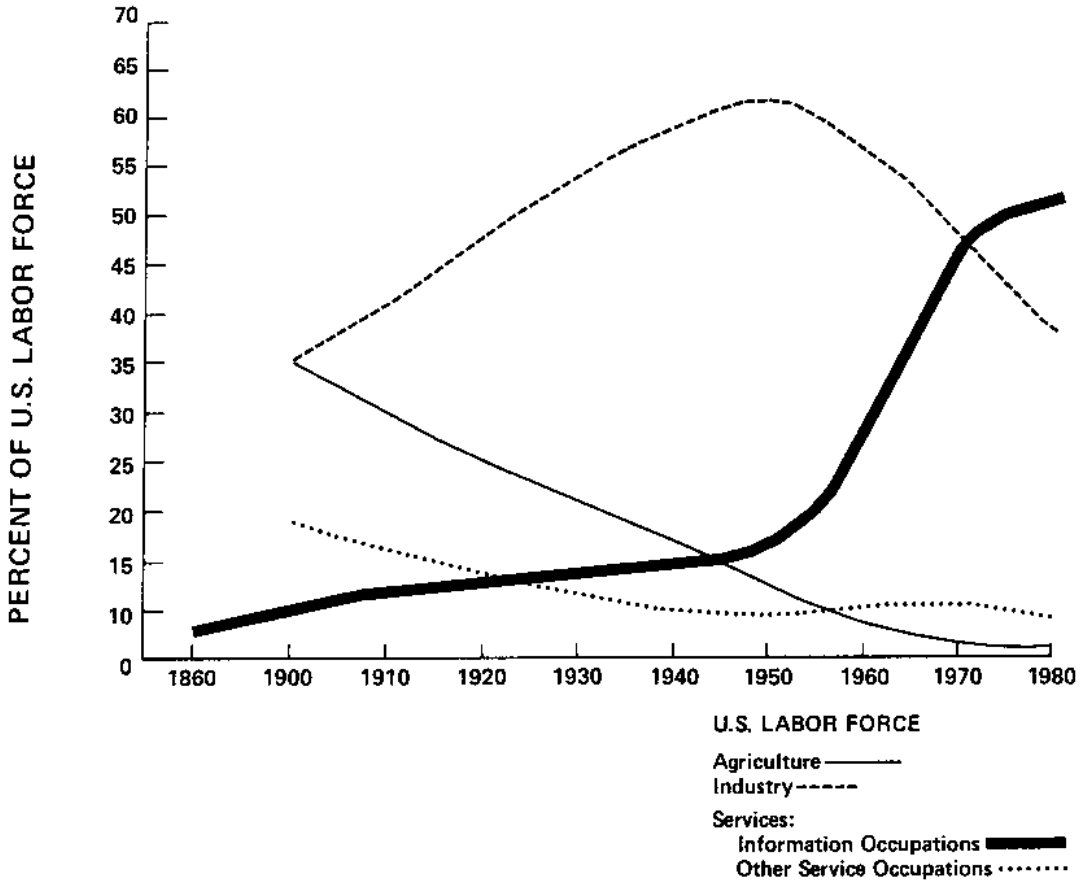
The implications are not obvious now. Even in this "electronic age" with its "information explosion" and its "knowledge revolution," very few people could sketch in the common features of the communications system and the computation system, but the fact is that they are no longer separate at all. They are the same thing.

The first century of modern communications, from Morse's telegraph of 1836 through World War II, was characterized by almost complete technological distinction. Telephone and telegraph were wire-borne, but in entirely different ways. Radio and television were wireless, for the most part. Motion pictures were on film, but transported by hand like the mail. Printing was heavy industry. And, at everyone's headquarters, there were files and adding machines and more and more clerks.

continued on page 32

THE INFORMATION SECTOR EMPLOYS NEARLY 50% OF THE LABOR FORCE . . .

Figure 2.



Growth in information-processing service occupations is the major factor in the increase of all service occupations relative to industrial and agricultural occupations. This finding by Edwin B. Parker and Marc Porat is based on their analysis of U. S. Bureau of Labor Statistics data (*Social Implications of Computer/Telecommunications Systems*, Report No. 16, Program in Information Technology and Telecommunications, Center for Interdisciplinary Research, Stanford University, February 1975).

THE INFORMATION SECTOR IS STILL GROWING AND CHANGING, NATIONALLY . . .

Figure 3.
AVERAGE ANNUAL GROWTH OF VARIOUS TRANSACTIONS

TYPE OF TRANSACTION	AVERAGE ANNUAL PERCENTAGE INCREASE (in percent)							
	1940-75	1940-45	1945-50	1950-55	1955-60	1960-65	1965-70	1970-75
Checks written	7.8	2.7	9.2	7.1	5.9	6.9	11.1	11.9
Telephones in use	6.4	5.4	10.9	6.2	6.4	5.2	5.7	4.8
Individual Social Security beneficiaries	27.3	96.0	34.0	25.8	17.3	8.1	5.1	4.5
Individual federal tax returns	8.6	47.9	1.1	2.0	1.0	2.2	2.0	3.2
Public welfare recipients	4.2	−9.8	13.8	−0.8	4.4	2.0	15.4	4.2
Airline passengers	18.4	32.1	32.8	23.9	9.6	12.7	13.3	4.6
Persons entering hospitals for treatment	4.3	12.2	2.7	2.8	3.8	3.0	2.1	3.0
Persons covered by private hospitalization insurance	11.4	32.2	27.7	6.5	4.2	2.6	2.9	2.1
Motor vehicle registrations	4.7	−0.9	11.7	5.5	3.6	4.5	4.0	4.7
Passports issued	24.3	98.3	18.7	15.2	12.3	11.2	13.4	1.0
Students enrolled in colleges and universities	6.3	2.5	7.2	3.3	7.0	10.9	8.7	4.6
Applications processed for federal employment	0.6	NA	NA	0.6	1.6	−2.8	−0.1	3.5
New York Stock Exchange daily volume	12.2	17.9	7.9	6.0	3.6	20.6	16.9	12.5
Pieces of mail handled, U.S. Postal Service	3.7	7.3	3.8	4.5	3.1	2.6	3.6	1.0
Abstracts produced by Chemical Abstracts Service	7.7	−7.4	15.1	9.2	11.1	9.4	8.1	8.4
U.S. population	1.4	1.2	1.7	1.8	1.8	1.5	1.1	0.9
U.S. Gross National Product	4.1	12.5	−1.1	4.6	2.5	5.1	3.2	2.1

. . . AND INTERNATIONALLY.

Figure 4.
CHANGING PATTERNS OF WORLD TRADE IN ELECTRONICS PRODUCTS

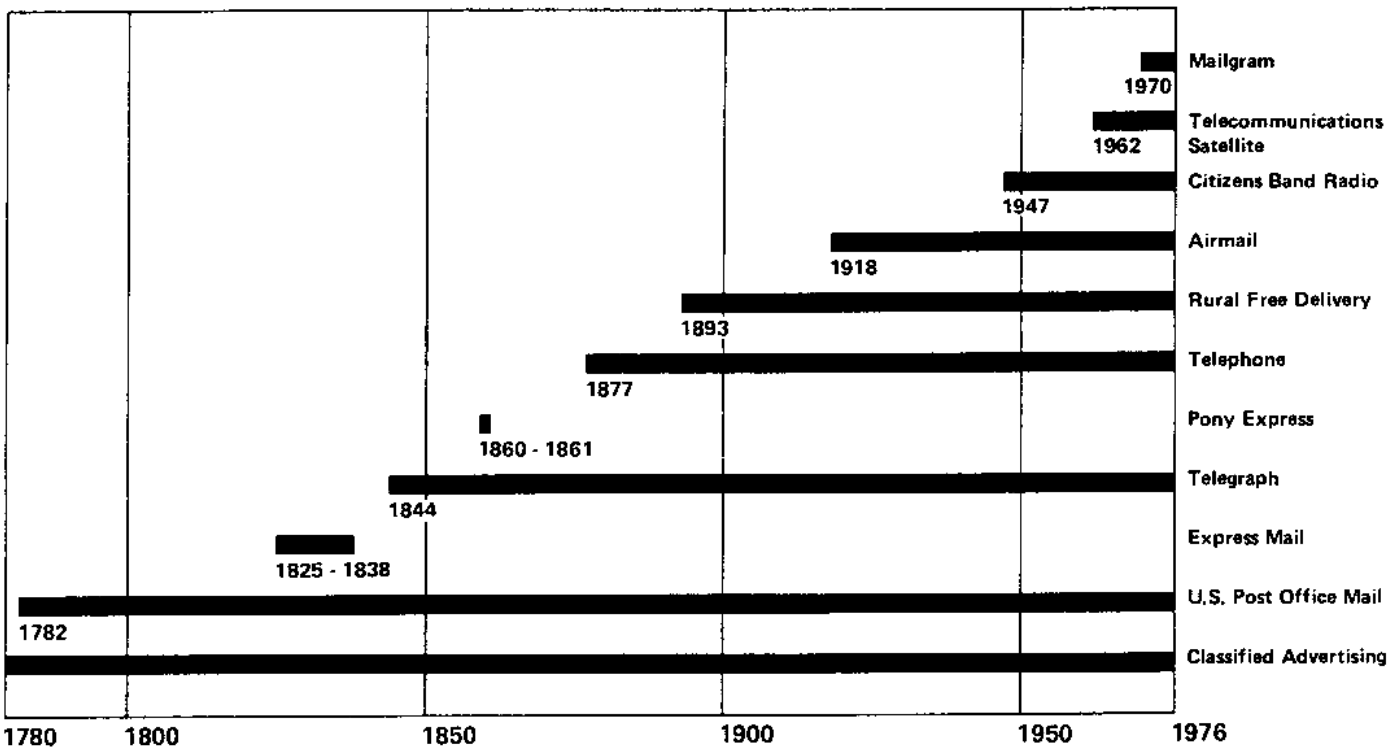
	IMPORTS	EXPORTS	BALANCE
	(in millions of dollars)		
CONSUMER ELECTRONICS			
1967	562	98	−464
1971	1,487	169	−1,318
1972	1,993	231	−1,762
1973	2,259	318	−1,941
1974 (est.)	2,337	383	−1,954
1975 (est.)	1,870	346	−1,524
1976 (est.)	2,000	380	−1,620
TELEPHONE AND TELEGRAPH EQUIPMENT			
1967	31	46	+15
1971	79	61	−18
1972	86	77	−9
1973	125	113	−12
1974 (est.)	162	160	−2
1975 (est.)	100	200	+100
1976 (est.)	130	250	+120
COMPUTERS AND CALCULATING EQUIPMENT			
1967	59	475	+416
1971	232	1,217	+985
1972	348	1,340	+992
1973	344	1,715	+1,371
1974 (est.)	388	2,196	+1,802
1975 (est.)	423	2,300	+1,877
1976 (est.)	467	2,480	+2,013

The trends in U.S. imports and exports in three categories of electronics goods.

Source: Adapted from the Office of Telecommunications, and the U.S. Dept. of Commerce, *U.S. Industrial Outlook*, 1976, pp. 280, 292, 313.

INFORMATION RESOURCES WERE ONCE INCOMPATIBLE, SCARCE AND COSTLY.

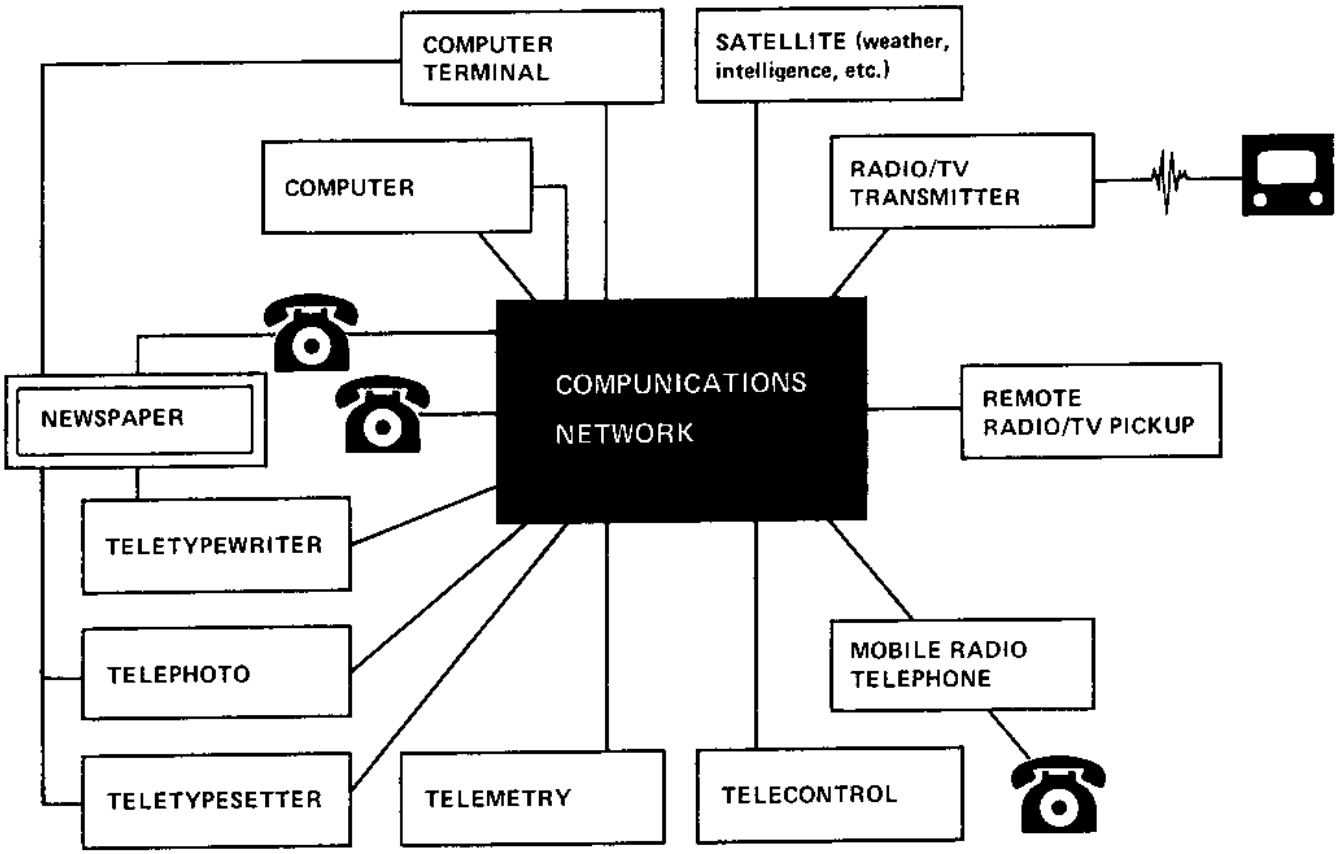
Figure 5.
CHOICES FOR PERSONAL COMMUNICATION



The choices for personal communication have grown rapidly. New technologies and new services developed in the last half of the 19th century, but each developed independently. The charges for sending a message can vary widely. When the Pony Express started in 1860, a letter cost $10 an ounce, but by the time the service shut down the next year it was $2 an ounce. In 1919, a three-minute station-to-station call from New York to San Francisco cost $16.50. By 1946, the charge was $2.50. It is now $1.45. In 1800, it cost 17¢ to mail a one-page first-class letter 300 miles. Now it is 13¢ for the first ounce and 11¢ for each additional ounce to anywhere in the country. A telegram could cross the country for $7.45 for a 10-word-minimum message in 1866. In 1876, the same message went for $2 and by 1946 it was $1.20. In 1970, a 15-word-minimum telegram from coast to coast was $2.25, but by 1975 it was $4.75.

NOW INFORMATION RESOURCES ARE VERSATILE . . .

Figure 6.



At first, it was a telephone network, and telephones still predominate, but many other kinds of communications are also carried. The national broadcasters took their places starting fifty years ago. As computer and communication facilities have come more and more to share the same technology in the past twenty years, the network has developed toward an integrated computer/ communications or *compunications* network. This network is an infrastructure basic to most social functions, including many that reach directly into the home.

. . . ABUNDANT AND CHEAP.

Figure 7.
TIME, MONEY AND MEMORY

STORAGE MEDIA	ON-LINE CAPACITY (Bytes)	ACCESS TIMES	DOLLARS PER BYTE	BYTES PER CUBIC FOOT
Magnetic cores Metal-oxide semiconductors	1 million	1 microsecond	$ .10 on-line	25 thousand
Magnetic bubbles Semiconductor charge-coupled devices	10 million	.2-1 milliseconds	$ .017 on-line (1978)	100 thousand
Magnetic disk	2.5 billion	35 milliseconds	$ .00013 on-line	5 million
Magnetic tape	1 billion	seconds	$ .0000002 off-line $ .00033 on-line	250 million off-line 1 million on-line
Mass stores	250 billion	10 seconds	$ .000004 on-line	100 million
Paper	2-6 thousand per page	minutes	$ .000001	1.5 million
Microfiche	1-5 million per fiche	minutes	$ .00000002—.00000005	2 billion

The cost of storing information has decreased greatly during the past 10 years. New technologies, such as magnetic bubbles or electron beams, promise to continue the trend.

Computers process information in "bits", each representing a "yes-or-no", "one or zero" answer. Typically, 8 bits are used to represent a character or "byte". The 256 possible combinations of 8 bits are used to represent the digits, letters and most of the symbols commonly used in business and science.

"On-line" capacity, comparable to the capacity of a juke-box, measures the amount of information that can be kept on a computer and accessed without manual intervention. To get at more information, you have to change storage units manually. Indicated on-line capacities are for a moderately large computer system.

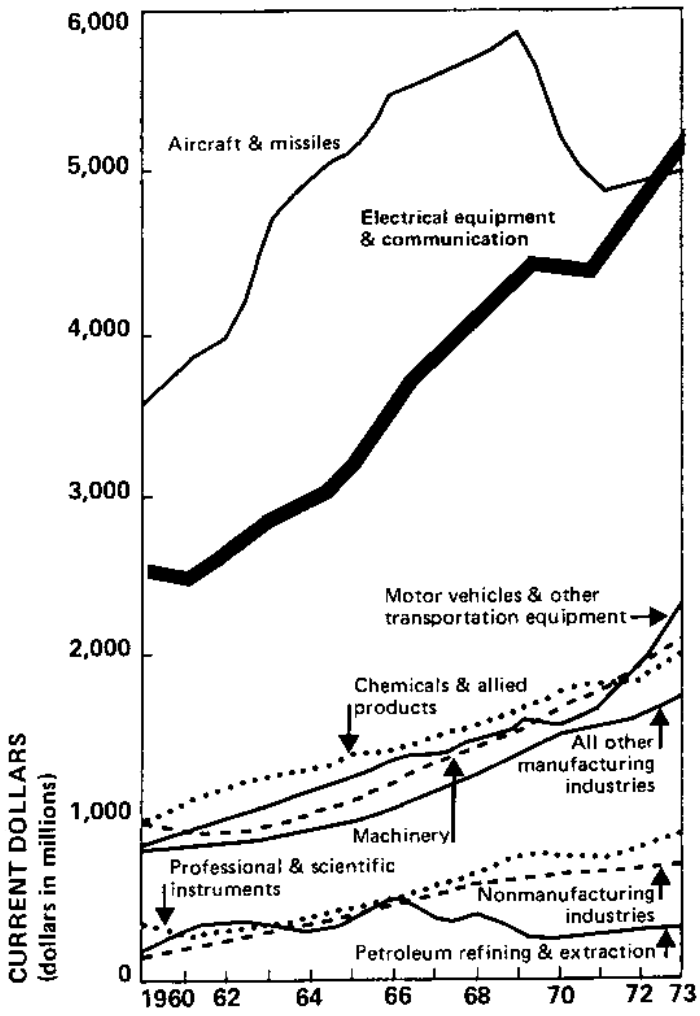
"Off-line" computer storage is dominated by magnetic tape because of its extremely low cost. The recent introduction of several types of Mass Store devices has encouraged moving the data in manual magnetic tape libraries to "on-line" storage. However, for permanent archival storage, microfiche remains the unchallenged leader.

Source: Estimates, as of May 1976, are by F. Grant Saviers, Digital Equipment Corporation.

INFORMATION RESOURCES ARE STILL GROWING AND CHANGING.

Figure 8.
RESEARCH AND DEVELOPMENT

EXPENDITURES 1960-1973



EXPENDITURES AS PERCENT OF NET SALES, 1973

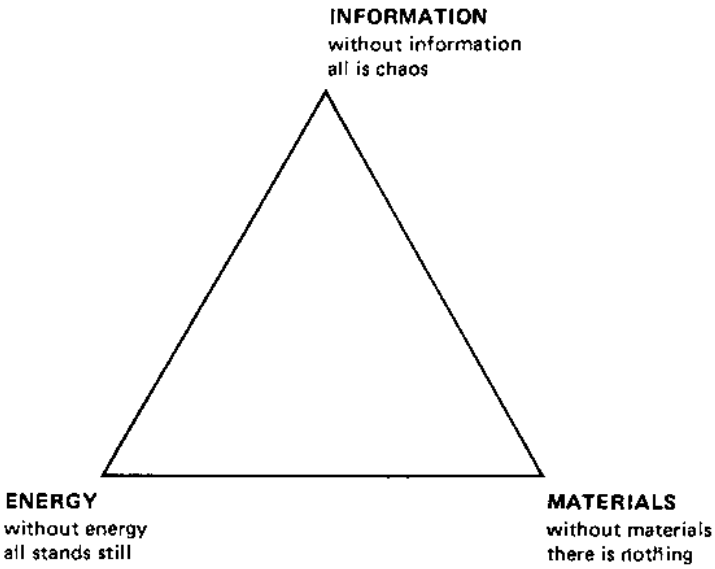
Chemicals and allied products	3.5
Drugs and medicines	7.3
Machinery	3.8
Office, computing and accounting machines	9.6
Electrical equipment and communication	7.1
Electronic components	5.3
Communication equipment and communication	8.7
Aircraft and missiles	13.5
Professional and scientific instruments	5.6

Research and development expenditures are high in the electrical, data processing, and communications and control industries both absolutely and compared to net sales. Other industries are heavy users of these technologies in their own research and development, particularly aircraft and missiles, drugs and chemicals.

Source: National Science Foundation, *Science Indicators, 1974*, Figure 4-5, p. 88. National Science Foundation, *Research and Development in Industry, 1973*, May 1975, Table B-36, p. 51.

LIKE MATERIALS AND ENERGY . . .

Figure 9.



. . . INFORMATION IS A BASIC RESOURCE.

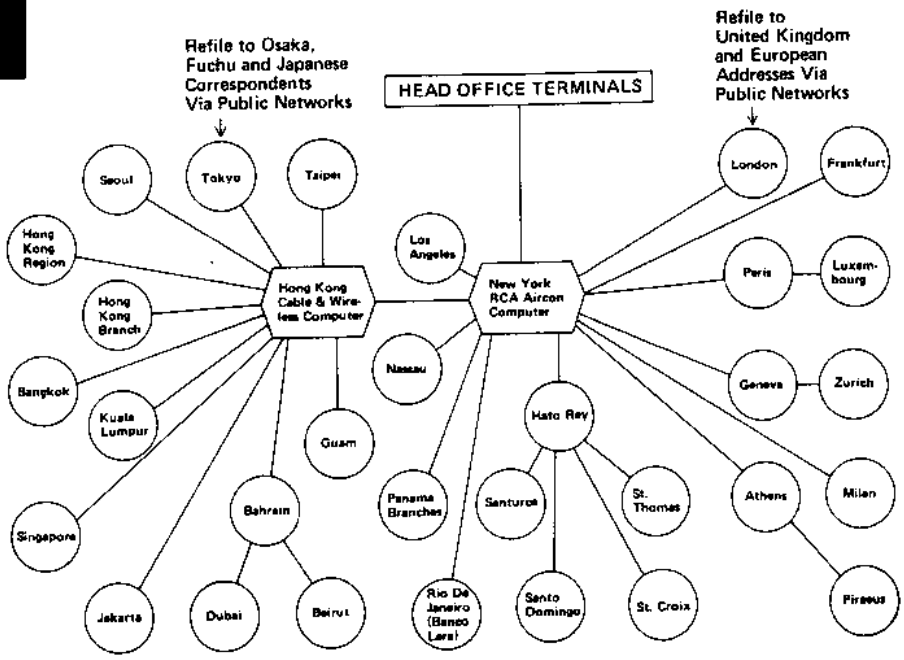
Figure 10.

MODES	PRE-INDUSTRIAL	INDUSTRIAL	POST-INDUSTRIAL
Transforming Resource	Natural Power *Wind, Water, Draft animals, Human muscle*	Created Energy *Electricity – oil, gas, coal Nuclear power*	Information *Computer and data-transmission systems*
Strategic Resource	Raw Materials	Financial Capital	Knowledge

Source: Bell, Daniel. "Welcome to the Post-Industrial Society", *Physics Today*, Vol. 29, No. 2, February 1976, p. 47.

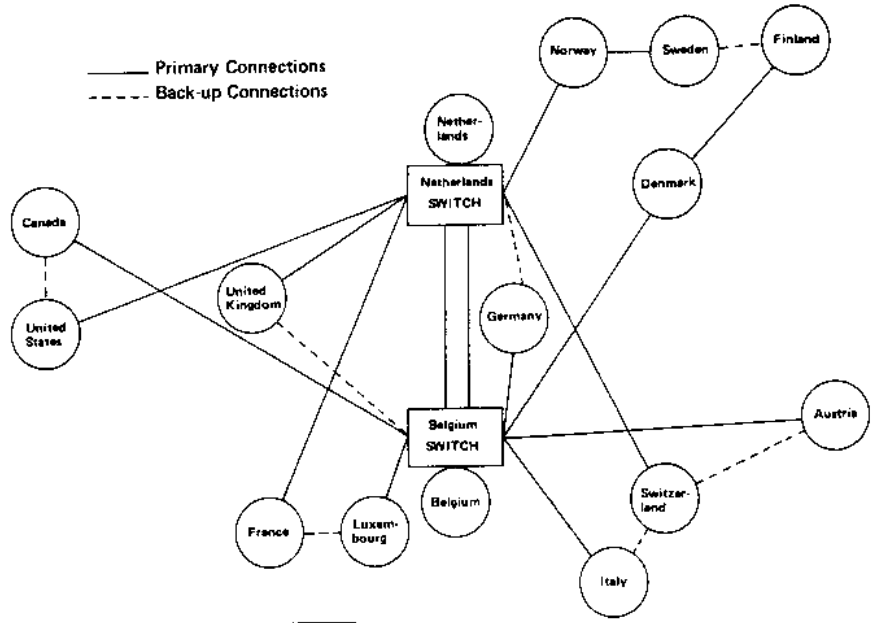
INFORMATION RESOURCES EXTEND STRATEGIC STRENGTH . . .

Figure 11.
CHASE MANHATTAN PRIVATE COMMUNICATIONS NETWORK



. . . AND EXPOSE STRATEGIC WEAKNESS . . .

Figure 12.
SWIFT BANKING NETWORK (Society for Worldwide Financial Telecommunications)



Figures 11 & 12: Modern information resources give businesses close, quick control of assets and operations around the world as around the corner. At the same time businesses grow more dependent on the reliability of widespread technical facilities, and on internal political developments of important exchange points like Belgium, the Netherlands, and Hong Kong. Today, these are "free ports" for information, but will they always be?

Fig. 11, Source: Chase Manhattan.

Fig. 12, Source: Wadman, Laurence E., Jr. "SWIFT — Building an International Communications Network", *The Magazine of Bank Administration*, Vol. LI, No. 9, September 1975, p. 36.

. . . FOR INDIVIDUALS . . .

Figure 13.
CARD TRANSACTIONS, 1973

Type of Card	Number of Cards (millions) Extant	Active	Volume ($ billions)	Average Sale Amount ($)	Transactions (billions) All Amounts	Amounts over $10
Retail store	169[a]	?	27.0[a]	$18	1.50	many
Oil company	160[a]	?	12.0[a]	6.5	1.85	few
Bank	35[a,b]	22[a,b]	12.4[a]	20	0.62	many
Travel and entertainment	6	?	5.5[a]	20	0.28	very many
Air travel	3	?	2.2[a]	50	0.04	all
Rent-a-Car	6	?	1.8	30	0.06	all
Miscellaneous	?	?	10.0	15	0.67	many
Totals	400	250	70.9	14.1	5.02	

[a] Accuracy of these estimates has been confirmed by independent sources.
[b] Accounts.

As more personal expenditures are recorded and transmitted, life is made easier and more personal information is accessible by wiretap, subpoena, or subterfuge.

Source: Adapted from *The Consequences of Electronic Funds Transfer: A Technology Assessment of Movement Toward a Less Cash/Less Check Society*, Arthur D. Little, Cambridge, Mass., June 1975, Table 4-6, p. 56.

. . . INFORMATION RESOURCES ALSO EXPOSE STRATEGIC STRENGTH AND WEAKNESS FOR INDUSTRIES . . .

Figure 14.

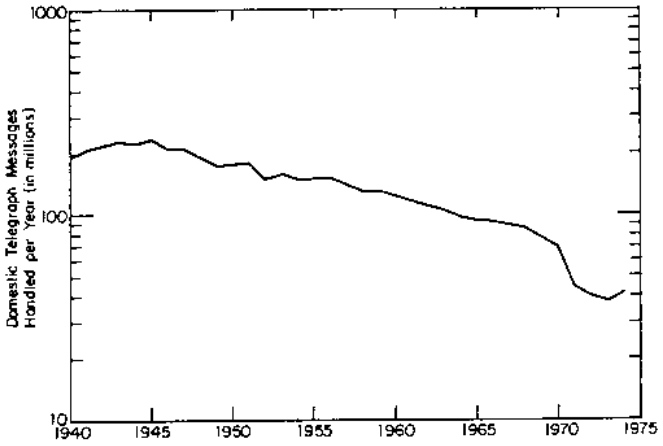


Figure 15.

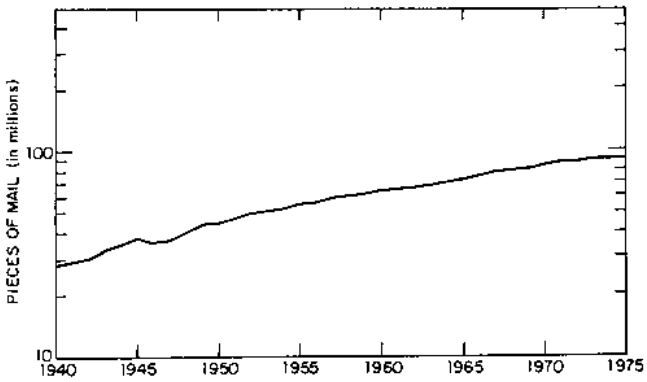
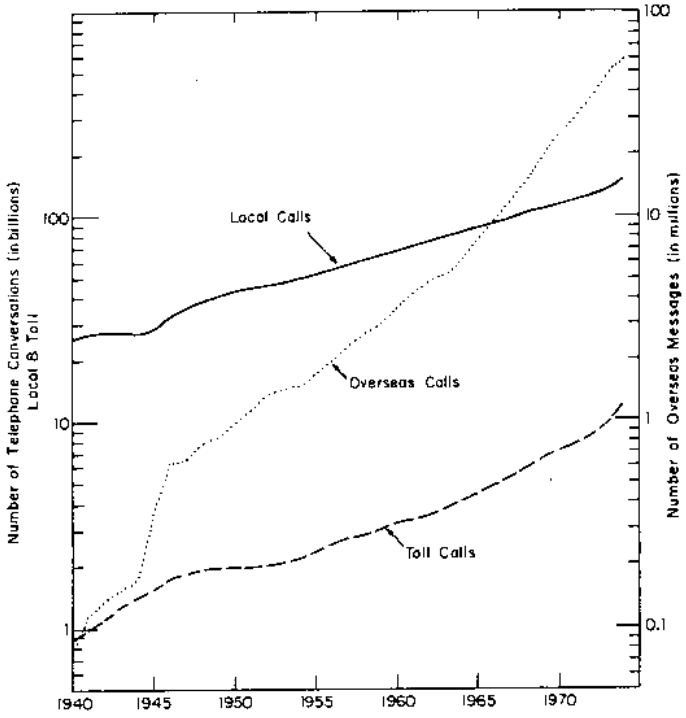


Figure 16.



Usage of telegrams has declined fivefold since World War II (Figure 14) **while mail volume tripled** (Figure 15). **In the same period, local and toll telephone calls grew about tenfold and overseas calls nearly a thousandfold** (Figure 16). **A three minute New York to Paris phone call, available in 1936 only person-to-person for $21.00, could be dialed-up for $6.75 in 1970. The $21.00 in 1936 is $58.85 in 1970 dollars. The growth of traffic has attracted competition to AT&T's busiest routes** (Figure 17).

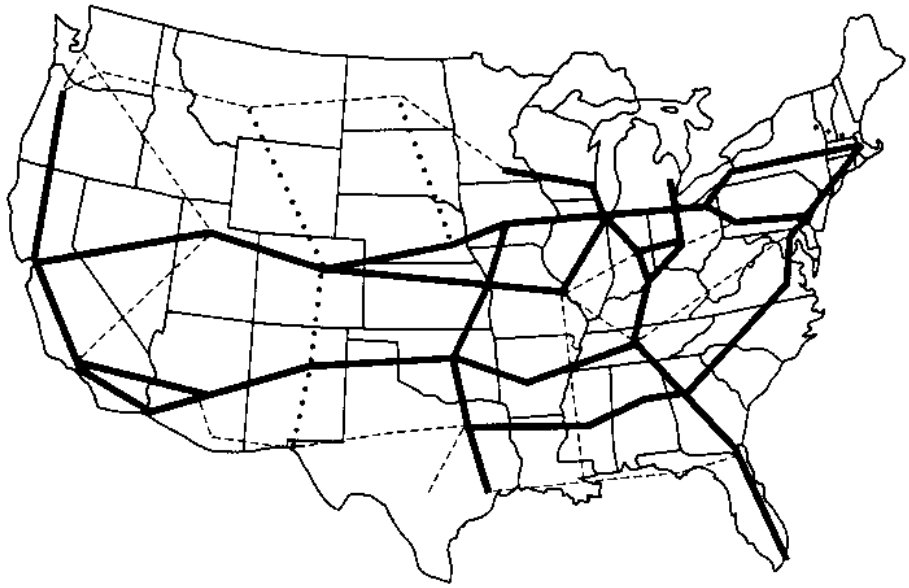
Sources: Price of 3-Minute Telephone Call: Cole, J.E., G.W. Arnaud and L.H. Adams, *U.S. International Telecommunication Rate History*, U.S. Dept. of Commerce, Office of Telecommunications, December 1973, OT Report 73-25, Table V-26, p. 66. The price inflator for the 1936 dollars to 1970 dollars is the change in the consumer price index.

Fig. 14: Bureau of the Census, U.S. Dept. of Commerce, *Historical Statistics of the United States: Colonial Times to 1970, Part 2*, U.S. Government Printing Office, Washington, D.C., 1975, Series R 56, p. 789, and Federal Communications Commission, *Statistics of Communications Common Carriers, 1974*, U.S. Government Printing Office, Washington, D.C., Table 23, p. 168.

Fig. 15: Bureau of the Census, U.S. Dept. of Commerce, *Historical Statistics of the U.S.*, Series R 169, p. 804, and *Statistical Abstract of the United States, 1975*, Table No. 842, p. 511.

Fig. 16: American Telephone and Telegraph Co., *Bell System Statistical Manual*, §800-Volume of Communications, p. 803 and 807.

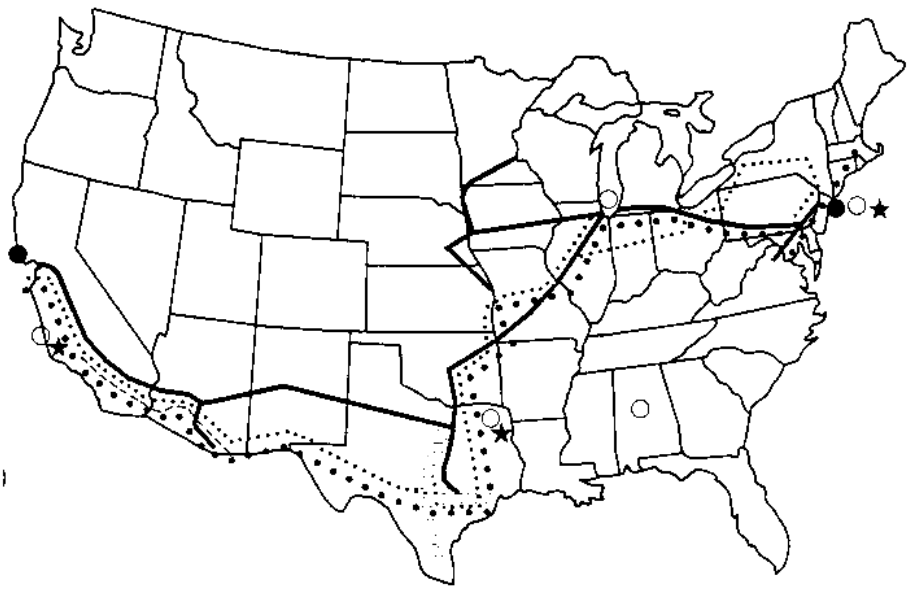
Figure 17.
BELL SYSTEM MAJOR LONG DISTANCE ROUTES



——— high capacity
- - - - - - medium capacity
. . . . . low capacity

Source: Mandanis, George P. et al., *The Domestic Telecommunications Industry: Economic Behavior, Competition, and Public Policy*, Systems Applications, Inc., San Rafael, Ca., May 10, 1974, p. 255.

SPECIALIZED ("OTHER") COMMON CARRIERS' ROUTES



——— MCI Communication (MCI)
. . . . . Southern Pacific Communications (SPC)
- - - - - Western Tele-Communications, Inc. (WTCI) (subsumed in MCI network)
CPI Microwave (CPI)
. . . . Datran
● RCA Earth stations
○ Western Union earth stations
★ American Satellite (Amsat) earth stations

MCI: Coast-to-coast, uses WTCI (Ariz/Calif) and WUT (LA-SF).
SPC: Own microwave used coast-to-coast, augmented by WUT and Westar circuits.
DATRAN: Uses DDS to Northeast cities, SPC to West.

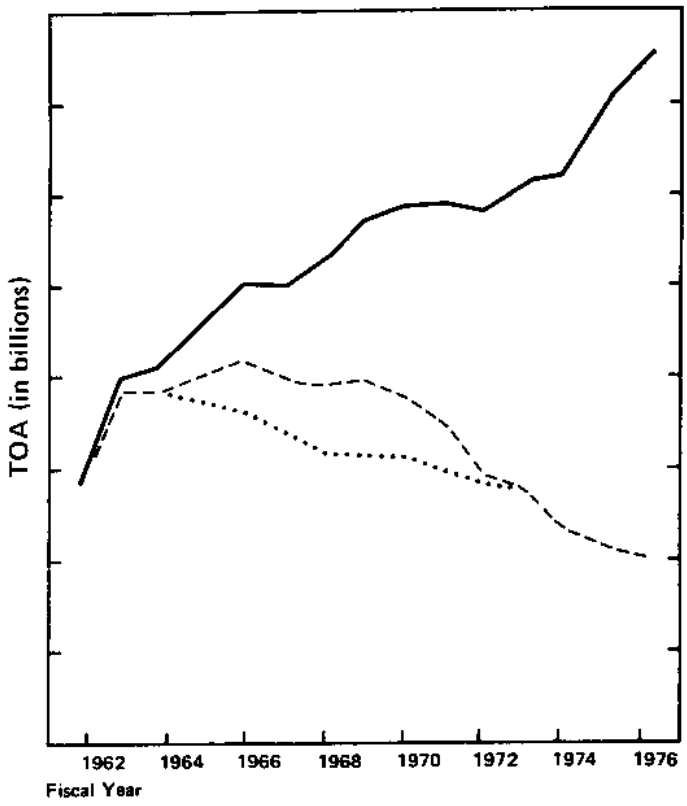
Source: Arthur D. Little, Inc.

. . . AND INFORMATION RESOURCES EXPOSE STRATEGIC STRENGTH AND WEAKNESS FOR GOVERNMENT.

Figure 18.
TRENDS IN THE NATIONAL INTELLIGENCE BUDGET: FY 1962-1976*

**Includes CIA budget. Does not include costs of tactical military intelligence activities.*

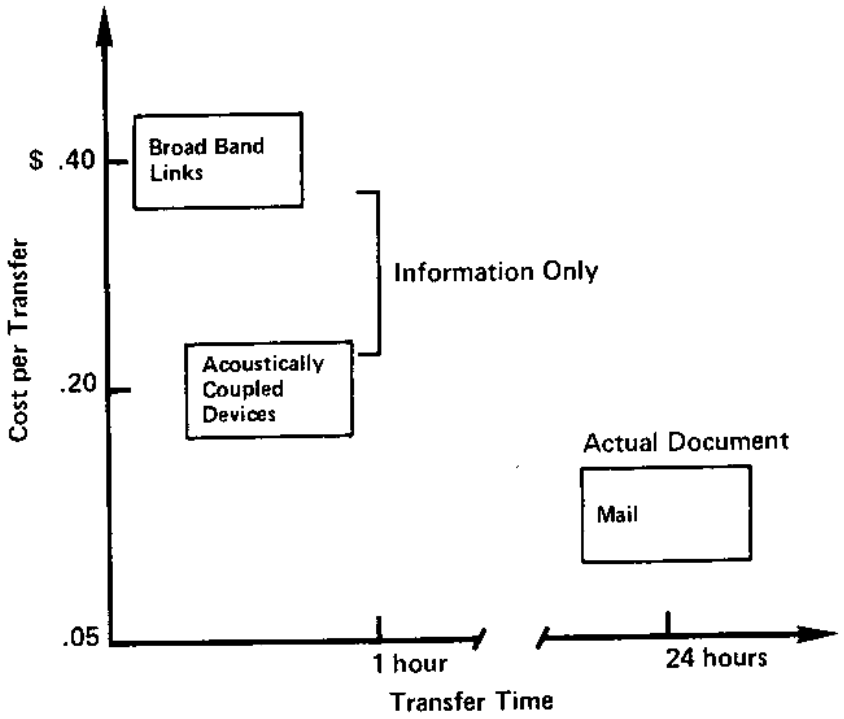
——— current dollars
– – – – constant (FY62) dollars
. . . . . SEA incremental costs



This chart from the U.S. Senate's Church Committee report on Foreign and Military Intelligence shows "trends" in the national intelligence budget. Clearly labelled are the years, current dollars, constant dollars and the increment for Southeast Asia (SEA). The unscaled vertical axis shows Total Obligational Authority (TOA), or the size of the budget. As the committee report notes, the national intelligence budget is a "[deleted] billion 'package' ".

ARENAS CHANGE, BARRIERS SHIFT: FOR INFORMATION INDUSTRIES AND TECHNOLOGIES . . .

Figure 19.
MAIL vs. TELECOMMUNICATIONS



Telecommunications costs have decreased and mail costs have increased since this chart was prepared in 1968.

Source: U.S. President's Commission on Postal Organization, *Towards Postal Excellence*, 1968, Annex, Vol. 4, part 8, p. 8.6, Fig. 8.1.3.

. . . FOR WAYS OF GETTING AND USING INFORMATION . . .

Figure 20.
LIBRARY ACTIVITIES USING CABLE TELEVISION

	U. S. libraries	U. S. schools	Canada libraries
No. of agencies reporting	22	7	14
Programming means			
Cablecasting live from libraries	4	3	0
Producing tapes for cablecasting	5	3	2
Using nonlibrary produced tapes for cablecasting	8	2	10
Not specified	4	5	3
Types of library programming			
Spot announcements	3	0	0
Children's story hours	11	0	3
Programs about library services	5	0	10
Educational programs for special groups	3	2	2
Educational programs on specific topics	4	3	3
Local news programs	0	2	1
Community events	1	0	1
Meetings or conferences	2	0	0
Talk shows or interviews	2	1	1
Audience participation	1	0	0
Video reference service	2	0	0
Not specified	5	1	1

Fig. 20, Source: R.R. Bowker Co., *The Bowker Annual of Library and Book Trade Information*, 1974, Table 2, p. 109.

Figure 21.
NEWSPAPER CITIES, 1880-1970

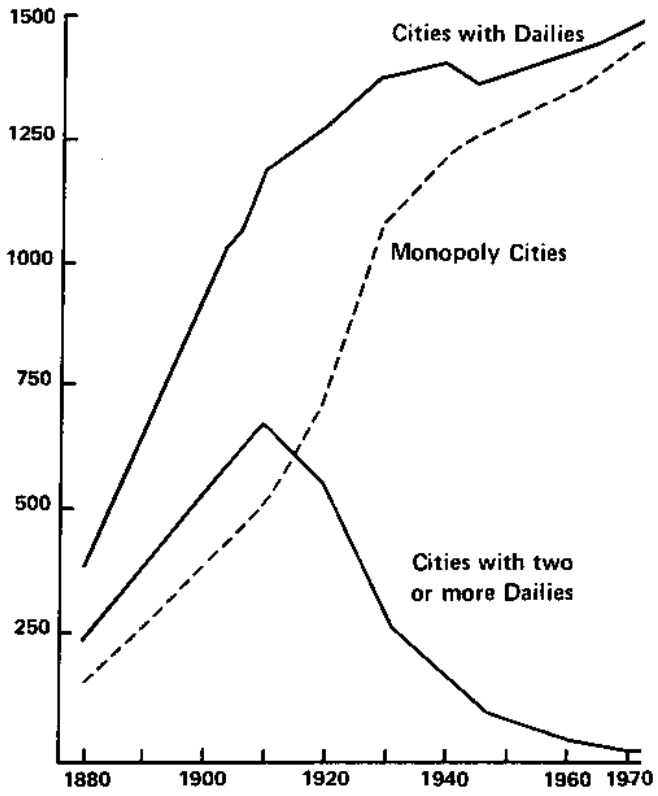
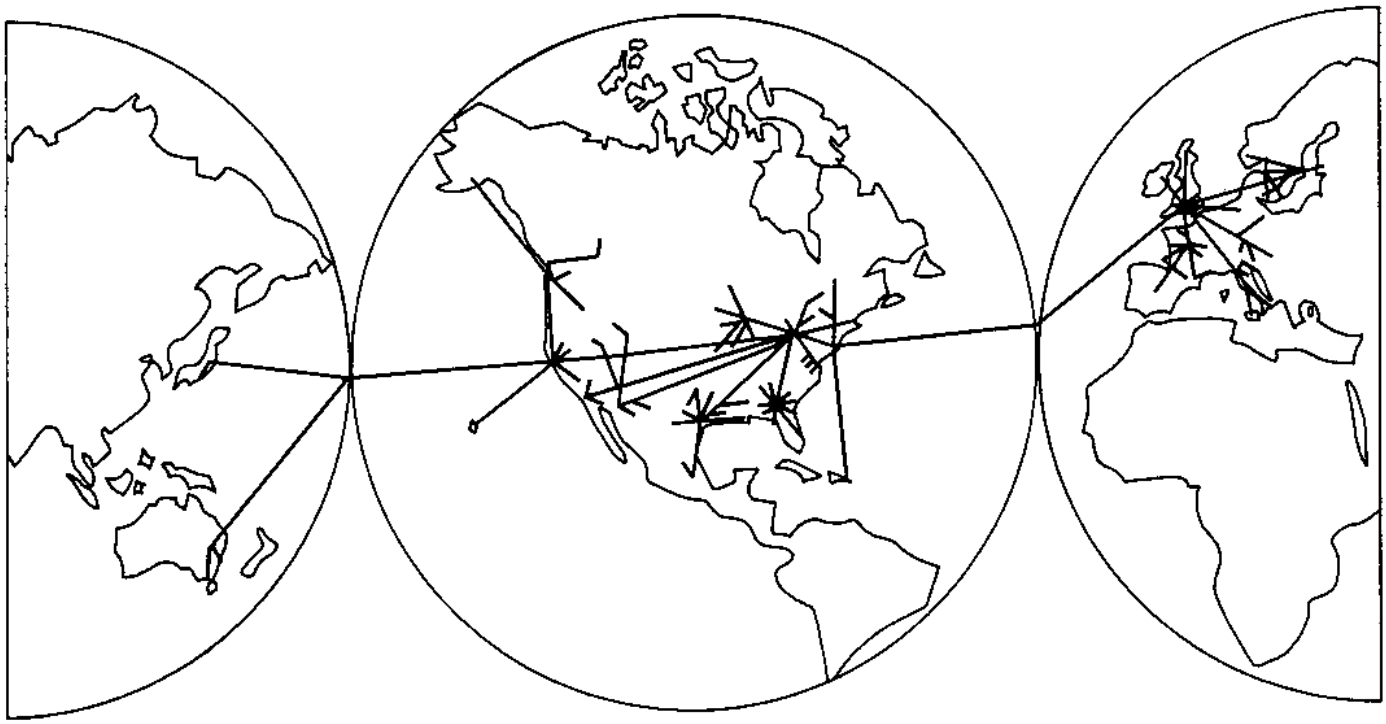


Fig. 21, Source: Owen, Bruce M. *Economics and Freedom of Expression: Media Structure and the First Amendment*, Ballinger Publishing Co., Cambridge, Mass., 1975, p.78.

. . . BARRIERS SHIFT EVEN FOR NATIONS AND CONTINENTS.

Figure 22.



General Electric's MARK III teleprocessing network has 5,000 customers spread over 4 continents and 18 time zones with computers in Cleveland, Ohio, and Washington, D.C. The wide distribution spreads out the peak load, but individual customers need take no notice of the nature of the network. There are at least a dozen such international networks linking computers through satellite, undersea cable and terrestrial connections.

Source: General Electric Co.

THE STAKES ARE HIGH: POWER IS AT STAKE . . .

Figure 23.

Rank order by GNP per capita	Country	GNP per capita (in dollars)	Rank order by EDP base as % of GNP	Rank order by phones per 100 population
1	Switzerland	5,933	4	3
2	United States	5,526	1	1
3	Sweden	5,463	13	2
4	West Germany	4,710	8	11
5	Canada	4,682	5	4
6	Denmark	4,540	3	5
7	France	4,250	7	15
8	Australia	4,054	10	6
9	Norway	4,050	14	7
10	Belgium	3,880	15	12
11	Netherlands	3,846	9	10
12	Austria	3,257	16	13
13	Japan	3,187	6	8
14	United Kingdom	2,714	2	9
15	USSR	2,223	20	18
16	Italy	2,185	12	14
17	Spain	1,491	18	16
	Worldwide average	1,147		
18	Yugoslavia	1,129	19	19
19	South Africa	830	11	17
20	Mexico	747	21	20
21	Brazil	503	17	21

National power is closely associated with highly developed computer and telecommunications resources. The anomalies are instructive. Japan's national economic planning, for instance, continues to stress the development of computer, communications and other information resources. The USSR, lagging in civilian deployment of computer and communication facilities, seeks to import them from the West.

Source: International Data Corporation, *Testimony and Background Material before the U.S. Senate Committee on the Judiciary, Subcommittee on Antitrust and Monopoly, July 23, 1974*, IDC, Newtonville, Mass., July 1974, Table No. 135, p. 81. and United Nations, *Statistical Yearbook, 1973*, U.N., New York, N.Y., 1974, p. 495-498.

. . . HUMAN RIGHTS ARE AT STAKE . . .

Figure 24.

Legislator claims U.S. spy posts in Britain steal commercial secrets

London (AP) – The U.S. National Security Agency is stealing British commercial secrets "on a colossal scale" by eavesdropping on corporate communications from bases in Britain, a left-wing lawmaker claimed yesterday.

Tom Litterick, who represents a district in the industrial city of Birmingham, said he will ask the foreign secretary, Anthony Crosland, to raise the matter urgently with the U.S. Secretary of State, Henry A. Kissinger.

"They are using four British military installations, at Edzell in Scotland, Chicksands, Cheltenham and one in Hampshire to monitor the communications of British commercial organizations," Mr. Litterick told reporters.

He said he obtained his information "from a former employee of the NSA who, in the course of his duties, noticed that commercial information was being decoded and transmitted to the United States and made available to American firms."

"This is nothing short of commercial espionage by an American state agency using facilities provided by the British," Mr. Litterick charged.

KGB, SOVIET INTELLIGENCE, MONITORS TELEPHONE CONVERSATIONS WITHIN U.S.

The *Chicago Tribune* reported June 22 that the Soviet Union had put into effect a massive operation to monitor, record and identify private phone calls within the U.S. The Soviets had long possessed the technology necessary to intercept microwaves, which were used in the U.S. to transmit 70% of all long distance telephone calls, but had only recently developed the computer technology required to separate the conversations and identify the callers, the *Tribune* said.

The disclosure, according to the *Tribune*, had prompted investigations by the White House and congressional committees to determine how much information was being gathered, how it was used and what if anything, was being done by U.S. intelligence agencies to stop the monitoring by the KGB, the Soviet security police.

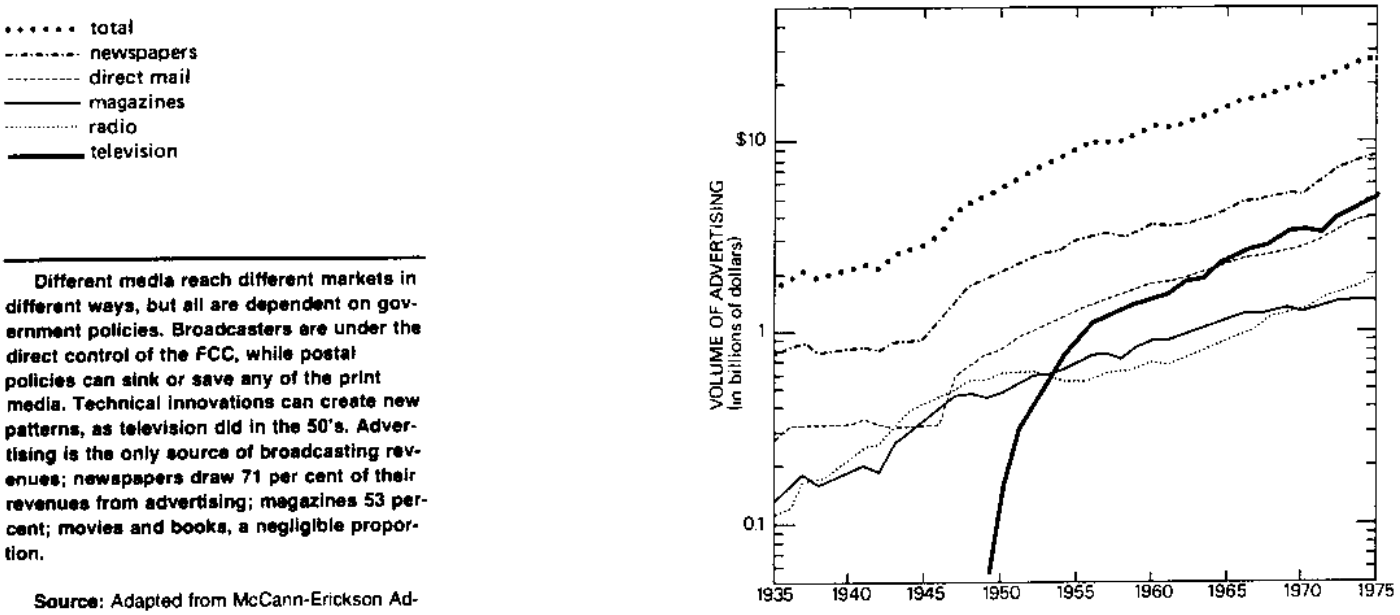
The newspaper indicated that the information had been disclosed in testimony to the Rockefeller commission during its probe of domestic U.S. intelligence, but that the testimony had been heavily censored from the commission's final report for reasons of national security.

Fig. 24a., Source: *Baltimore Sun*, July 30, 1976, p. 2.

Fig. 24b., Source: Buncher, Judith F. (ed.). *The CIA & the Security Debate: 1971-1975*, Facts on File, Inc., New York, N.Y., 1976, p. 289.

. . . MARKETS ARE AT STAKE . . .

Figure 25.



Different media reach different markets in different ways, but all are dependent on government policies. Broadcasters are under the direct control of the FCC, while postal policies can sink or save any of the print media. Technical innovations can create new patterns, as television did in the 50's. Advertising is the only source of broadcasting revenues; newspapers draw 71 per cent of their revenues from advertising; magazines 53 percent; movies and books, a negligible proportion.

Source: Adapted from McCann-Erickson Advertising Agency, Inc., New York, N. Y., 1976, compiled for Crain Communications, Inc.'s *Advertising Age*.

. . . INDUSTRY STRUCTURE IS AT STAKE . . .

Figure 26.

THE ANSWER TO THE HEADLINE'S QUESTION: YES

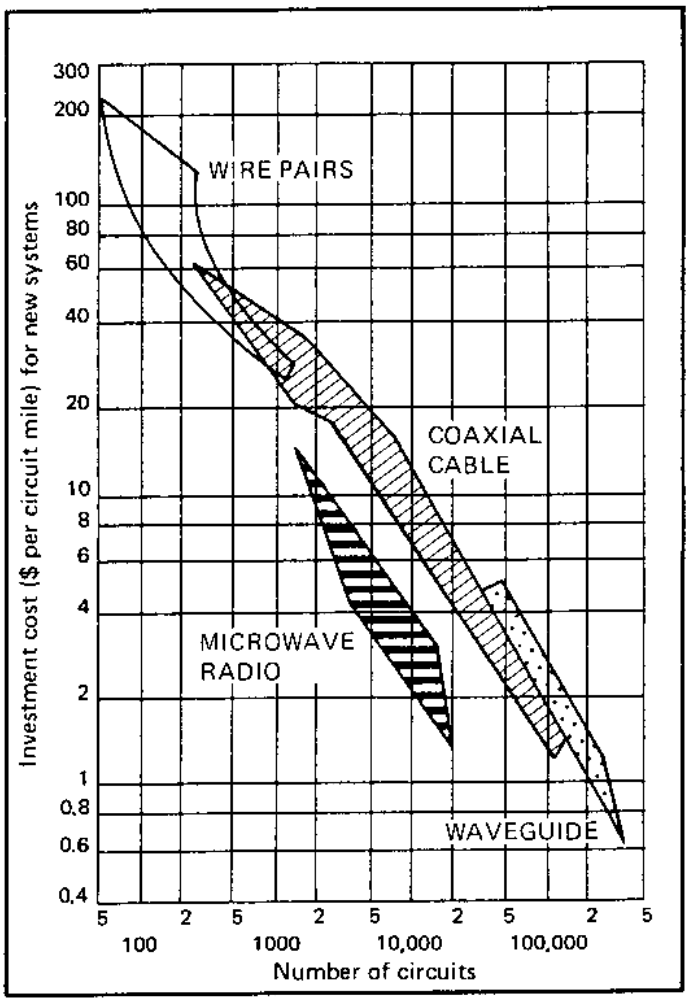
BARRON'S

NATIONAL BUSINESS AND FINANCIAL WEEKLY © DOW JONES & CO., INC.

Ma Bell vs. IBM?

They Are Squaring Off at Each Other in Data Communications

Figure 27.



Costs for transmission of information are down; carrying capacity is up. Wire pairs are the original telephone technology still in use; the others are later developments. The investment costs are expressed as a range.

Source: Adapted from O'Neill, Eugene F., "Radio and Long-Haul Transmission", *Bell Laboratories Record*, January 1975, p. 55.

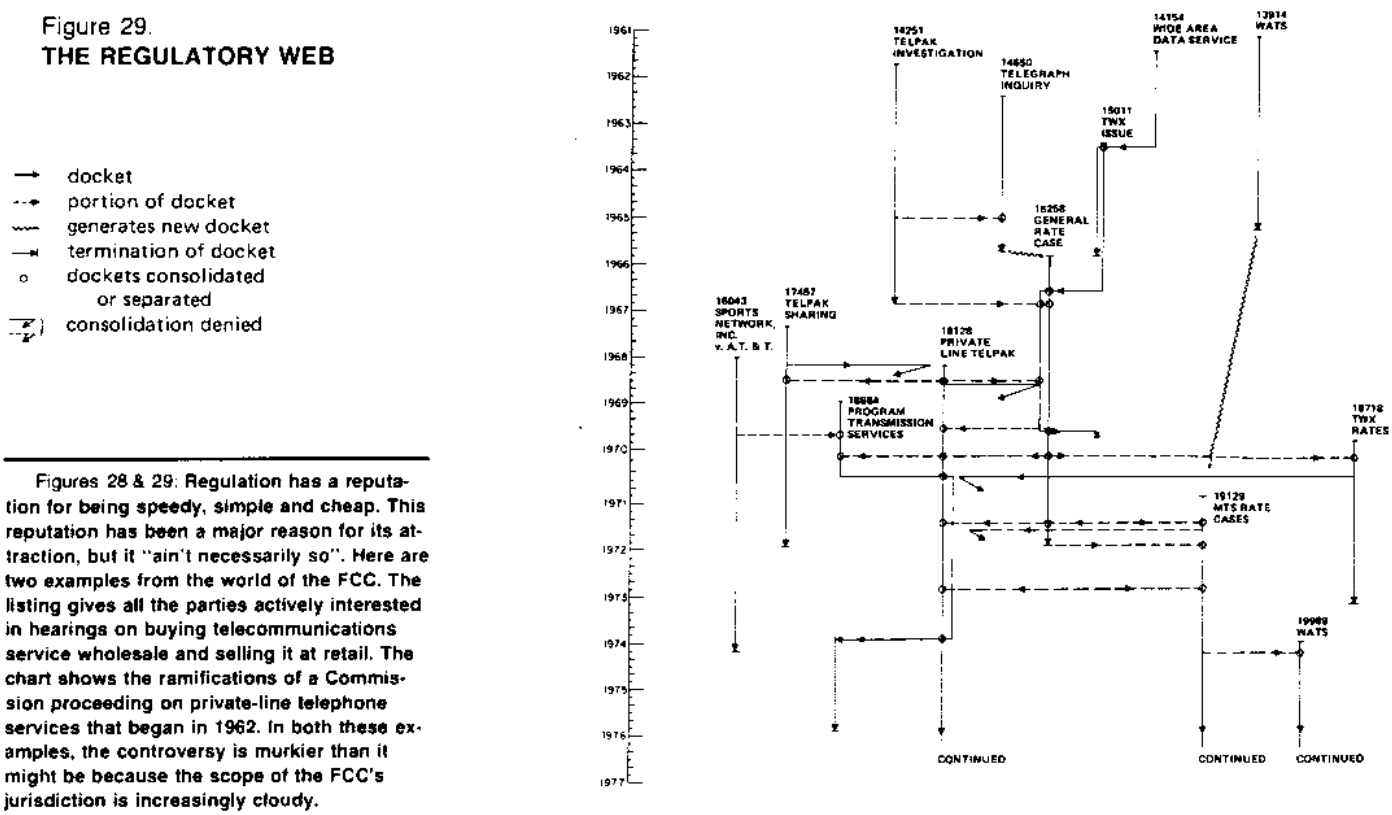
THE STAKES EMBROIL USERS AND PROVIDERS AS CONFRONTATIONS CONTINUE.

Figure 28.

Aeronautical Radio, Inc.
Aerospace Industries Association of America, Inc.
Air Transportation Association of America
Altair Airlines
American Facsimile Services Corp.
American Newspaper Publishers Association
American Satellite Corp.
American Telephone and Telegraph Co.
American Trucking Associations, Inc.
Associated Press
Association of American Railroads
Bank Wire
Boeing Computer Services, Inc.
Bunker Ramo Corp.
Central Committee on Telecommunications of the American Petroleum Institute
Citicorp
Commodity News Services, Inc.
Computer and Business Equipment Manufacturers Association
Data Transmission Company
Dow Jones & Company, Inc.
Graphnet Systems, Inc.
GTE Service Corp.
International Business Machines
ITT World Communications Inc.
MCI Telecommunications Corp.
National Association of Manufacturers
National Association of Motor Bus Owners
National Retail Merchants Association
National Data Corp.
North American Telephone Association
Orlando Communications Club, Inc.
Packet Communications Inc.
RCA Global Communications, Inc.
Remote Data Processing Services Section of Adapso, Inc.
Satellite Business Systems, Inc. (formerly CML Satellite Corp.)
Securities Industry Automation Corp.
Southern Pacific Communications Co.
Telenet Communications Corp.
Tymshare, Inc.
United Press International, Inc.
United Systems Service, Inc.
Utilities Telecommunications Council
Wells National Services Corp.
Western Union International, Inc.
Western Union Telegraph Company
Xero-Fax, Inc.

Department of Health, Education and Welfare
Department of Justice
Office of Telecommunications Policy

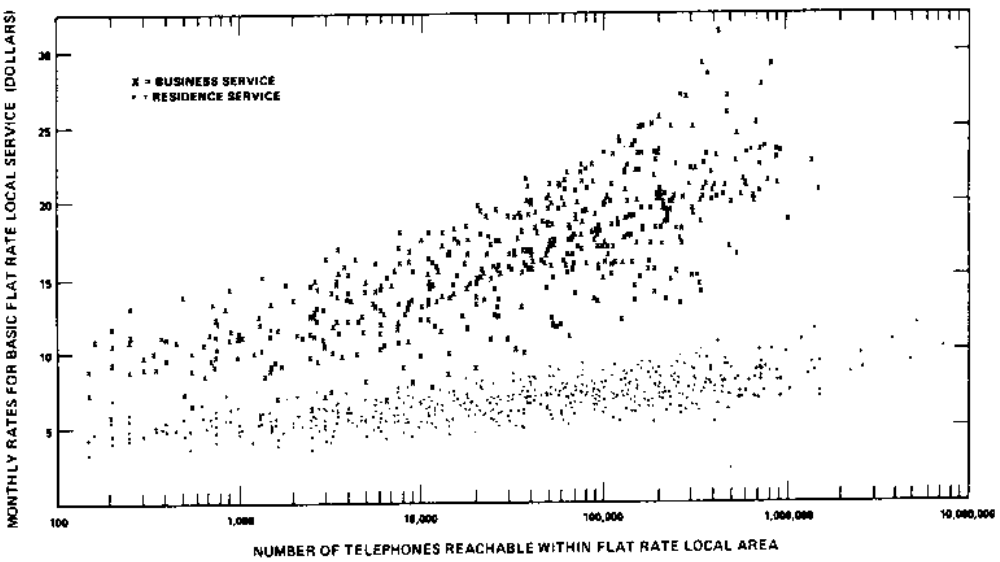
Figure 29.
THE REGULATORY WEB



Figures 28 & 29: Regulation has a reputation for being speedy, simple and cheap. This reputation has been a major reason for its attraction, but it "ain't necessarily so". Here are two examples from the world of the FCC. The listing gives all the parties actively interested in hearings on buying telecommunications service wholesale and selling it at retail. The chart shows the ramifications of a Commission proceeding on private-line telephone services that began in 1962. In both these examples, the controversy is murkier than it might be because the scope of the FCC's jurisdiction is increasingly cloudy.

THE ISSUE IS WHO GETS WHAT, WHEN, AND HOW . . .
. . . NATIONALLY?

Figure 30.
HOW ARE TELEPHONES PAID FOR?



The most important difference between basic rural and urban telephone service, or between basic business and residential service, is the rates. The more phones in the local flat-rate area, the higher the flat rate. Businesses pay about twice as much for the same service in any area. The range shown here is from $5 for residential service to 1000 local phones to $25 for business service to 1,000,000 local phones. Electrical power rates run the other way, higher for basic residential service, lower for businesses. So, in practice, do rates for private line telephone services.

Source: *Exchange Service Telephone Rates in Effect June 30, 1974*, National Association of Regulatory Utility Commissioners.

Figure 31.
WHAT'S IN THE MAIL?

	1968	1974
Transactions (Mail containing checks, bills, statements of account, purchase orders, etc.)	40%	35%
Correspondence	22%	26%
Personal	13%	11%
Business	5%	10%
Government	4%	5%
Advertising	26%	27%
Magazines and Newspapers	11%	11%
Merchandise	1%	1%

Business and government are using the mails in new ways. Business correspondence doubled, but mail containing transactions dropped by 12 percent. Government correspondence increased by 25 percent. Personal correspondence dropped 15 percent, but the percentage of sealed first-class mail remained relatively unchanged. Who's winning? Who's losing?

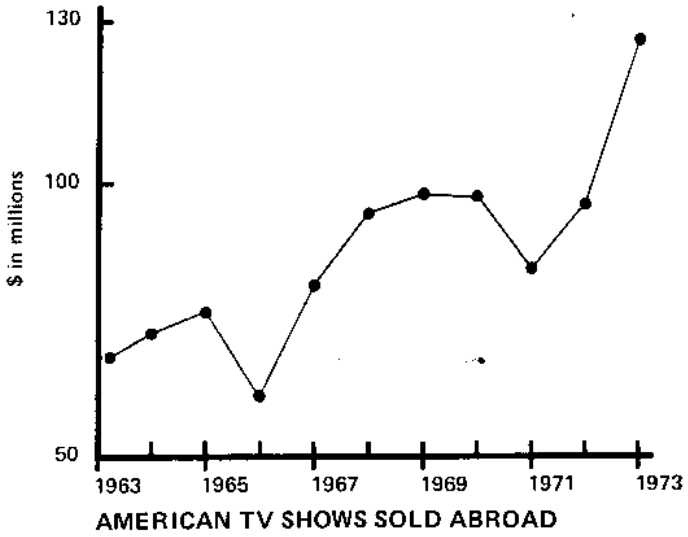
Source: Report of the President's Commission on Postal Organization, *Towards Postal Excellence*, 1968, p. 48, and a March 1976 U.S. Postal Service study.

. . . INTERNATIONALLY?

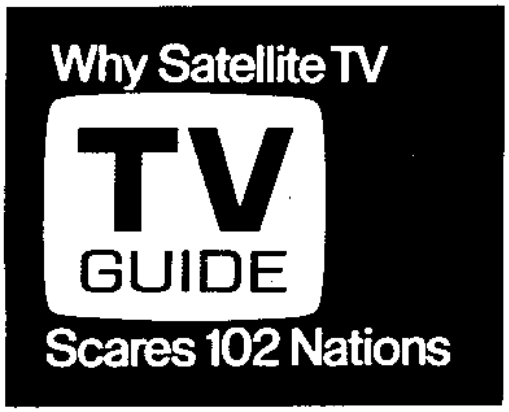
Figure 32.

Article 19
Declaration of Human Rights
"Everyone has the right to freedom of opinion and expression; this right includes freedom to hold opinions without interference and to seek, receive and impart information and ideas through *any media and regardless of frontiers.*"
(emphasis added)

United Nations General Assembly Proclamation, December 10, 1948.



AMERICAN TV SHOWS SOLD ABROAD

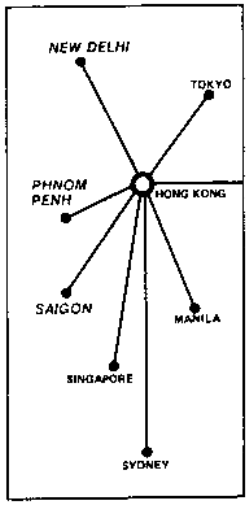


The world-wide flow of American television shows is already a potent economic issue, particularly in Canada, but the content of the shows may provoke foreign governments even more. Does the UN Declaration of Human Rights cover satellites used for direct broadcasting, agricultural mapping, mineral prospecting, or spying?

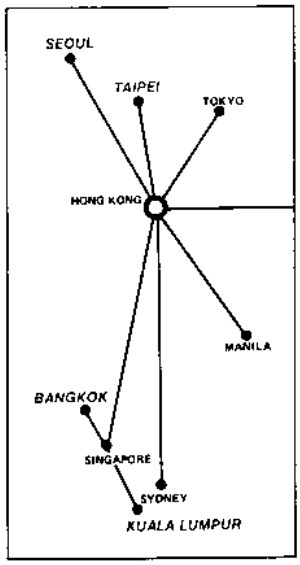
Source: Motion Picture Export Association of America, Inc., William H. Fineshriber, Jr., vice president, letter, January 31, 1974, p.3.

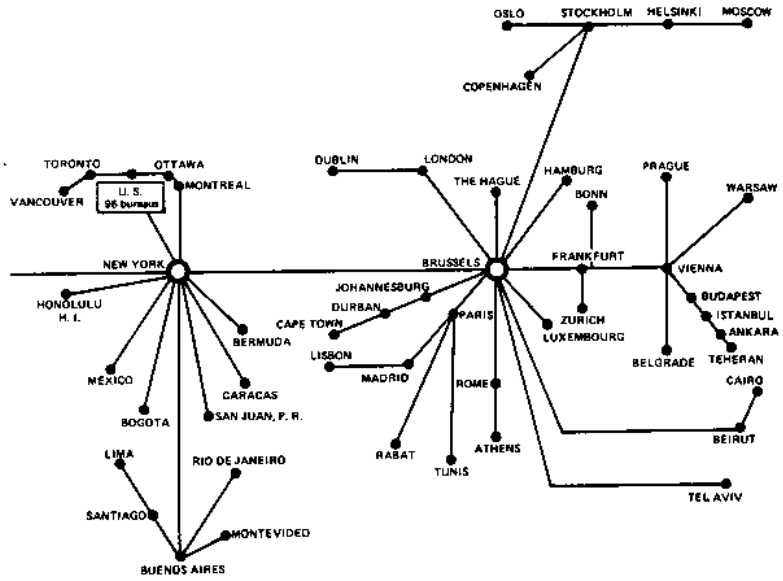
AGAIN, WHO GETS WHAT, WHEN, AND HOW . . .
. . . INTERNATIONALLY?

Figure 33.



1975





1976

Press Worried by Third World's Move to Restrict Flow of News

THE NEW YORK TIMES, MONDAY, JULY 19, 1976

Political limitations affect the global information flow more than technical problems. The end of the Vietnam War and the end of Indian democracy changed the information available to UPI clients everywhere.

Source: United Press International.

WHO MAKES POLICY?

Figure 34.

1	American Telephone and Telegraph Company (including Bell Laboratories, Western Electric, and Long Lines)
25	Bell Operating Companies
1	Western Union
Ca. 1600	Independent telephone companies
5+	Specialized common carriers and domestic satellite carriers
x_1	Value-added service companies
x_2	Teleprocessing service companies
x_3	Electronics and business machines companies
x_4	Trade associations (Association of Data Processing Service Organizations, Inc., Computer and Business Equipment Manufacturers Association, Electronic Industries Association, National Telephone Cooperatives Association, North American Telephone Association, U. S. Independent Telephone Association, etc.)
1	Congress of the United States
1	Federal Communications Commission
1	United States Postal Service
x_5	Other federal executive agencies (Internal Revenue Service, Rural Electrification Administration, Rural Telephone Bank, White House Office of Telecommunications Policy, etc.)
x_6	Courts
50	States (regulators, legislators, consumer agencies, etc.)
1	National Association of Regulatory Utility Commissioners
x_8	Municipalities (local taxation, pole rights and other rights-of-way, etc.)
x_9	Investors supplying debt and equity capital
x_{10}	Consumers and consumer groups (including individuals, corporations, consumer groups, and government)
x_{11}	Foreign nations

In folklore, Ma Bell gets what she wants from the Federal Communications Commission, but in actual practice it isn't easy. The principal players in the telecommunications arena are many and varied and they don't all want the same thing at the same time. Other information arenas tend to be less organized and more sprawling — education, for instance, or the media.

HOW ARE POLICIES CARRIED OUT?

Figure 35.

Laissez-faire

Taxes

Tax write-offs

Regulation of price, quality and entry

Standards

Research and development

Prohibitions; financial and criminal sanctions

Subsidies

Rewards for innovation and invention

Incentives, e.g., matching funds

Model legislation

Import/export trade management

Information exchange

Establishing or supporting an industrial base by government purchase

Establishing new institutions

War

Government control or monopoly

Building civil works

Propaganda

Fear

Police

Most discussions of information policies are cast in terms of competition versus monopoly, but modern economic theory recognizes that various performance goals and diverse conditions of production are best accommodated by various shadings of the extreme structures. And this means various shadings of policy tools. Hammers are made for nails and nails for hammers, but saws are best for sawing wood. Thus, policy is made through the relationship between the government and the governed. Laissez-faire policies are useless when the government is fundamentally unhappy with the way things are going. Patents can't be awarded for nonexistent inventions. The governed greatly influence the way they are governed.

Source: Listing adapted from Joseph F. Coates, *Structural Failure: The Case of Local Government*, an unpublished paper.

HOW MUCH POLICY? FOR WHICH INDUSTRY?

Figure 36.

ARENAS	GAMES
Postal services	In U.S., an ailing government monopoly with private competition in some services. Tradition of privacy. In other countries, postal services bundled with telephone and telegraph in government ministry. Little competition. Privacy variable.
Compunications	In U.S., communications industry private, but regulated; clashing with data processing industry, private and unregulated; difficult to distinguish the two. Both undergoing antitrust proceedings. In other countries, an important national asset, government supported and run in large part. Capacity and flexibility of international compunications seen as promise or threat to national resources, sovereignty.
Electronic funds transfer	In U.S., extent of E.F.T. system regulation and who regulates unsettled. Banking regulators, communications regulators, state and federal, all interested. Non-banking industries vying for market. Privacy unsettled. Abroad, bank compunications networks are policy concern, as above.
The Media *(newspapers & magazines)*	Unregulated but affected by antitrust laws. Protected by First Amendment, tested in courts. Dependent on regulated postal rates and services, compunications rates and services. Increasingly competing with electronic media.
TV-radio broadcasting	Regulated by FCC. First Amendment protection eroded; Fairness Doctrine, etc. License renewal for individual stations; networks not regulated as such, but affected by antitrust laws. Threatened by CATV.
CATV	Regulated by FCC, but not covered by statute. State and local regulation mixed. Doctrine unsettled. Competing with broadcasting and telephone industries.
Libraries	Many kinds—public, educational, organizational, and private—no settled doctrine on rights of access, use.
Education	Direct government control over public education. Mixed federal, state and local jurisdiction. Some private school regulation, but little for large corporate sector training and education. Content of course materials controlled by private and public organizations.
Management information systems	Unregulated as such. Affected by privacy and freedom-of-information legislation. Communications component regulated to varying degrees. Much of output required by various arms of government.
Privacy and access	Public awareness very high. Constitutional protections, but governments important offenders, also businesses, professions. Countervailing pressures strong, doctrine unsettled. Conflicting claims of society and individuals.

HOW THE PROGRAM WORKS

THE PROGRAM DEALS WITH ISSUES WHEN THEY ARE CLOSE ENOUGH TO BE ENGAGED BUT STILL DISTANT ENOUGH TO BE OUTFLANKED.

The Goal: For the Program, success is laying out the policy game clearly so that all those who are involved — the players — will have available the same high-quality, objective background information.

WHAT WE DO:

- **Describe the arenas of conflict**
- **Name the significant players**
- **Enumerate the stakes of the game**
- **Identify the forces in action**
- **Mark the trends**
- **Discuss strategies**
- **Specify the policy options and their likely consequences.**

WE DO NOT TAKE SIDES. WE DO NOT PRESCRIBE.

There is no shortage of advocates in information resources policy; lawyers, speechmakers, public relations counsel, economists, consultants, futurists, experts and executives are already vocal on most sides of every issue.

The Program does not advocate solutions. We recognize that policies are made through compromises between actively involved players and not on the basis of intellectual suitability. We have observed that no one pays much attention to academic recommendations, so we do not make them.

TO ASSURE COVERAGE, ACCURACY AND INDEPENDENCE, THE PROGRAM MANAGEMENT:

- **Finds diverse, competing sources of funds**

The Program is not dependent on any single source of funds. It is supported by a network of more than forty affiliates, listed in the front of this volume. Thus, we aim to avoid even the appearance of being in the pay of any party with a stake in the policy issues we study. No contributor looms particularly large. Collectively, the affiliates represent interests diverse enough to cancel any pressures any one of them might apply.

The collective pressure we feel from our affiliates is towards relevance. Our cash will dry up if we cease to be relevant, not if we cease to please some sugar daddy.

- **Works with all the players**

The program is involved with players from all the information arenas: users and providers of information services; competitors and allies in business and industry; legislators and regulators. These are our sources of funds. These are our sources of data. These are the reviewers of our work. These are our audiences.

- **Focuses diverse talents through review and project direction**

The Program's research project directors come from a variety of backgrounds in industry, government and academic life. They include senior business executives and undergraduates, regulators and entrepreneurs, legislative staff and professors with endowed chairs. They may come to the Program with a topic in mind or they may be sought out to work on a given project.

The researchers do not work in a vacuum. Each project also involves a group of reviewers, many from the affiliates, who oversee the research. These reviewers represent each group with a stake in the subject being studied and each academic specialty with a contribution to make to the research.

To combat sprawl, the natural companion of variety, the Program insists on centralized management of each research project: the project director has the sole responsibility for producing a final product from the insights of the research staff and the reactions of his reviewers.

THE PROGRAM CHOOSES ITS PROJECTS:

- **By close observation of industry and government**
- **By suggestions from staff, affiliates and other players.**

THE PROGRAM REACHES ITS AUDIENCES.

The Program makes efforts to bring its research findings to all interested parties in the most useful form.

Dissemination begins long before final publication with the selection of project reviewers representing important players and academic specialties. Dissemination does not end with publication, but may continue as long as the work is timely.

Usually, the results of a single project will appear in several different forms for different audiences. Projects are presented at industry forums as well as at academic meetings. Project directors testify in Congress and state legislatures. Published research is used as text material by industry and government, as well as in courses at Harvard and other schools.

No report is published until it is in English plain enough for the layman. If necessary, the Program's editorial consultants will help put the finish on a report. Lengthy reports are prefaced by a short executive summary.

Once published by the Program — as either a working paper or formal publication — the research may also appear in one or more academic or popular journals. The Program distributes to libraries both directly and through the National Technical Information Service. All these efforts at getting the word out are discussed in more detail in Volume Two of this annual report.

ALL FINDINGS ARE PUBLIC.

The Program accepts no restrictions on the dissemination of its research results. We do not undertake proprietary research for any party.

The Program will accept confidential data as part of its research input and will protect their confidentiality. No attributions are made without prior consent, and all Program reports are public.

PROGRAM AFFILIATES ARE INVOLVED IN THE PROGRAM'S WORK.

Affiliation is more than financial support. Affiliates provide us with basic industry data and other information available to them. Affiliates suggest research topics and assign project reviewers on topics of interest to them. They disseminate Program findings within their organization. They help the Program with informal referrals.

In return, the Program keeps this research involvement simple and productive. The Program's staff is available, formally and informally, for discussion of matters of mutual interest. We will provide data and commentary to affiliates on request. Project reviewers are kept fully informed, but are not deluged with raw data. Suggestions for research topics are welcomed. Affiliates also receive all Program publications and open invitations to all faculty seminars and presentations.

Affiliation is participation in a public forum on information resources with the goals of quality work, independence and high usefulness to the players. Many affiliates have stated that the main return to them is the improvement of the policy-making process through open-minded research and frank discussion.

AFFILIATION MEANS A WORKING PARTNERSHIP BRIDGING THE GAP BETWEEN OPERATIONS AND POLICY FOR THE BENEFIT OF ALL.

continued from page 4

There was no confusing any one of these activities with another. There was hardly any connecting one of them with another. They involved separate organizations which did not see each other as competitors and certainly not as part of anything called information resources. Each was bounded by its own technology and the market for the service it could provide; policy for each was set in terms of that service, technology and market.

But the divergence of technologies was superficial, not fundamental. Today there are more forms of information technology than ever before, but the technical barriers between them are fewer. The beginnings of the process of coming together are shown in Figure 6. Messages are data; pictures and sounds are data; words are data; and, as data, all are subject to processing by computer, and all are subject to digital transmission.

A picture is the same as a thousand words.

The tiny dots that make a newspaper picture and the tiny dots we call letters are all the same to the computer. The path from the computer's keyboard to its memory is just as much a communications channel as the hotline from Washington to Moscow. And the switching system that chooses a path for a transcontinental telephone call is as much a computer as the one that routes your checks through the banking system.

That is, both communications and computation use the same digital electronic technology, which the Program has dubbed *compunications technology*. It is this shared technology that has put Bell, as the leader of the telephone industry, into competition with IBM, as the leader of the computer industry.

But technical compatibility is not necessary for industries to compete. Only the functions have to be the same. You can make a purchase with cash, a check, a bank card, a credit card, or on account with the store. These are choices among financial information resources, each depending on different organizations and using different technologies. Regardless of the choice you make, part of what you pay will go to provide the information service necessary to complete the transaction.

Each service has a different cost, to be paid in a different way. With cash, the cost is undetectably small, unless you lose it before you spend it. The bank charges you 10¢ a check, or requires a minimum balance. The credit and bank cards cost you 18 per cent annual interest on your unpaid balance. The store may charge you 50¢ for handling if they have to send a second bill. Some pay your postage, and some do not.

So how much is paying for the purchase worth to you? Is a cancelled check or itemized account worth what it costs? You can get a cash receipt for free. If a store offers credit, or accepts bank cards, how much is added to the purchase price? Is it more convenient to pay one way or another? For you? For the store? For the bank? What is the credit worth if you don't need it? If you do? Who will have access to your purchase records? What you spend and what you buy tells a lot about you. Some banks offer direct, immediate transfer of funds through electronic systems. They'll take the money out of your account and credit it to the store's with just the push of a few buttons. Is that worth more than a check? Or less? Does it cost more? Or less? For that matter, what makes a check equal 10¢ worth of information processing and transmission while credit card service is free, if payment is received within 25 days?

Or, maybe you should have ordered by mail.

When you pay your bill, you are making your own information resources policy. You are choosing among technologies and industries, among costing and pricing practices, among regulated and unregulated information re-

sources. You, and the store, and the bank, and the card companies are all standing around your transaction, waiting to see who gets what, when and how.

If you have never looked at bill-paying in this light, if you have never thought of the questions raised and answered every time you make such choices, you need not feel embarrassed or even left out, because almost all information resources policy is made in the same way you make yours.

Take governments, for example.

Government control of information policy in the United States is fragmented, to say the least, as shown in Figure 34, which covers telephones only. Much power remains with the states, and even with municipalities. Within the federal government, policy may stem from this or that executive agency or major government information user, from the courts and the Constitution, or from Congress. The Federal Communications Commission is the most visible federal agency with explicitly delegated authority in any arena of information resources policy.

The FCC's authority comes from the Communications Act passed in 1934, and not changed much since. The FCC covers broadcasting, telegraphy, and telephony only. Most of the components of the compunications network shown in Figure 6 were non-existent in 1934. Electronic data processing was still in the future. No one anticipated that clerical work was going to be transformed into an integral part of the compunications system. But the compunications network shown in Figure 6 includes the telephone switching system — a computer for handling communications traffic — as well as many physically separate computers linked by telephone lines to form larger computers. The FCC has made a number of attempts to link up data processing to the categories established in the Communications Act, but the results have been mixed at best.

The Act treats information technologies as separate and incompatible. Telegraphy and telephony are defined as *common carriage,* meaning that carrying messages is analogous with carrying freight so far as the law is concerned. The Act treats broadcasting as a local phenomenon. Common carriage and broadcasting each have their bureau in the FCC and the bureaucracy to go with it.

But these technologies were not entirely separate and distinct even in 1934. The compunications network in Figure 6 began in 1926 when the broadcasters and Bell got together to establish the first national radio network.

Today, after three decades of computers, space walks, transistors, integrated circuits, hot and cold war and unprecedented economic growth, information resources are versatile and abundant, not scarce and incompatible, and technological distinction is unimportant, but the FCC is still operating under the same statute.

The FCC was not established to make information resources policy, but to regulate electronic communications. Of all the forms of compunications, however, the FCC's statutory authority covers only two, broadcasting and common carriage. Thus, under its mandate, the FCC is not constituted to link up to most of the compunications world outside that mandate.

Nor does the FCC's mandate give it adequate access to broadcasting and common carriage. With its divided authority and its divided bureaucracy, the FCC cannot even regulate both of them at the same time. In terms of the blind men and the elephant, the Broadcast Bureau is set up for handling snakes only and the Common Carrier Bureau is set up for trees. (And, on the other side, the Anti-Trust Division of the Justice Department has what it takes for dealing with walls.)

These institutional limitations make it hard for the FCC to operate. Its

charter no longer fits reality, but it cannot operate except under its charter. In fact, the FCC's charter gives it no better preparation to deal with modern information resources than do those of the Federal Home Loan Bank Board or the Senate Foreign Relations Committee, which are also having elephantine problems defining and directing information policy.

Naturally, these agencies must proceed with their assigned tasks, but the results reflect their difficulties. The FCC's response to the rise of compunications has been to make room for some competition in the telephone monopoly. Figure 17 illustrates one instance. The FCC has allowed the establishment of "specialized" communications lines parallel to Bell's long-distance lines on major routes. Bell's traditional lines can handle data communications and the specialized common carriers also carry regular telephone calls. As a monopoly, Bell serves the by-ways as well as the highways, but the specialized carriers stick to the main lines. And, as a monopoly, the telephone companies must provide these competing carriers with local service linking the competitor's customers.

A monopoly with competition? And this confusion arises in the one arena where Congress has attempted to establish order. Figures 28 and 29 give some idea of the order that resulted. Other information arenas are even harder to see and understand, education, for instance, or the media. Figure 36 lists some of the most important issues in the arenas the Program has examined.

It is not that chaos is unbearable or even undesirable, or that a central information policy apparatus ever could or should be devised by Congress. The point is that these issues remain essentially unexamined while policy continues to be made by fate, fiat, or *fait accompli*.

Information resources policy is made in the same dim light as everyday decisions to pay a bill by cash, check or credit card. The implications of policy decision are scaled up considerably, however. And, if there is little attention given to information resources policy on the national level, there is even less attention given on the international level.

What will be the effects on the international political system of direct broadcasts by satellite? American television exports are already a matter of international controversy. (See Figure 32.) Not only are they seen as taking work away from local program producers, but they are also seen as propaganda. Police shows may be violent, but they also occasionally embody Constitutional rights not found in other countries. In France, you are guilty until you prove yourself innocent. Could *Starsky and Hutch* threaten the world's systems of justice?

And what of transnational information networks like that shown in Figure 22? Or the banking networks shown in Figures 11 and 12? Since a business may consist entirely of information systems, these transnational networks may have powers and potentialities almost governmental in scope without coming under any particular form of control. On the other hand, they may be outside any particular system of protection as well, with fragile physical facilities and complicated political liabilities wherever they pass.

In the underdeveloped countries, information resources are built with great expectations. Broadcasting systems will foster national unity within borders established for European colonial purposes, many nations hope. National telecommunications systems are necessary for the development of modern industry, so they believe. Are they backing the right horses? Where should scarce national resources go? Should we export the FCC? The Bell System? IBM? None of the above?

We opened this discussion with a paradox: Information policy is

everywhere and nowhere. We rest our case on the paradox, but the question remains: What is to be done?

These things are happening now. The established relationships between information technologies, organizations, markets, and regulators are being upset now, nationally and internationally. IBM and the computer industry are facing Bell and the telephone industry now. National power in information resources is being established now.

There is no official "information crisis" on front pages and political platforms, but there might as well be. There will be one. It is already close enough to be engaged. It should be met while it is still far enough away to be outflanked. The Program does not advocate the coronation of national and international information czars to run everything nicely and sensibly, nor do we advocate the abandonment of the attempt to regulate as a bad job. We don't know, but neither does anyone else. Our aim is to sketch the web of relations among information systems, to portray the diverse political, economic and technological factors that shape the structure of information resources issues. We are trying to raise the questions that are not being raised.

WHAT ARE THE ENDS OF POLICY AND WHO SAYS SO?

What should be our aims for information resources policy in the next twenty years?

What is necessary? What is desirable? How can foreign and domestic policy aims be harmonized?

What should be the scope of information resources policy?

What, if anything, will be regulated? And to what ends? Who will get what? Who will pay for what? Who will get paid? In the United States? In other countries?

Who should decide?

These issues seem complicated and boring, but would they seem so if the stakes were better known? Who is deciding now? Is the power in the right hands? These are matters for broad public debate.

WHAT ARE THE MEANS?

What are the limits of present policy instruments?

What should be kept? What should be discarded? What is missing? What is possible? What is impossible? What's the catch?

What institutions and processes might best serve our policy aims?

Public? Private? Markets? Elections? One big information company? Myriads of small ones?

These questions are still hard to ask, much less answer. So long as they remain unexamined, information resources policy will continue to be made haphazardly through institutions established for other purposes.

DIRECTOR

Anthony G. Oettinger, director of the Harvard Program on Information Resources Policy, is Gordon McKay Professor of Applied Mathematics, Professor of Information Resources Policy and a member of the Faculty of Public Administration at Harvard University.

He is chairman of the CATV Commission of the Commonwealth of Massachusetts and a consultant to the National Security Council, Executive Office of the President of the United States. He is a member of the Research Advisory Board of the Committee for Economic Development and was an advisor to the CED subcommittee that prepared the report *Broadcasting and Cable Television: Policies for Diversity and Change,* issued by CED in April 1975. Since 1956, he has served as a consultant to Arthur D. Little, Inc., on the uses of information technologies in many industries; he served as a principal consultant to the team that prepared *The Consequences of Electronic Funds Transfer – A Technology Assessment of Movement Toward a Less Cash/Less Check Society,* a report for the National Science Foundation published by the Government Printing Office in June 1975.

He has been president of the Association for Computing Machinery (1966-68) and a consultant to the Office of Science and Technology, Executive Office of the President of the United States (1961-73). He is a Fellow of the American Academy of Arts and Sciences, the American Association for the Advancement of Science and the Institute of Electrical and Electronics Engineers.

As chairman of the Computer Science and Engineering Board of the National Academy of Sciences (1967-73), he led the preparation of NAS reports on *A Technical Analysis of the Common Carrier/User Interconnections Area* (Lewis S. Billig, Project Director), *Databanks in a Free Society: Computers, Record Keeping and Privacy* (Alan F. Westin, Project Director) and on *Libraries and Information Technology – A National System Challenge* (Ronald L. Wigington, Project Director). He is the author of *Automatic Language Translation: Lexical and Technical Aspects,* of *Run, Computer, Run: The Mythology of Educational Innovation* and of numerous papers on the uses of information technologies, including, most recently, *Foreign Policy Choices for the 1970s and 1980s: Information Resources: Strategic Strengths – Strategic Weaknesses,* a report of the Program prepared, with William Read, at the request of the U.S. Senate Foreign Relations Committee.

EXECUTIVE DIRECTOR

John C. LeGates is Executive Director of the Program and Lecturer in Information Resources Policy. His experience prior to joining the Program has been in the development of educational and medical applications of computing.

At EDUCOM, he was the executive director of the Educational Information Network (EIN) and the author of several articles on computer networking. Earlier, as Vice President of Cambridge Information Systems, Inc., he was director of the technical staff, and responsible for the company's nationwide marketing efforts. He also directed the development of the Massachusetts General Hospital Integrated Information System.

At Computer Advisory Services to Education, Inc., he was vice president and director. At Bolt, Beranek and Newman, Inc., he was responsible for exploring the potential of the TELCOMP language in education.

His studies were in mathematics (Harvard) and philosophy (Yale).

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