INFORMATION RESOURCES POLICY AND
THE HARVARD PROGRAM

Information resources policy is about the rapidly changing world of postal services, communications (computers and communications) facilities and services, the media, databanks, electronic fund transfer systems, business and governmental intelligence organizations and other information resources on which we all depend as we do on energy and materials.

The vanishing of boundaries among traditional information resources confronts us with the issues that the Program on Information Resources Policy addresses; its aim is to lay out the policy game clearly so that all the players will have the same high-quality, objective background information. Volume I of this, our fifth annual report, details what we mean by information resources, what issues we see and how we work.

Looking at the middle-term, two to ten years ahead, the Program serves as a neutral forum to describe the arenas of conflict, the significant players, the stakes of the game and the forces in action. We mark the trends, discuss the possible strategies and lay out for all players the policy options and their likely consequences.

For independence and quality, we seek diverse and competing affiliates as sources of our funds, we build in review of our plans and projects by players and other experts, and we make all our findings public by such means as testimony, seminars and publications. Our affiliates provide not only financial support but also reviews of our strategy and information about themselves and their arenas. Accomplishments to date and where we are going are spelled out in Volume II.

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

Available on request is Volume 2 of the annual report for 1976-77, Information Resources Policy: Program Projects, describing the Program’s research, teaching and dissemination activities.

PROGRAM ON INFORMATION RESOURCES POLICY

200 Aiken
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**

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<td>National Intelligence community</td>
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<td>123.6</td>
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<td>13.7</td>
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<td>NA</td>
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</table>

| U. S. Gross National Product    | 982.4| 1,063.4| 1,171.1| 1,306.6| 1,413.2| 1,516.3| 1,691.6|

*estimated

**official government figures computed by different methods for each year.

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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 1970-1976 provide a rough index of the relative sizes of the information industries. Double counting has not been eliminated.
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. 18, Program in Information Technology and Telecommunications, Center for Interdisciplinary Research, Stanford University, February 1975).
THE INFORMATION SECTOR IS STILL GROWING AND CHANGING, NATIONALLY AND INTERNATIONALLY.

Figure 3.
AVERAGE ANNUAL GROWTH OF VARIOUS TRANSACTIONS

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<td>Checks passed through the Federal Reserve System</td>
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<td></td>
<td></td>
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<tr>
<td>Telephones in use</td>
<td>6.4</td>
<td>5.4</td>
<td>10.9</td>
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<td>5.2</td>
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<td>Individual Social Security beneficiaries</td>
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<td>25.8</td>
<td>17.3</td>
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<td>5.1</td>
<td>4.5</td>
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<td>Individual federal tax returns</td>
<td>8.6</td>
<td>47.9</td>
<td>1.1</td>
<td>2.0</td>
<td>1.0</td>
<td>2.2</td>
<td>2.0</td>
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<td>Public welfare recipients</td>
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<td>13.8</td>
<td>-0.8</td>
<td>4.4</td>
<td>2.0</td>
<td>1.5</td>
<td>1.5</td>
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<td>32.1</td>
<td>32.8</td>
<td>23.9</td>
<td>9.6</td>
<td>12.7</td>
<td>13.3</td>
<td>4.6</td>
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<tr>
<td>Persons entering hospitals for treatment</td>
<td>4.3</td>
<td>12.2</td>
<td>2.7</td>
<td>2.8</td>
<td>3.8</td>
<td>3.0</td>
<td>2.1</td>
<td>3.0</td>
</tr>
<tr>
<td>Persons covered by private hospitalization insurance</td>
<td>11.4</td>
<td>32.2</td>
<td>27.7</td>
<td>6.5</td>
<td>4.2</td>
<td>2.6</td>
<td>2.9</td>
<td>2.1</td>
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<td>Motor vehicle registrations</td>
<td>4.7</td>
<td>-0.9</td>
<td>11.7</td>
<td>5.5</td>
<td>3.6</td>
<td>4.5</td>
<td>4.0</td>
<td>4.7</td>
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<td>Passports issued</td>
<td>24.3</td>
<td>98.3</td>
<td>18.7</td>
<td>15.2</td>
<td>12.3</td>
<td>11.2</td>
<td>13.4</td>
<td>1.0</td>
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<td>Students enroled in colleges and universities</td>
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<td>2.5</td>
<td>7.2</td>
<td>3.3</td>
<td>7.0</td>
<td>10.9</td>
<td>8.7</td>
<td>4.6</td>
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<td>Applications processed for federal employment</td>
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<td>New York Stock Exchange daily volume</td>
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<td>3.6</td>
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<td>16.9</td>
<td>12.5</td>
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<td>Pieces of mail handled, U.S. Postal Service</td>
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<td>7.3</td>
<td>3.8</td>
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<td>3.1</td>
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<td>U.S. population</td>
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<td>1.5</td>
<td>1.1</td>
<td>0.9</td>
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<td>U.S. Gross National Product</td>
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<td>2.5</td>
<td>5.1</td>
<td>3.2</td>
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AVERAGE ANNUAL PERCENTAGE INCREASE (in percent)

Figure 4.
CHANGING PATTERNS OF WORLD TRADE IN ELECTRONICS PRODUCTS

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<th>EXPORTS</th>
<th>BALANCE</th>
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<td>(in millions of dollars)</td>
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<td></td>
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<td>CONSUMER ELECTRONICS</td>
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<tr>
<td>1967</td>
<td>562</td>
<td>98</td>
<td>-464</td>
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<tr>
<td>1971</td>
<td>1,487</td>
<td>169</td>
<td>-1,318</td>
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<td>1972</td>
<td>1,933</td>
<td>231</td>
<td>-1,762</td>
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<td>1973</td>
<td>2,259</td>
<td>318</td>
<td>-1,941</td>
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<tr>
<td>1974 (est.)</td>
<td>2,337</td>
<td>383</td>
<td>-1,954</td>
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<tr>
<td>1975 (est.)</td>
<td>1,870</td>
<td>346</td>
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<td>1976 (est.)</td>
<td>2,000</td>
<td>380</td>
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<td>TELEPHONE AND TELEGRAPH EQUIPMENT</td>
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<td>1967</td>
<td>31</td>
<td>46</td>
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<td>1971</td>
<td>79</td>
<td>61</td>
<td>-18</td>
</tr>
<tr>
<td>1972</td>
<td>96</td>
<td>77</td>
<td>-9</td>
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<tr>
<td>1973</td>
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<td>-12</td>
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<td>1974 (est.)</td>
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<td>1975 (est.)</td>
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<td>1976 (est.)</td>
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<td>COMPUTERS AND CALCULATING EQUIPMENT</td>
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<td>1967</td>
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<td>1971</td>
<td>232</td>
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<td>1972</td>
<td>348</td>
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<tr>
<td>1973</td>
<td>344</td>
<td>1,715</td>
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<td>1974 (est.)</td>
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<td>1975 (est.)</td>
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<td>1976 (est.)</td>
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The trends in U.S. imports and exports in three categories of electronics goods.

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 1819, 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 cents to mail a one-page first-class letter 300 miles. Now it is 13 cents for the first ounce and 11 cents 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.
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 communications network. This network is an infrastructure basic to most social functions, including many that reach directly into the home.
Figure 7
TIME, MONEY AND MEMORY

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

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 Savers, Digital Equipment Corporation.
Figure 8.
RESEARCH AND DEVELOPMENT

EXPENDITURES 1960-1973

EXPENDITURES AS PERCENT OF NET SALES, 1973

<table>
<thead>
<tr>
<th>Industry</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chemicals and allied products</td>
<td>3.5</td>
</tr>
<tr>
<td>Drugs and medicines</td>
<td>7.3</td>
</tr>
<tr>
<td>Machinery</td>
<td>3.8</td>
</tr>
<tr>
<td>Office, computing and accounting machines</td>
<td>9.6</td>
</tr>
<tr>
<td>Electrical equipment and communication</td>
<td>7.1</td>
</tr>
<tr>
<td>Electronic components</td>
<td>5.3</td>
</tr>
<tr>
<td>Communication equipment and communication</td>
<td>8.7</td>
</tr>
<tr>
<td>Aircraft and missiles</td>
<td>13.5</td>
</tr>
<tr>
<td>Professional and scientific instruments</td>
<td>5.6</td>
</tr>
</tbody>
</table>

Source: National Science Foundation, Science Indicators, 1974, Figure 4-3, p. 88.
LIKE MATERIALS AND ENERGY . . .

Figure 9.

INFORMATION
without information
all is chaos

ENERGY
without energy
all stands still

MATERIALS
without materials
there is nothing

. . . INFORMATION IS A BASIC RESOURCE.

Figure 10.

<table>
<thead>
<tr>
<th>MODES</th>
<th>PRE-INDUSTRIAL</th>
<th>INDUSTRIAL</th>
<th>POST-INDUSTRIAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transforming Resource</td>
<td>Natural Power, Wind, Water, Draft animals, Human muscle</td>
<td>Created Energy, Electricity – oil, gas, coal, Nuclear power</td>
<td>Information, Computer and data transmission systems</td>
</tr>
<tr>
<td>Strategic Resource</td>
<td>Raw Materials</td>
<td>Financial Capital</td>
<td>Knowledge</td>
</tr>
</tbody>
</table>

Figure 11.
CHASE MANHATTAN
INTERNATIONAL TELETYPE NETWORK

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, April 10, 1977.

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.
Figure 13.
CARD TRANSACTIONS, 1973

<table>
<thead>
<tr>
<th>Type of Card</th>
<th>Number of Cards (millions)</th>
<th>Volume ($ billions)</th>
<th>Average Sale ($)</th>
<th>Transactions (billions)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Retail store</td>
<td>169&lt;sup&gt;a&lt;/sup&gt;</td>
<td>27.0&lt;sup&gt;a&lt;/sup&gt;</td>
<td>$18</td>
<td>1.50</td>
</tr>
<tr>
<td>Oil company</td>
<td>160&lt;sup&gt;a&lt;/sup&gt;</td>
<td>12.0&lt;sup&gt;a&lt;/sup&gt;</td>
<td>6.5</td>
<td>1.85</td>
</tr>
<tr>
<td>Bank</td>
<td>35&lt;sup&gt;a,b&lt;/sup&gt;, 22&lt;sup&gt;a,b&lt;/sup&gt;</td>
<td>12.4&lt;sup&gt;a&lt;/sup&gt;</td>
<td>20</td>
<td>0.62</td>
</tr>
<tr>
<td>Travel and entertainment</td>
<td>6</td>
<td>5.5&lt;sup&gt;a&lt;/sup&gt;</td>
<td>20</td>
<td>0.28</td>
</tr>
<tr>
<td>Air travel</td>
<td>3</td>
<td>2.2&lt;sup&gt;a&lt;/sup&gt;</td>
<td>50</td>
<td>0.04</td>
</tr>
<tr>
<td>Rent-a-Car</td>
<td>6</td>
<td>1.8</td>
<td>30</td>
<td>0.06</td>
</tr>
<tr>
<td>Miscellaneous</td>
<td>?</td>
<td>10.0</td>
<td>15</td>
<td>0.67</td>
</tr>
<tr>
<td>Totals</td>
<td>400</td>
<td>70.9</td>
<td>14.1</td>
<td>5.02</td>
</tr>
</tbody>
</table>

<sup>a</sup> Accuracy of these estimates has been confirmed by independent sources.

<sup>b</sup> 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.
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 $8.75 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).


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


**SPECIALIZED ("OTHER") COMMON CARRIERS' ROUTES**

- MCI Communication (MCI)
- Southern Pacific Communications (SPC)
- Western Tele-Communications, Inc. (WTCI) (subserviced in MCI network)
- CPI Microwave (CPI)
- 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.

**Source:** Arthur D. Little, Inc. and Southern Pacific Communications.
AND INFORMATION RESOURCES EXPOSE STRATEGIC STRENGTH AND WEAKNESS FOR GOVERNMENT.

Figure 19.
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 labeled 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.
PERSONAL MOBILE COMMUNICATIONS CB OR TELEPHONE

Fed or forerunner, the dramatic growth of citizens band radio illustrates how technological innovation can upset traditional boundaries. In May 1977, Texas Instruments introduced equipment that allows direct dialing between CB radios. Meanwhile, American Telephone and Telegraph Co. is experimenting in Chicago with a "cellular" radiotelephone system that would permit for more mobile telephones to be linked into the national telephone network than present technology permits. Which shall prevail? At what costs? With what benefits?

FIGURE 20
LIBRARY ACTIVITIES USING CABLE TELEVISION

<table>
<thead>
<tr>
<th>U.S. libraries</th>
<th>U.S. schools</th>
<th>Canada libraries</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of agencies reporting</td>
<td>22</td>
<td>7</td>
</tr>
</tbody>
</table>

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

FIGURE 21
NEWSPAPER CITIES, 1880-1970

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

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.

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

Figure 23.

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

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.

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 Littlerick, 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. Littlerick 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. Littlerick charged.

Wired Spies

By CHARLES OSOLIN

WASHINGTON — President Carter has approved a top-secret project to determine what action the government should take to prevent Soviet spies from gaining access to American industrial secrets and sensitive trade information, it has been learned.

According to administration sources, a major option under consideration involves the use of sophisticated electronic equipment to encrypt or "scramble," private telephone calls involving investments, new technological developments and other delicate business information which might be useful to foreign countries.

Sources said Carter signed a memorandum dealing with steps to counter the Soviet monitoring of American telephone calls about a week ago after a review by his National Security Council.

The project is so sensitive and so closely held that only a few top officials in the Carter administration and Congress know about it.

An informed source said that Carter ordered that the project be conducted under the over-all direction of the White House rather than exclusively under the Pentagon's super-secret National Security Agency (NSA).

He did so because of concern over possible intrusion by the military into the business world.

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

Fig. 24b, Source: The Atlanta Journal and Constitution, April 3, 1977, p. 1A.
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 74 per cent of their revenues from advertising; magazines 53 per cent; 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.

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
Xerox-Fax, Inc.

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

Figure 29.

THE REGULATORY WEB

- docket
- portion of docket
- generates new docket
- termination of docket
- docket consolidated or separated
- consolidation denied

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 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.

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?

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.

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. Finshinbar, Jr., vice president.
Press Worried by Third World’s Move to Restrict Flow of News

*The New York Times, Monday, July 13, 1976*

---

Political limitations affect the global information flow more than technical problems. The end of the Vietnam War and the changes in India’s government altered the information available to UPI clients everywhere.

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
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.
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. Costes, Structural Failure: The Case of Local Government, an unpublished paper.
## HOW MUCH POLICY? FOR WHAT OPERATIONS IN WHICH INDUSTRIES?

Figure 36.

<table>
<thead>
<tr>
<th>ARENAS</th>
<th>GAMES</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Postal services</td>
<td>In U.S., an ailing government monopoly with private competition in some services. Tradition of privacy.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>In other countries, postal services bundled with telephone and telegraph in government ministry. Little competition. Privacy variable.</td>
<td></td>
</tr>
<tr>
<td>Communications</td>
<td>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.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>In other countries, an important national asset, government supported and run in large part. Capacity and flexibility of international communications seen as promise or threat to national resources, sovereignty.</td>
<td></td>
</tr>
<tr>
<td>funds transfer</td>
<td>Abroad, bank communications networks are policy concern, as above.</td>
<td></td>
</tr>
<tr>
<td>The Media</td>
<td>Unregulated but affected by antitrust laws. Protected by First Amendment, tested in courts. Dependent on regulated postal rates and services, communications rates and services. Increasingly competing with electronic media.</td>
<td></td>
</tr>
<tr>
<td>newspapers &amp; magazines</td>
<td>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.</td>
<td></td>
</tr>
<tr>
<td>Libraries</td>
<td>Many kinds—public, educational, organizational, and private—no settled doctrine on rights of access, use.</td>
<td></td>
</tr>
<tr>
<td>Education</td>
<td>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.</td>
<td></td>
</tr>
<tr>
<td>Management</td>
<td>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.</td>
<td></td>
</tr>
<tr>
<td>information</td>
<td>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.</td>
<td></td>
</tr>
<tr>
<td>systems</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
TO ILLUMINATE THESE ISSUES OF POLICY AND OPERATIONS...

Figure 37.

...THE PROGRAM HAS CONDUCTED STUDIES IN THESE ARENAS:

- Postal Services
- Communications (Computer/Communications)
- Electronic Fund Transfer Systems (EFT)
- The Media
  - Newspapers, TV, CATV
- Libraries
- Education
  - In-School
  - Out-of-School
- Management Information Systems
- Privacy & Access
- Basic Data
- Miscellaneous

In-arena Program Project
Across-arena Program Project (Shown under Main Arena)
THE STUDIES DEAL WITH...

...THESE PLAYERS...

Markets
- Users
- Providers

Labor and Capital

Government Agencies
- Scope
  - State/Local
  - Federal
  - International

- Function
  - Legislative
  - Executive
  - Regulatory
  - Judicial

...AND THESE STAKES...

- Power
- Human Rights
- Industry Performance and Structure
- Costs and Prices

...USING THESE TOOLS.

- Economics
- Finance and Management Science
- History
- Law
- Science and Engineering
- Sociology and Political Science

Percent of Projects
0 50 100
The chart shows some affiliates of the program and their major activities. Their interest in the Program is stimulated by the complex policy issues that arise nationally and internationally among industries and firms, and even within a single company.

Other affiliates (not shown) — such as the Federal Communications Commission, the Communications Workers of America, and foundations — represent further elements of diversity in the Program’s makeup. Affiliates are listed on page 38.
The affiliates are major consumers of the Program's products and services. For the most part, their support is from their operating budgets; their collective pressure is for utility. Diversity and competition offset any individual pressures.

The program has grown from its 1973 beginnings by adding affiliates and decreasing dependence on a few contributors.
A standard negotiated contract for federally funded research.

The Program does no proprietary work. The common clause giving publication control to the government is deleted here.
BY BUILT-IN REVIEW
BY PLAYERS AND OTHER EXPERTS.

THE LIFE OF A STUDY

COMPUTERS OR COMMUNICATIONS?
ALLOCATION OF FUNCTIONS AND THE ROLE OF THE FCC

by Paul Berman

May 1973  Idea presented to Faculty Seminar
September 1973  Working Paper issued
November 1973  Announcement in Telecommunications Reports, 200 requests filled
January 1974  Seminar at Office of Telecommunications of Department of Commerce, IBM, etc.
May 1974  Program publication issued; submitted to National Technical Information Service and to journals
Fall 1974  Publication in the Federal Communications Bar Journal
April 1975  Abridged version reprinted in Computer Law Service
July 1975  Principal background paper for Computer-Communications Interface workshop at the FCC's first Future Planning Conference
April 1977  Publication as section of book High and Low Politics: Information Resources for the 80s, by Oettinger, Berman, and Read; Ballinger Publishing Co., Cambridge, Mass.

Review and revision go on throughout the course of a project. Outside reviewers are asked:
Are we on the right track?
Have we missed any important facts?
Have we misrepresented anyone?
Within the Program, efforts are directed at making the most of the research. The Program staff ask:
How does this relate to our research?
What are the various audiences for this project?
Is the report clear enough for the interested layman?
TO GET THINGS DONE, EACH PROJECT DIRECTOR HAS FINAL RESPONSIBILITY.

Figure 43.
EFT POLICY
AND COMPETITIVE EQUALITY
BY DANIEL PRIVES

Reviewers come from important centers of interest in the subject — competitors, regulators, and scholars — but the final responsibility remains with the project director. In this way we can represent a variety of interests without giving in to committee — built projects or turning out reports reduced to a lowest common denominator.

THE PROJECT DIRECTORS JOB:

Figure 44.

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.
Program on Information Resource Policy

THE MEDIUM AND THE TELEPHONE
THE POLICIES OF INFORMATION RESOURCES
Paul J. Henry
Anthony G. Gettinger
June 1976
Publication 2-76-3

Harvard University
Cambridge, Massachusetts 02138

PROGRAM PUBLICATION

TELEPHONE
ENGINEER & MANAGEMENT
The Telephone Industry Magazine
VOLUME 80, No. 13 July 1, 1976

MANAGEMENT NOTES
By Lon B. Gregory

The Medium and the Telephone


It does, however, provide a logical, current analysis of the telecommunications industry as it exists today in this country. And, as ever, the competition, regulation, financial and operating, legislative issues so much a part of the current scene.

It does provide an apparently objective, analytical picture of the industry as it exists today. It's loaded with data, statistics, charts and comments, including a golden number we've not seen before. As much as anything, it appears as a work by someone without any particular axe to grind.

TRADE PRESS REVIEW

Mass Media Booknotes

© 1976 Christopher H.Sterling, Department of Radio - TV - Film
Temple University, Philadelphia, Pennsylvania 19122

September 1976 page 81 9

"The Medium and the Telephone: The Politics of Information Resources... There are nearly 60 tables, charts, diagrams, etc. to supplement the text in this report which is one of the best and most useful yet issued in the program."

September 1976 page 82 25

"It is indeed unfortunate that Program reports don't give an explicit academic dimension, for the Harvard program is allowing itself to become part of the elite, elite... you'll find the Harvard/March 1977 study of information production in the U.S. and it provides current perspectives on major policy problems in all aspects of information and mass communication... The publishers might as well stop the program entirely..."

ACADEMIC REVIEW

The Program serves players from all information areas: users and providers of information services; competitors and allies in business and industry; legislators and regulators; scholars and the general public.

35
Social Sciences 106: Informational Resources and Public Policy

Anthony G. Oettinger

Generalist and expert roles in shaping the complex socio-technical systems that marshal and distribute the world's basic resources. Selected economic and social theory and bases of personal science and technology lead into an extensive case study of information resources as a case in point: television, newspaper, postal, telephone, computer and other information systems as they intertwine in serving the public. Among the perennial issues considered: quality and cost of service, incidence of economic and other benefits and burdens, distribution of power and control. Emphasis is on understanding how scientific, technological, economic, legal and political factors interplay as the issues are confronted by private and public policy makers.

Note: Term paper in lieu of final examination; extensive research expected of graduate students who elect this course. Pre-requisite: Economics 10 or elementary calculus or equivalent.

Half course (full term). M., W., 2-3:30 3172 (VII, VIII)

UNDERGRADUATE AND GRADUATE TEACHING...

REGULAR SEMINARS FOR RESEARCHERS AND PLAYERS...

CONGRESSIONAL TESTIMONY...
Announcing an International Symposium

Electronic Funds Transfer Systems in the United States

WORKSHOPS AND CONFERENCES...
Senator Gale McGee (left) and Representative Tim Wirth (right) were among the discussion leaders at an executive forum held in March 1977 by the Program and the Nieman Foundation for Journalism.

OFF-CAMPUS VISITS AND PRESENTATIONS...

Ma Bell fights for her monopoly

The promise of high profits through high technology has set off a spectacular battle among communications giants, in the marketplace and in Congress.

By Milton R. Benjamin and William H. Read

It is 11 A.M. on a sunny spring day in 1971. The private line rings in the third-floor executive office of the chairman of a major oil company. "Frank," says the firm's Washington representative, "I've just had an urgent call from the Federal Energy Administration. They want to know our petroleum reserve position, and they want it fast."

"Is this a test, George?" the chairman asks.

Milton R. Benjamin is an associate editor of Newsweek. William H. Read is a fellow of Harvard's Program on Information Resources Policy.

STUDY PROGRAMS FOR VISITORS FROM INDUSTRY AND GOVERNMENT.

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

Figure 47.

AFFILIATES:

American Cen Company
American District Telegraph Company
American Telephone and Telegraph
Arthur D. Little Foundation
Bell Canada
Booth Newspapers
The Boston Globe
Codex Corporation
Communications Workers of America
Computer and Communications Industry Association
Data Transmission Company
Donaldson, Lufkin & Jenrette
Executive Office of the President, Office of Telecommunications Policy
L. M. Ericsson (Sweden)
Federal Communications Commission
Federal Reserve Bank of Boston
First National Bank of Boston
First National Bank of Chicago
General Electric Company
General Telephone & Electronics
Harper & Row
Harte-Hanks Communications, Inc.
Honeywell, Inc.
IBM Corporation
International Data Corporation
International Paper Company
International Resources Development, Inc.
Interpublic Group of Companies, Inc.
Iran Communications & Development Institute
Lee Enterprises
Litton Industries
Lockheed Missiles and Space Company
John & Mary R. Markle Foundation
McGraw-Hill, Inc.
Mead Corporation
Minneapolis Star and Tribune Company
New York Times Company
Nippon Electric Company
Norfolk & Western Railway Company
Payment Systems, Inc.
Pitney Bowes, Inc.
Polaroid Foundation, Inc.
PRC Information Sciences Company
RCA Global Communications
Reuters, Ltd.
Rockefeller Brothers Fund
Rockwell International
Salomon Brothers
Seiden & De Cuevas, Inc.
Southern Pacific Communications
Stromberg-Carlson Corporation
Systems Applications, Inc.
Time, Incorporated
Transamerica Corporation
United Telecommunications
U.S. Department of Commerce:
National Technical Information Services
Office of Telecommunications
United States Postal Service
Western Union Corporation
Western Union International, Inc.
Xerox Corporation
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 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 techno-
logical 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.

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 "communications 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 10c 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 resources. You, 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 communications 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 communications system. But the communications 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 communications 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 incompatibile, 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 communications, 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 communications 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 communications 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?
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.
SOME NOTES ON THE PROGRAM

The Program lays out the policy game clearly so that all players can have an accurate overview of the arenas and an analysis of their options and of the likely consequences of exercising them.

The Program works in ways designed to encourage independence and quality. Our money comes from many affiliates with differing stakes in information policy. Their competition and diversity lets us call things as we see them. And since their support comes from operating budgets for the most part, if they are not satisfied with our work, they leave.

We gain more than money from our affiliates. They help with data, and they also supply interested, informed reviewers of our research. These reviewers participate in every stage of research, from talking it out to final report, and further. One reviewer from industry ended up with a research project of his own.

All the Program's research is public. We do no proprietary or confidential work. Project results are usually presented in several different forms for different audiences. Program staff go to industry forums as well as academic meetings. Project directors testify before the Congress and elsewhere. Written research reports often become articles in popular, trade, or scholarly journals or books. Published research is used as text material by industry and government, as well as at Harvard and other schools.

Sole responsibility for the final results rests with the project director. We want the advantages of collective knowledge and individual responsibility. 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.

In summary, the Program uses diverse, interested support, regular review of research, public availability of results and centralized project control to achieve quality and independence.
CHAIRMAN

Anthony G. Oettinger, Chairman 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 was a consultant to the Executive Office of the President of the United States through the National Security Council from 1975 to 1977 and the Office of Science and Technology from 1961 to 1973.

He is a member of the Research Advisory Board of the Committee for Economic Development and was an advisor to the CED sub-committee 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.

From 1966 to 1968 he was president of the Association for Computing Machinery. He is a member of the Council on Foreign Relations and 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), Databases 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. His most recent book, with Paul Serman and William Read, is High and Late Policies: Information Resources for the 80s, published by Ballinger Publishing Co. in 1977.

DIRECTOR

John C. LeGates is Director of the Program, and Lecturer in Information Resources Policy. His experience prior to joining the Program has been in the business community, developing and managing computer and communications systems.

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).

EXECUTIVE DIRECTOR/POSTAL AND ALLIED ARENAS

John F. McLaughlin is the Executive Director for Postal and Allied Arenas. He spent sixteen years with the Federal government, first with the Federal Aviation Agency's Research and Development Service and then more than twelve years at the Headquarters of the Post Office Department and the Postal Service. During his last four years with USPS, he was the Director of Strategic Planning. In that role, he also headed the task force that prepared the USPS Staff Study, Necessity for Change, and he was the principal author of that report.

He has a bachelor's degree in history from Princeton University and studied at M.I.T. as a Presidential Fellow in Systems Analysis.
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* Resigned May 10, 1977; currently on a two-year sabbatical in Europe.

** Resigned January 31, 1977; currently Deputy to the Under Secretary of State for Security Assistance, Science and Technology.
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