NTIA Report 84-144

Policy Implications of Information Technology

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February 1984

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

POLICY IMPLICATIONS OF INFORMATION TECHNOLOGY

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Today, three-quarters of the U.S. employment and one-half of the Gross National Product (GNP) are associated with services. In 1981, services employment predominated, for the first time, over both agriculture and manufacturing, even in the Third World countries. The increasing importance of services to the economy and the society has been stimulated by the greater availability of information and communications products. This report presents the initial analysis of a project devoted to formulation of national information policy as necessary to accommodate the new opportunities presented by advanced information technologies, and the impact on the economy and society. After defining the meaning of information policy, the report discusses current issues concerning domestic industry growth, maintaining international leadership, and new considerations regarding intellectual property.

Key words: economic development; education; information policy; intellectual property; international trade; research and development; services economy; telecommunications policy

1. INTRODUCTION

The shift of private sector employment trends from production of goods to the offering of services is evident in the curves of Figure 1.[1] Agriculture predominated in the first 100 years of our Nation's development. This was followed by a relatively short 50 years of concentration on manufacturing of goods.[2] As explained by many authors (e.g., Machlup, 1962; Bell, 1973; Toffler, 1980; Naisbitt,

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1 These curves do not include transportation (which today is about 7% of employment), nor government employment at any level. Including public sector services employment would, of course, further de-emphasize the length of the manufacturing era.

2 It is interesting to note that the Departments of Commerce and Labor were established at precisely the time when manufacturing became dominant over agriculture.

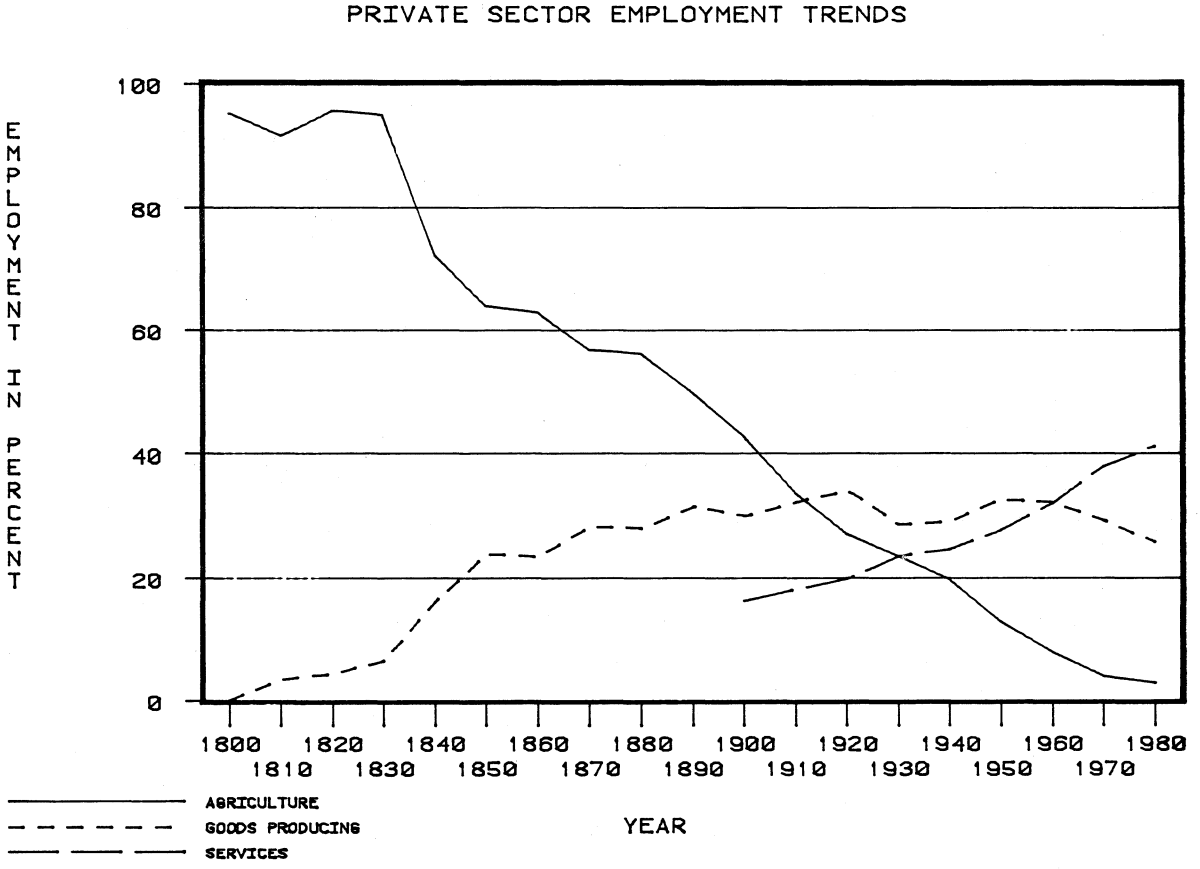

Figure 1. Private sector employment.

1982), this second period was spent in developing skills for the production of material goods, and in becoming proficient in amplifying our physical power through control of energy derived from natural resources. The peak in manufacturing occurred in the 1950's. By the mid-1960's, the economy had increased emphasis on services, a trend which is expected to prevail into the twenty-first century. The excitement of this new era lies in amplifying our mental capabilities. The basic fuel of this era is not the scarce natural energy resources, but the nonexpendable quantity called information. Since a significant part of these services is becoming increasingly dependent upon information, the current period has been called the "information society."

The current transition period has been characterized by the mismatch between employment demands and available skill levels. But just as important is the growth of new information-oriented business.[3] New business starts were up 29% from 1981 to 1982, with electronics, primarily communications and computers, receiving 73% of the venture capital in 1982. (Electronics, 1983)

Two particularly important results of this era now being realized are the substitution of intelligent machines for the toil of labor, and in enhancing our mental capabilities to think, reason, and make more intelligent decisions. The automation of information is leading to new products such as robots and word processors that are improving productivity and substituting for labor in redundant or dangerous processes. At the same time, the application of information products, including communications and computer goods and services, is being used to overcome inherent limitations of the human mind. The "information society" is becoming a reality as the capabilities of products such as the personal computer become a significant component of business and individual decision making. Such products are now extending our memory and our access to diverse data sources, increasing the speed at which we can comprehend and analyze information, stimulating human creativity, and allowing us to simulate specific courses of action without incurring the risks of bad decisions. By the year 2000, integrated circuits the size of a fingernail, which are the heart of these devices, are expected to have as many cells as the human brain. Although hardware development has predominated till now, the emphasis is now shifting to development of software and the application of these "information machines" to create new intellectual products. With the ease by which information can now be accessed and reproduced, there is increasing concern about the lines drawn between the economic and social rights associated with these "intellectual properties."

It is no simple task to understand the significance that this transition from manufacturing to services is having on the Nation's ecomony and society, and in fact on the world. Current policies are largely based on the 50-year

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[3] It is unfortunate that the changes occurring today are often perceived as problems rather than opportunities. The difference is that in evaluating problems, one looks to the experience of the past for modifications to policy. In the present transition, however, when considering opportunities not previously available, one must look to the future in developing new policies that will allow the greatest latitude for product diversity and economic and social development.

manufacturing era in which economic growth depended upon improving the production of goods. It is only the current generation now entering the workforce after high school and college that has lived only in a predominantly service-oriented, rather than goods-oriented society. However, after two decades of moving toward an information-based services economy and society, new policies are needed that are appropriate to an era where human resources are devoted to serving man rather than machine. (Congressional concerns of this sort are discussed in Section 1.3.)

The first step in developing new information policies was taken in 1968. A Presidential task force, after a year of study, set policy directions that expanded our telecommunications opportunities consistent with information demands still emerging. (Rostow, 1968) The significance of this task force is discussed in Section 1.2. Today it may be appropriate to take the next step by establishing the same type of cooperative joint industry and government effort, this time devoted to setting the framework for information policy into the next century.

1.1 Definition of Information Policy and the Information Industries

The conventional meaning, which is applicable here, is that information is the fact of knowing, as well as the communication of this knowledge. Included in information policy is both information intensive goods and services, and conceptual issues such as freedom of speech, privacy, intellectual property rights, etc. Information policy and the information industries deal not only with information, but also the development of this knowledge and intelligence--learning, reasoning, understanding, and applying what is known. Since information is acquired or used in almost every human endeavor, it is useful to focus the scope of issues by considering which information policies and which information industries are information intensive, that is, where the primary quantity involved is information.

From an economic standpoint, the Nation's condition is often categorized by use of the Gross National Product (GNP), the total of goods and services. Only part of the GNP concerns information intensive goods and services. In terms of goods, for example, the telecommunications and much of the computer industry is developing products where the primary function is the handling, processing, and communication of information, knowledge, and intelligence. Likewise, services

such as professional consulting, education, finance, and real estate are primarily engaged in brokering information, and therefore are also considered as information intensive.

To understand better the information industries, it is useful to search for this categorization in the Standard Industrial Classification (SIC).[4] The industry subdivisions are shown in Table 1. (U.S. Department of Commerce, 1972) The major industry divisions are: agriculture and the extractive industries (A and B), construction (C), manufacturing (D), the services Divisions, (E through J). The services category has been defined in the U.S. Department of Commerce publication "Services Industry Trends and Products" (1975). The contribution of these areas to the GNP is given in Table 4 on page 15.[5] The information industries are not segregated in the SIC code listing. They mainly form a subset of those service industries that supply information-intensive services, and the few manufacturing divisions where such equipment facilitates the handling, processing, and dissemination of information. Table 2 provides a listing of the industry categories that exemplify the information industries. A good topological description of the information field is contained in an information map copyrighted by Harvard (McLaughlin and Birinyi, 1979). The basic question distinguishing information policy is whether the product (i.e. good or service) that is supplied primarily performs a physical or an informational function.

1.2 Perspective

Telecommunications and computers are primary information industry tools. With 20 years of progress in stimulating diversity in telecommunications products and services, the emphasis in policy making seems now to be shifting toward information technology that has primary application in enhancing intellectual creation. Although the telephone was invented over 100 years ago, it

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[4] The Statistical Policy Division of OMB is beginning the revision of the SIC codes, which is scheduled for completion in 1988. The latest supplement to the present 1972 manual was issued in 1977.

[5] In Table 4, Division E is subdivided into communications and utility services, and does not include public administation or nonclassifiable establishments.

Table 1. Standard Industrial Classifications
(including numbers of Major Groups)

Division A. Agriculture, forestry, and fishing
- 01. Agricultural Production--crops
- 02. Agricultural production--livestock
- 07. Agricultural Services
- 08. Forestry
- 09. Fishing, hunting, and trapping

Division B. Mining
- 10. Metal mining
- 11. Anthracite mining
- 12. Bituminous coal and lignite mining
- 13. Oil and gas extraction
- 14. Mining and quarrying of nonmetallic minerals, except fuels

Division C. Construction
- 15. Building construction--general contractors and operative builders
- 16. Construction other than building construction--general contractors
- 17. Construction--special trade contractors

Division D. Manufacturing
- 20. Food and kindred products
- 21. Tobacco manufactures
- 22. Textile mill products
- 23. Apparel and other finished products made from fabrics and similar materials
- 24. Lumber and wood products, except furniture
- 25. Furniture and fixtures
- 26. Paper and allied products
- 27. Printing, publishing, and allied industries
- 28. Chemicals and allied products
- 29. Petroleum refining and related industries
- 30. Rubber and miscellaneous plastics products
- 31. Leather and leather products
- 32. Stone, clay, glass, and concrete products
- 33. Primary metal industries
- 34. Fabricated metal products, except machinery and transportation equipment
- 35. Machinery, except electrical
- 36. Electrical and Electronic machinery, equipment, and supplies
- 37. Transportation equipment
- 38. Measuring, analyzing, and controlling instruments; photographic, medical and optical goods; watches and clocks
- 39. Miscellaneous manufacturing industries

Table 1 (continued)

Division E. Transportation, communications, electric, gas, and sanitary services
- 40. Railroad transportation
- 41. Local and suburban transit and interurban highway passenger transportation
- 42. Motor freight transportation and warehousing
- 43. U.S. Postal Service
- 44. Water transportation
- 45. Transportation by air
- 46. Pipe lines, except natural gas
- 47. Transportation services
- 48. Communications
- 49. Electric, gas, and sanitary services

Division F. Wholesale trade
- 50. Wholesale trade--durable goods
- 51. Wholesale trade--nondurable goods

Division G. Retail trade
- 52. Building materials, hardware, garden supply, and mobile home dealers
- 53. General merchandise stores
- 54. Food stores
- 55. Automotive dealers and gasoline service stations
- 56. Apparel and accessory stores
- 57. Furniture, home furnishings, equipment stores
- 58. Eating and drinking places
- 59. Miscellaneous retail

Division H. Finance, insurance, and real estate
- 60. Banking
- 61. Credit agencies other than banks
- 62. Security and commodity brokers, dealers, exchanges, and services
- 63. Insurance
- 64. Insurance agents, brokers, and service
- 65. Real estate
- 66. Combinations of real estate, insurance, loans, law offices
- 67. Holding and other investment offices

Division I. Services
- 70. Hotels, rooming houses, camps, and other lodging places
- 72. Personal services
- 73. Business services
- 75. Automotive repair, services, and garages
- 76. Miscellaneous repair services
- 78. Motion pictures
- 79. Amusement and recreation services, except motion pictures

80. Health services
81. Legal services
82. Educational Services
83. Social Services
84. Museums, art galleries, botanical and zoological gardens
86. Membership organizations
88. Private households
89. Miscellaneous services

Division J. Public administration
91. Executive, legislative, and general government, except finance
92. Justice, public order, and safety
93. Public finance, taxation, and monetary policy
94. Administration of human resources programs
95. Administration of environmental quality and housing programs
96. Administration of economic programs
97. National security and international affairs

Division K. Nonclassifiable establishments
99. Nonclassifiable establishments

Table 2. Major Information Industry Categories
(with major SIC groups)

COMMUNICATIONS
Broadcasting (36, 48, 50,57)
Newspapers, periodicals, and wire services (27,73)
Postal Service (43)
Private delivery systems (47, 59)
Telephone (36, 48, 50)

INFORMATION ACCESS AND PROCESSING
Book publishing and printing (27)
Computer systems, services, and software (35, 73)
Libraries, service bureaus, and other information utilities (73)

INFORMATION SERVICES
Business services including advertising and legal (73, 81, 86)
Consulting and Brokerage (62, 64, 89)
Education (82)
Entertainment including theaters and organized sports (78, 79)
Finance, insurance and real estate (60 series)
Government (90 series)
Research and development (73, 89)
Social services (83)

took until the mid-1960's before universal service was essentially attained (Figure 2). The emphasis then turned toward diversifying the use of the telephone system. A new demand for data transmission began to emerge, primarily to and from computers. It became evident that new concepts were needed to handle the data communications traffic expected to arise from the rapidly developing computer field. There was reluctance by the established telephone companies to allow connection of new diverse terminal equipment to the Nation's primary telephone system. In addition, the potential was growing for new communications services through use of emerging satellite and cable technology.[6]

Twenty years after the invention of the transistor (in 1948), commercial opportunities for new, cheap, lightweight, small-volume communications and data processing equipment and new information services provided the potential to

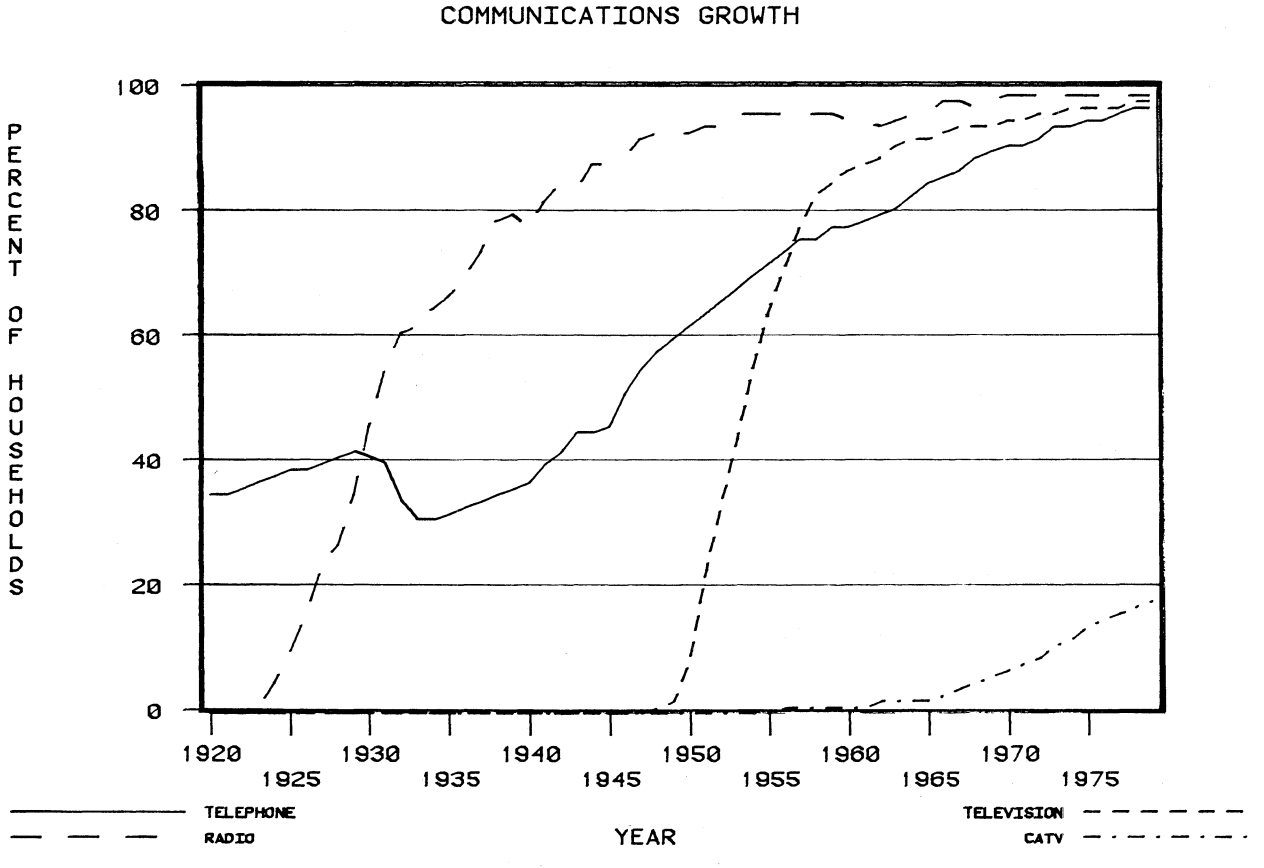

Figure 2. Penetration of communications service.

[6] Satellite communications was stimulated by the Soviet launching of Sputnik in 1957, and the U.S. launch of Explorer I in 1958.

greatly expand the diversity of information services. The Carterfone case and industry interest in offering specialized and value-added services in the mid-1960's (see Table 3) created pressure on the FCC to shift telecommunications policy from merely promoting universal service (the direction of the Communications Act of 1934 which, as shown in Figure 2, had essentially been achieved), to stimulating a diversity of service offerings. (U.S. Department of Commerce, 1982)

It was just at this time, the mid-1960's, that new electronic communications and information processing opportunities were driving the economy toward a services orientation. (See Figure 1 on page 2) The computer microelectronics industry, largely devoid of government regulation found in the telecommunications industry, was developing at a very rapid pace--decreasing prices and at the same time increasing equipment capabilities. The time had come for government policy to concentrate on stimulating new communications opportunities, through deregulation of the telecommunications industry, and thus a new office was created in the Executive Department to meet this policy need.[7]

The guideline for this policy direction was mapped by the 1968 President's Task Force on Communications Policy (Rostow, 1968). After completion of the study, the task force members and their staffs, all of whom were leaders in the communications field, became dispersed throughout industry and government in key positions. Although no official schedule was formulated to implement this policy direction, members of this group, each in their own way, participated in leading the Nation through an intense step-by-step deregulation of this $50 billion industry. Table 3 provides a summary of key telecommunications decisions that have provided the opportunity for an expanding diversity in products and services. The apex of activity occurred during debate of S. 898 and H.R. 5158 of the 97th Congress in 1981-82. Although these bills were not enacted into law, they provided a de facto endorsement of the telecommunications deregulation process. Today the fruits of deregulation are widely evident in the diverse equipment and services available in the marketplace. Congress has recently become involved in the details of implementing deregulation.

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[7] The Office of Telecommunications Policy, containing the President's advisor on telecommunications and information policy, was created in the Executive Office in 1970. These functions were transferred to the National Telecommunications and Information Administration in the Department of Commerce in 1978.

Table 3. Emphasis on Telecommunications Deregulation

Equipment

1956	Hush-a-phone decision by the D.C. Court of Appeals
1968	Carterfone decision by the FCC to allow consumer provided devices to be connected to the telephone system
1976	4th Circuit Court upholding FCC decision to allow non-AT&T terminal equipment interconnection to the telephone system
1978	FCC decision to allow any equipment to be interconnected to the public telephone system (except on party lines and pay phones), provided that the equipment has technical registration at the FCC
1980	FCC extended terminal equipment interconnection to private line in addition to switched network

Transmission

1959	FCC decision to allow point-to-point private microware links above 890 MHz, even if facilities duplicate those of common carriers
1971	FCC inquiry to allow specialized common carriers
1972	FCC decision to allow open entry of domestic satellite service suppliers
1974	FCC decision to require interconnection between traditional and other common carriers (Docket 19896)
1976	FCC decision to allow resale and shared use of private line services by customers
1978	FCC decision to allow non-AT&T Execunet switched long-distance telephone service
1980	FCC decision to allow open entry to MTS and WATS service
1980	FCC decision to allow resale and shared use of switched long-distance service

Services

1956	Consent Decree excluding AT&T from unregulated businesses such as data processing
1971	FCC decision to require common carriers to establish separate subsidiary to provide data processing services (1st Computer Inquiry)
1980	FCC decision to allow enhanced services to be provided without regulation, but maintaining regulation for basic telephone service.
1982	Consent Decree for AT&T to divest the local portions of the Bell operating companies from other parts of the company

Policy concerns today are now largely centered on the diversity and deregulation of services at the local level, called the "last mile." (Report of limited circulation: Local Distribution--The Next Frontier, by J. Charter, D. Hatfield, and R. Salaman, NTIA-TM-81-54, 1981) Current issues include cost recovery by local operating companies, cost of local basic service to the consumer, and the conflict between the opportunity for new diverse services (made possible by cable and

satellite systems) and local regulatory constraints. Today, only traditional telephone service, called "basic service", remains tightly regulated by the FCC. Much of the remaining work in domestic telecommunications is devoted to oversight of deregulatory policies, and is being carried out at the regulatory level.

Following the past 15 years of concentration in the telcommunications area of information policy, it appears that the policy focus is changing, or at least broadening, with the focus now on new opportunities available for telecommunications diversity. Concern about the United States leadership in information technology is being addressed at the present time. One might expect the policy focus to move to issues concerning the development and protection of intellectual property that is created by this technology as we move into the 1990's. An indication of the current concerns is contained in the following section.

1.3 Congressional Concerns

In the first session of the 98th Congress, 255 bills were submitted relating to development of information policy. The issues with the percent of bills can be categorized as follows:

- 60% of the bills dealt with high technology including information
    - o deficiencies in science and mathematics education
    - o improvement of R&D, International Trade, and government organization

- 35% of the bills were related to information and communications
    - o deregulation of telecommunciations services
    - o intellectual property rights including copyright, privacy, and Freedom of Information

- 5% of the bills were concerned with Federal Government enterprise
    - o Government competition with the private sector
    - o United States Postal Service.

The principle concern of the Congress in this area has been directed mainly toward how high technology products, principally those of the information industries can assist in improving the U.S. economic condition. A consistent theme for action has been the threat of foreign competition in light of the increased merchandise trade imbalance. Few bills recognized the significance of the services sector in the domestic and international economy. Although services account for only 40 percent of exports, they are sufficiently larger than service imports to make the overall balance of goods and services a positive quantity.

By far the largest Congressional effort in both the House and Senate has been devoted to maintain technology leadership by improving science, mathematics, and foreign language education--primarily in the elementary and secondary schools. This is aimed at developing a labor force necessary to produce high technology products, but with little attention paid to developing a society capable of using these products, and thus creating the demand for their production.

The next largest effort has been devoted largely to maintaining leadership in international trade. One area has been reorganization of the Federal Government to deal better with international commerce issues. Another effort has been to provide Federal support for cooperative research and development of high-technology products, attempting to reduce the risks associated with individual company creativity, possibly with the side effect of reducing the diversity of products and ideas as well.

Also of significant interest is legislation directed toward continuing the telecommunications deregulation process--primarily through extension to broadcasting, but also with recent concern about the availability and cost of local telephone service. Legislation concerning intellectual property rights is also gaining momentum, with most of the concern being with copyright issues where new technology is facilitating easy reproduction of copyrighted material. There is less concern about privacy than was apparent several years ago.

Finally, there continues to be a marginal concern about the Government continuing to provide services that are also now being offered by private sector businesses.

2. ISSUES

With national policies now in place that stimulate diversity in communicating information, the basic policy concern is shifting toward issues regarding the generation, use, and rights associated with information. The 1976 revision of the Copyright Act probably provided a milestone in focusing attention on the information issues. However, it was not until Japan made significant inroads into U.S. information product markets in the last several years (largely with technology we provided to them) that information policy became a highly visible item in the Congress. Although in the next several years, information policies are expected to continue to center on assuring the opportunity to maintain leadership in developing information technology, it is likely that for the remainder of this century, information policy will emphasize the use of this technology consistent with the United States and world market orientation toward service economies.

As discussed above in Section 1.3 on Congressional Concerns, there are three major active issues: 1) enhancing our educational system to sustain growth and to insure that society can take advantage of the new information technology, 2) maintaining U.S. leadership in meeting the market requirements for information technologies, and 3) reassessing the policies and laws regarding rights and freedoms associated with information. The following three major sections in this chapter provide some insights into these issues.

2.1 Industry Growth

There is substantial concern in Congress about maintaining the educational environment to sustain growth in certain sectors of the information industries--primarily those concerned with hardware development. Some concern also exists regarding Government competition with the private sector.

The following two tables indicate that in general the information industries are a very healthy segment of the economy. Table 4 shows the traditional aggregation of industry by major sector. It is quite apparent that the information-intensive sectors (that is, communications, finance, insurance, and real estate, and about half of the other services), show the greatest annual compounded growth rate and provide a sizable contribution to the GNP. An evaluation of

Table 4. Major Industry Sector Compounded Annual Growth Rate

Major Sector	1973-81 Compounded Annual Growth Rate %	GNP Contribution $ Billions
Communications	7.3	$ 77.9
Finance, Insurance and Real Estate	4.1	448.2
Other Services	3.9	386.9
Agriculture Forestry and Fishing	2.6	85.6
Wholesale and Retail Trade	2.2	472.7
Utility Services	2.0	76.4
Mining	1.9	127.2
Manufacturing	1.2	644.0
Transportation	.5	107.6
Construction	-1.8	127.2

Table 4 is from the 1983 U.S. Industrial Outlook, Bureau of Industrial Economics, U.S. Department of Commerce, page XXI, January 1983.

Table 5. Ten Fastest Growing Industry Sectors

Rank	SIC	Industry Segments	1982-83 growth rate in percent
1	3573	Electronic computing equipment	17.8
2	2448	Wood pallets and skids	14.9
3	3674	Semiconductors and related devices	14.6
4	3678	Electronic connectors	13.2
5	3679	Electronic components n.e.c.	12.7
6	3944	Games, toys, children's vehicles	9.4
7	3623	Welding apparatus, electric	9.0
8	3841	Surgical and medical instruments	8.5
9	3662	Radio and TV communications equip.	8.2
10	3761	Guided missiles and space vehicles	8.0

Table 5 is from the 1983 U.S. Industrial Outlook, Bureau of Industrial Economics, U.S. Department of Commerce, page XXXVI, January 1983.

specific industry segments, as presented in Table 5, shows that four of the five fastest growing industry segments support the handling of information. In addition, computers, telephone equipment, office machines, and radio and television equipment are estimated to have the greatest compounded annual growth rate over the past decade. These rates varying from 15.5 to 9.3. (U.S. Department of Commerce, 1983) As previously stated, new business starts are up 29 percent from 1981 to 1982, electronics firms, primarily communications and computers, receiving 73 percent of the new venture capital in 1982. Computer services alone are expected almost to triple to a $74.4 billion market between 1982 and 1987. (Association of Data Processing Service Organizations, 1983)

2.1.1 Educational Considerations

In order to maintain a viable industry, it is necessary to assure that adequate talent is available to perform the research necessary to develop new concepts and new products. This is particularly important in rapidly emerging industries such as the information industries. Problems that exist at present include the reduced number of engineers being graduated, the void created by engineering and science teachers being attracted away from education by industry, the decrease in mathematics and science competency of students graduating from the public education system.

There were about 18,000 graduating college students with bachelor's, master's, and doctoral degrees in high-technology fields in this country in 1981. The fact that Intel, one of the leading U.S. semiconductor manufacturers, recruits about 30% of its employees from foreign nationals may be an indication of the shortage of U.S. engineers. (Electronics, 1982) The Immigration Reform and Control Act was introduced in Congress in 1982, aimed primarily at reducing the number of illegal aliens in this country. Concern has been raised that such legislation would decrease the number of qualified potential research employees educated at U.S. universities.

The basic problem is, of course, not the retention of foreign students, but rectification of deficiencies in the current educational system that leads to this lack of U.S. engineering talent. Research Management (1982) reported a declining number of qualified science and engineering students, with peaks in bachelor's, master's, and doctor's degrees occurring in 1974, 1979, and 1973, respectively. The 98th Congress has introduced 24 bills associated with this problem, but with little action. The significance of the educational problem is pointed out in a recent GAO publication (P-95 No. 76), which observed that the total number of Soviet scientists and engineers engaged in R&D during 1979 was 57% more than the number in the United States. In that year, 179,000 U.S. students (18 percent) received their bachelor's degree in science and engineering compared to 426,000 (53 percent) in the Soviet Union. (National Science Board, 1981)

A recent Engineering Manpower Commission report concludes that enrollment in engineering schools reached an all-time high in fall of 1981. There

are several problems, however, that provide significant deficiencies in engineering education. First, there is a shortage of 40% to 50% in engineering faculty. Competent university and high school instructors are leaving teaching careers to double their salaries in industry. Second, laboratory equipment in the academic environment has become obsolete. The 97th Congress considered several bills (S. 2475 and H.R. 9242, and P.L. 97-34--which passed) to establish tax incentives to industry to provide more recent equipment to higher level institutions. These same opportunities are not available for secondary school education.

Third, there is a significant deficiency in the preparation of students entering higher level education in science and engineering, where, at the primary and secondary education level, there is a general deficiency in mathematics and science competency. At the May 1982 National Academy of Science Conference, President Reagan told science educators that elementary and secondary school science and mathematics has reached such a state that it threatens "to compromise the Nation's future ability to develop and advance our traditional industrial base to compete in the international marketplace." Action on this problem, he said, is "long overdue." The Administration has called on private industry to do more to help local schools. The Administration has endorsed two related projects: 1) The National Commission on Excellence in Education within the Department of Education, and 2) The National Science Board's Commission on Pre-College Education in Mathematics, Science, and Technology. (Research Management, 1982a)

Education at the secondary level provides the basis for those pursuing higher level education which is generally needed for the development and innovation of information technology products, so critical to the advancement of the U.S. society and its standing in international trade.

Eighteen bills have been introduced so far this Congress on this issue. H.R. 1310 has already passed the House. Although it is important that the workforce include those with adequate science and mathematics competence, the major deficiency in the legislation appears to be that it does not stimulate the development of the competence necessary for the society to use the new information technologies. It is well-known in the computer field that the problem today is not hardware, but the lack of software to make information-handling

equipment useful. Raising the level of computer literacy for people in all disciplines, and not just improving the quality of mathematics and science students, is needed to assist in sustaining United States leadership in the offering and use of information technology.

The school systems are only at the beginning stages of introducing the subject of computer literacy, and even there, the approach is oriented to development of programmers rather than developing people literate in using the computer to improve the intellectual productivity of the workforce. Although industry has tax incentives to stimulate equipment donation to universities, the same incentives are lacking in the public school system. The "Apple Bill" has been reintroduced in this Congress as H.R. 701 to provide industry with a tax incentive to supply computers to primary and secondary schools. This bill has become lost with the emphasis on science and mathematics education. States are also considering similar legislation. In September 1982, California passed a similar bill which has stimulated a donation of about 9300 computers for elementary and secondary education in that state. (Uston, 1983) Consideration might be given to modifying Federal science and mathematics education legislation to include incentives for the elementary and secondary school system to stimulate a broad level of computer literacy, i.e., beyond just computer programming.

2.1.2 Government Versus Private Enterprise

Throughout the agricultural and industrial eras, Government has been a major supplier of a broad range of information services, from reports to massive data bases, to communications services. The Government has built substantial enterprises including the Postal Service, the Weather Bureau, the Census Bureau, and the National Technical Information Service, and many information systems like the Agricultural Service, the Federal Reserve electronic transaction system, and the National Library of Medicine. As the Nation moves further into an information society, the private sector has begun to offer services that overlap with those of Government. It is important that Government now evaluate what its role should be as it becomes a competitor with the private sector, and as new technology both changes the character of these products and demands a major rebuilding of Government information systems consistent with the electronic age.

United States Postal Service

There is little doubt that the nature of physical mail will continue to change as electronic communications carry more personal and business transactions. (Ewing and Salaman, 1976, McLaughlin et al., 1979) The Postal Service has already expanded into electronic communications by developing and offering a domestic electronic mail service (E-COM), and an international service (INTELPOST). Both of these services had ,direct private sector competitors even at the time of their introduction.

Because of this competition, the Service has been constrained in its development of these and other services to meet perceived demand. In turn, the private sector has been hesitant to develop services when there is the potential of Government competition. Because of this conflict, there was a 4-years policy and regulatory delay in development of electronic mail systems. This issue is still not adequately resolved. Rather than having the Postal Service's role in provision of electronic mail continually questioned, it may be desirable to decide either that the Postal Service should be kept out of the electronic communications business, or that it should be unrestrained in offering such service.

Were the Postal Service not a Government agency, there would be little question of not only its being able to offer such service, but that such new services would be available today. This leads directly to the issue of whether the Service should be a Government organization, where it is sometimes constrained from offering innovative services, and from implementing programs that would decrease the cost of postal services. As in previous years, bills have been introduced in this Congress to reorganize the Service (H.R. 86, 1205, 1830, 1831). With the changing character of mail in the next 10 to 20 years (e.g., a significant part of First Class mail--financial statements--conveyed via electronic communications), there is little question of the need to make changes. The questions are, whether and when should postal reorganization be reconsidered, how can basic mail service be sustained, and whether the Service should continue to expand into offering electronic mail services now offered by private sector business.

Government Competition in Information Services

There are other Government communications and information services that are encountering competitive challenges from the private sector. The

potential of moving several of NOAA's satellite programs to the private sector has illuminated the fact that the private sector is prepared to provide many types of information services.

The National Technical Information Service has been a candidate for transfer to the private sector almost since its inception. It and other governmental information services, such as the Department of Energy RECON system, have been expanding their offerings to provide on-line data base services that are also available from private suppliers.

As discussed above, Government information services are available that are competitive with emerging private business offerings. The primary issue is what role the Government should have in offering communications and information services that are competitive with similar private-sector offerings.

2.2 Maintaining International Leadership

2.2.1 Importance of Services in the Balance of International Transactions

Much of the concern about the U.S. information industry has centered around the ability to keep up with foreign competition. The origin of the debate is the deficit position of the United States merchandise trade balance (normally called the 'trade balance'). The trade deficit increased from $27.9 billion in 1981 to $36.3 billion in 1982, and is estimated to reach $57 billion in 1983 (Baldrige, 1983). As Lester Davis of the International Trade Administration points out (Davis, 1982), we have been looking to the high-technology area to offset declining competitiveness in lower technology products produced by the more mature U.S. industries. To analyze whether this has been the case, he develops two measures:

> Export Surplus Share of Exports - which would be an increasing percentage figure for an increasing U.S. competitive position in foreign markets versus foreign producers' competitiveness in the U.S. market. It is determined by (exports - imports)/exports, in percent.
>
> Import Share of Apparent Consumption - which would decrease as U.S. producers gain in their ability to compete against foreign imports. It is the imports/(U.S. shipments - U.S. exports + foreign imports), in percent.

From these measures, as shown in Figure 3, he concludes that the United States is losing both the ability to compete in foreign markets (relative to foreign competition in the United States), and the ability to maintain dominance in the U.S. domestic market, even in the area of high-technology merchandise.

The significance of telecommunications and information merchandise, which are important high-technology areas, is reflected in electronics equipment statistics (Electronic Industries Association, 1983). Figure 4 shows that the balance of electronics merchandise trade has remained positive. Figures 5 and 6 show the trade balance in the specific electronic categories. Consumer electronics is the primary detriment in electronics merchandise trade, with a $6.4 billion trade deficit. Industrial products (largely computers) are the primary asset with a $10.5 billion trade surplus. The electronic merchandise trade surplus decreased from $6.9 billion in 1980 to $3.2 billion in 1982 because of increased imports in consumer electronics from $4.5 billion to $6.7 billion, with little change in U.S. exports in this area. The electronic industrial products increase of $744 million in exports to $14,960 million was not sufficient to compensate for the consumer electronics imports increase. The overall electronics merchandise trade balance, however, has remained positive.

Information products (as well as other items in the economy) have significance not only as merchandise, but also as services. Although statistics on services are not as well documented, the following rough analysis shows the influence of services to the overall international balance of goods and services. Services, as defined by the U.S. international transaction accounts, are only about 40% of U.S. exports and 30% of U.S. imports. Figure 7 shows that when including both merchandise and services, the international balance has in fact been positive for all years in the last decade but 1977, 1978, and the current value for 1982 (not shown on the graph).[8]

Figure 8 compares imports and exports, as well as the trade balance for private sector merchandise and service. Again it can be seen that the positive balance of services has been greater than the deficit of merchandise, thus insuring

[8] Figure 7 also shows the balance in the overall Current Account, which includes unilateral transfers (U.S. Government grants, pensions, etc.) in addition to the balance on goods and services.

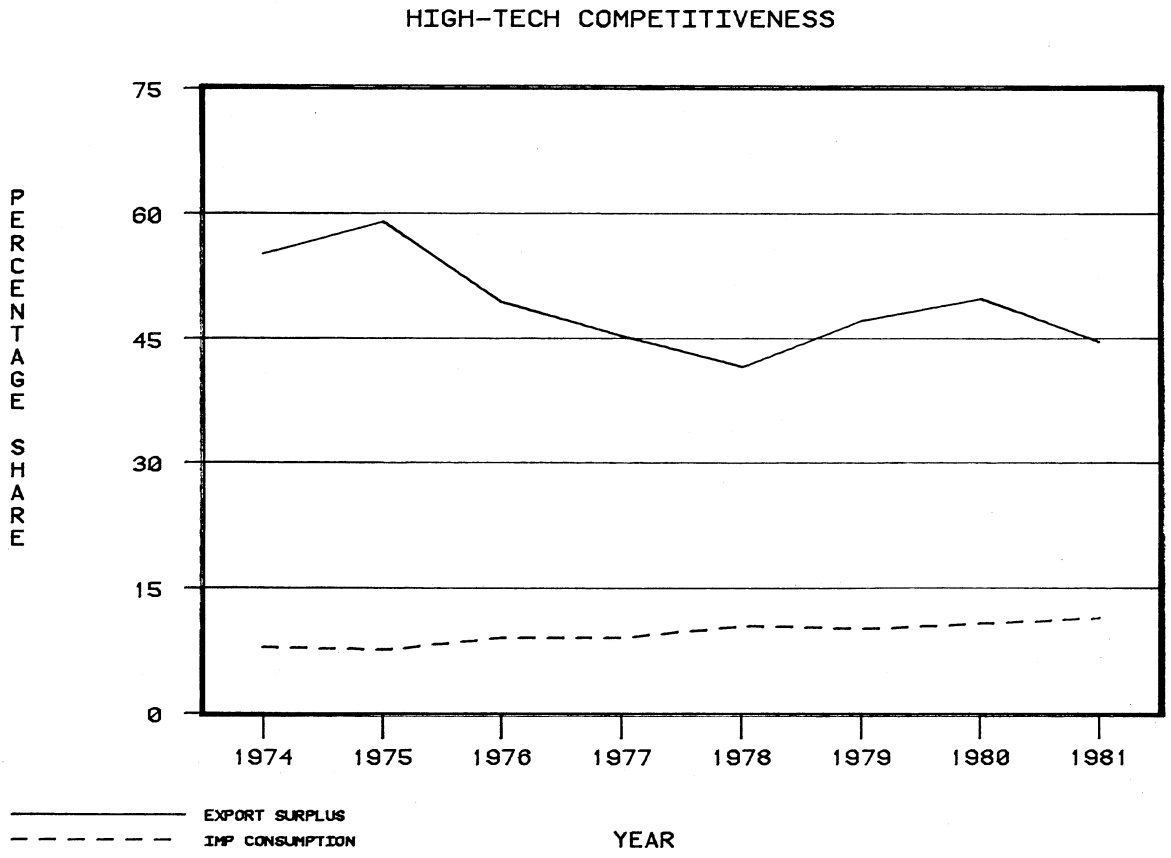

Figure 3. U.S. high-technology competitive measures.

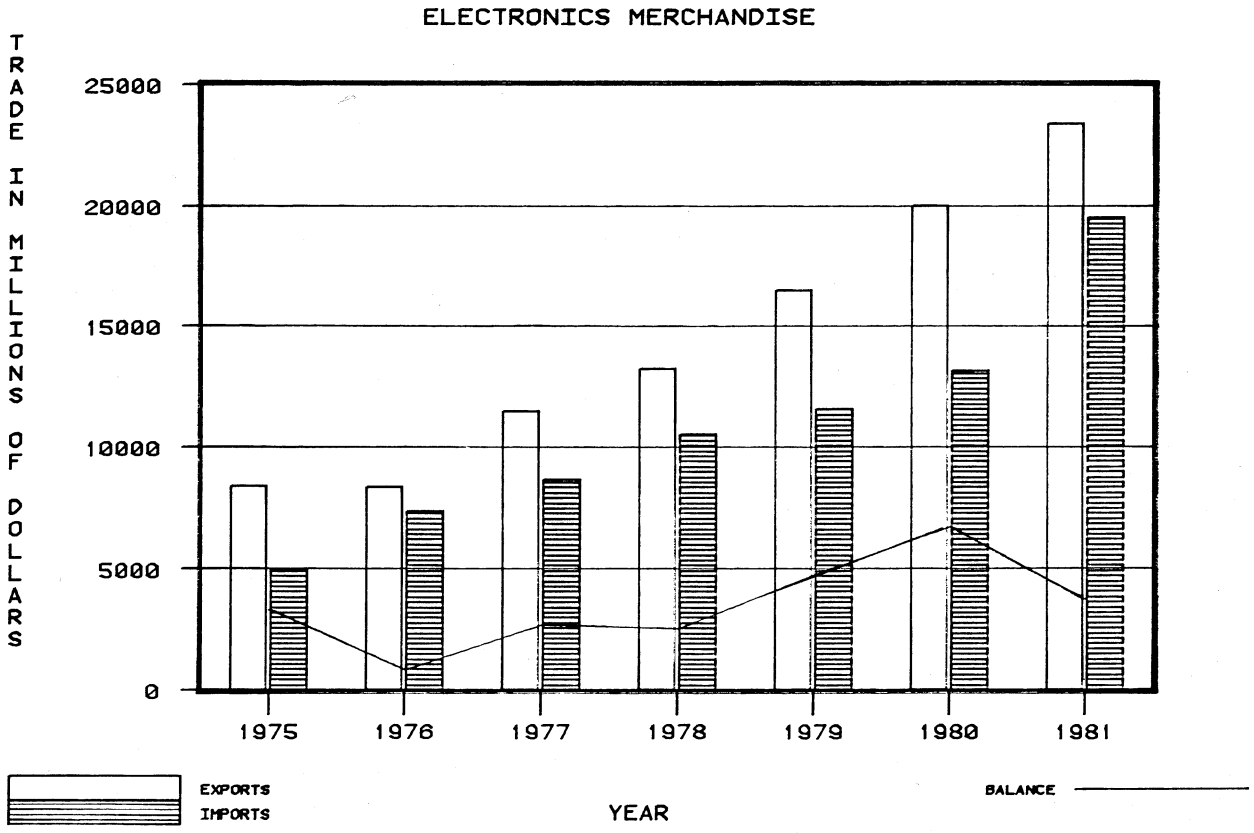

Figure 4. Electronics merchandise trade balance.

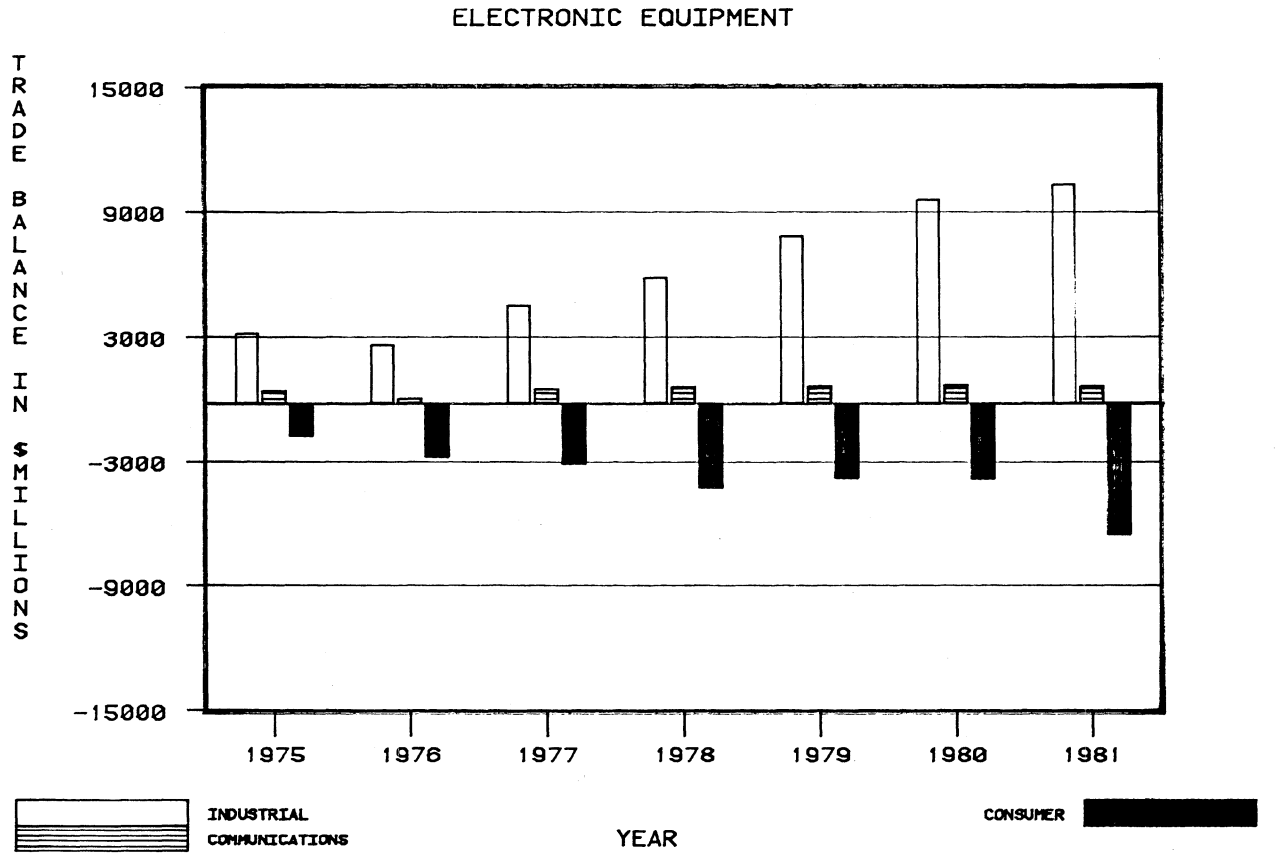

Figure 5. Electronic equipment trade balance.

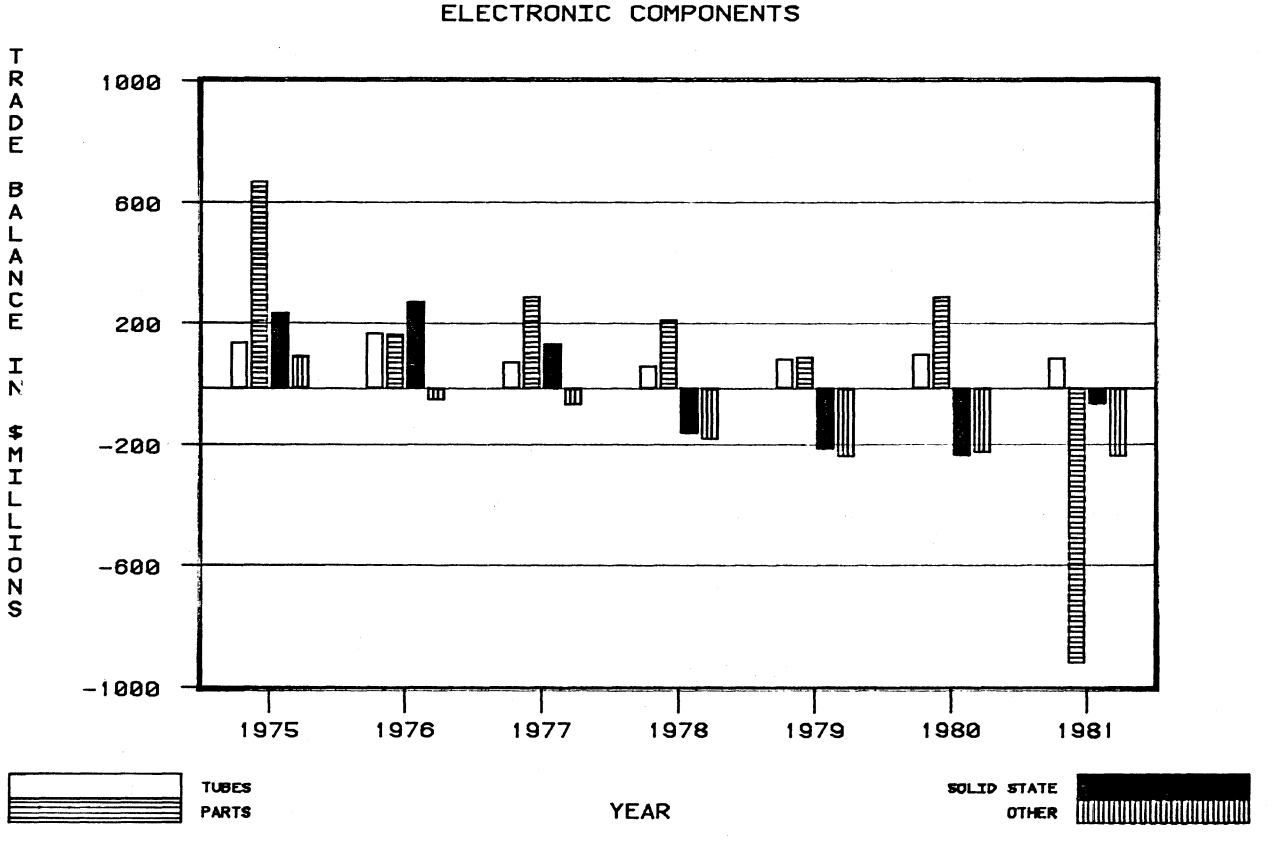

Figure 6. Electronic components trade balance.

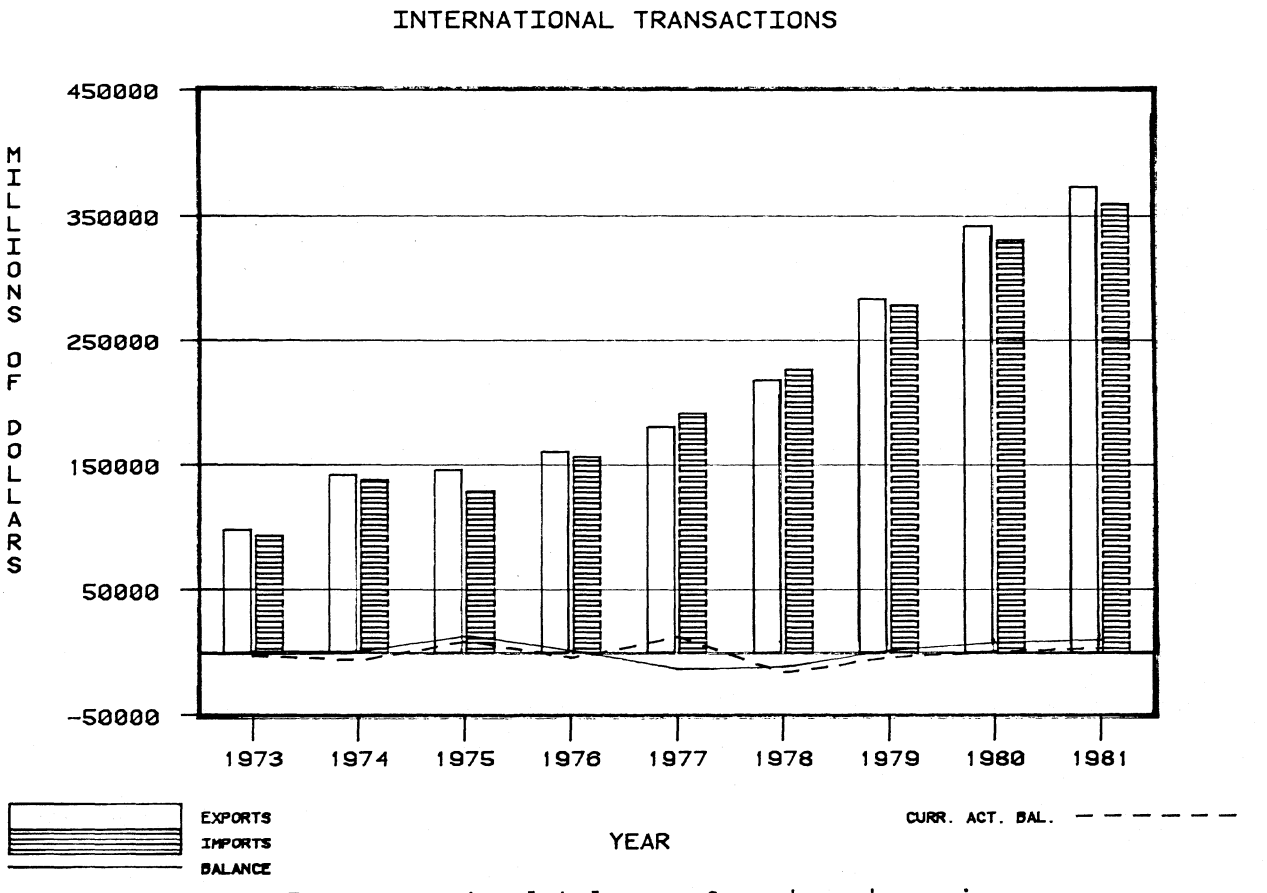

Figure 7. International balance of goods and services.

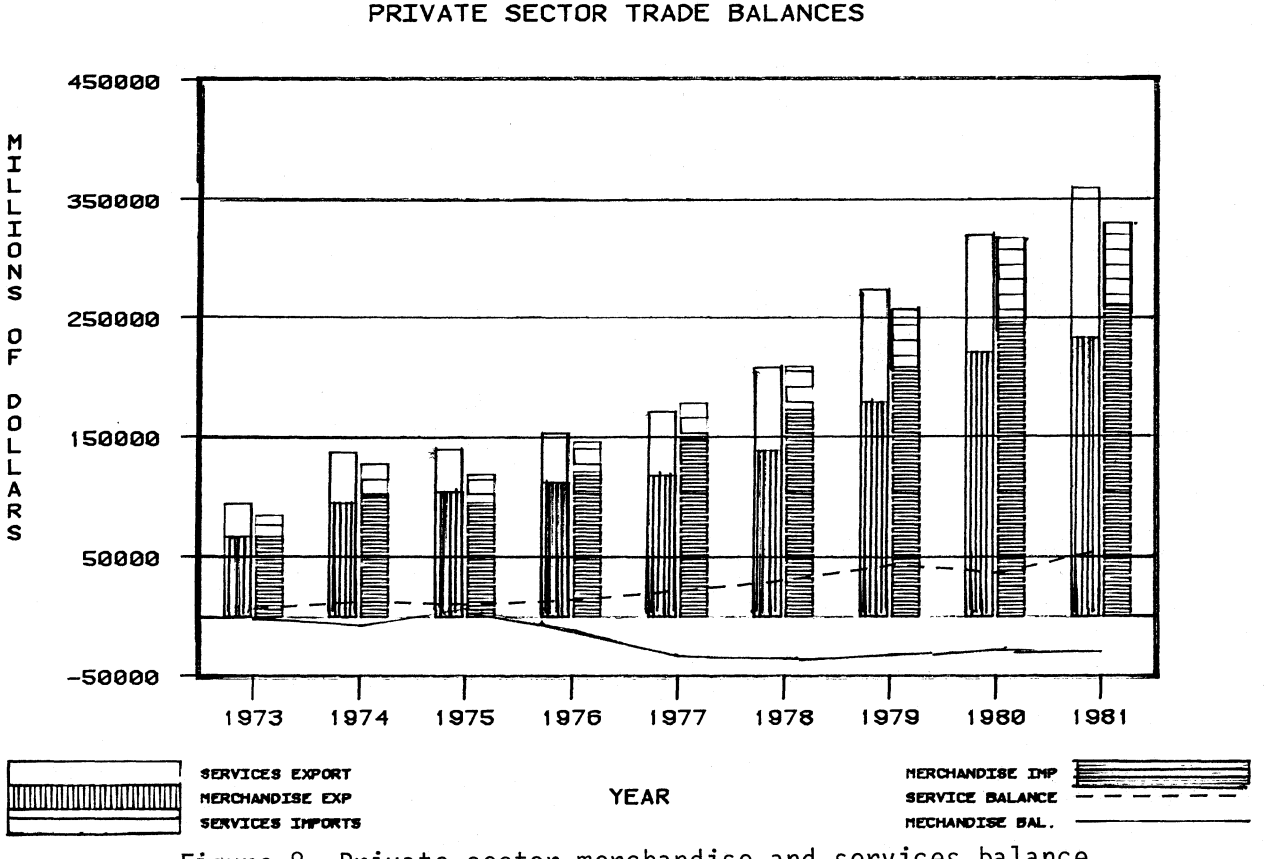

Figure 8. Private sector merchandise and services balance.

that the overall balance of goods and services has been positive. A recognition of the importance of services is reflected in U.S. Trade Representative Brock's seeking an extension of the General Agreement on Tariffs and Trade (GATT) to include trade in services at the November 1982 Geneva GATT meeting.

We have already seen that services have a very pronounced positive influence on the international balance, and that electronics has a positive influence on the trade balance. It is desirable to determine the influence of information services on the international balance. Alexander (1982) updated statistics presented by Barovick (1982) which estimate the foreign business of the U.S. services industries (see Table 6). Their estimates are for private sector business as shown in Figure 8, but are substantially greater than those presented in the U.S. International Transactions (published in the U.S. Survey of Current Business). As explained by Barovick, their analysis includes foreign business by local sales abroad done by affiliates of U.S. firms.

This rough aggregation of information-intensive services shows that they contribute significantly to exports (and amount to about 40% of all service exports). It is necessary to obtain better service and information area statistics in order to determine where Government might provide incentives to maximize these information service exports.

2.2.2 R&D Joint Ventures

United States semiconductor manufacturers have proposed developing cooperative R&D ventures (such as those supported by MITI in Japan). In February 1983, ten companies formed the Microelectronics & Computer Technology Corporation (MCC) for this purpose. At the urging of industry, several bills have been introduced in this Congress to lessen antitrust action against high-technology firms that engage in such joint R&D ventures in the United States (H.R. 108, H.R. 1952, S. 568, S. 737). United States semiconductor companies maintain a very aggressive program of international joint agreements and licensing, which transfers technology to foreign companies--particularly to Japan. (Research Managment, 1982b) In addition, U.S. companies transfer technology through technical conferences and the establishment of foreign based research, development, and manufacturing operations. Care must be taken not to inhibit creativity that comes from diverse thought.

TABLE 6. Foreign Business of U.S. Services Industries (1981)

	$Millions		
Receipts for exports, total	$ 32,246		
Travel	$ 12,168		
Passenger fares	2,991		
Other transportation	12,168		
Fees and royalties			
from affiliates	5,867	*	
from non-affiliates	1,386	*	
Other Private Services	5,940	**	
Income of foreign affiliates, total	$ 92,964		
Oil and gas field services	$ 6,454		
Petroleum tanker operations	9,576		
Pipeline transmission, oil and gas	1,823		
Finance, insurance, and real estate	20,703	*	
Banking	4,290	*	
Construction	20,889		
Wholesale and retail trade	5,196	*	
Transportation and communication	15,570	**	
Hotels and lodging	1,799		
Advertising	1,583	*	
Motion pictures, TV tape, and film	1,234	*	
Engineering, architecture, surveying	4,695	*	
Accounting	503	*	
Other personal and business services	5,678	**	
Total, exports plus affiliate's income	$128,210		
Information intensive services	$ 58,232		41% of total services

Notes:

* Information intensive services
** Assumed to be half information intensive goods vs services

The problem in foreign trade may not be the lack of American innovation through research (much of which is supported by the U.S. Government--particularly DOD), but the lack of techniques to compete in manufacturing. The need to maintain R&D strength through tax incentives is desirable. This is supported by H.R. 702 and H.R. 1887 in the current Congress, and by Vice President Bush's endorsement at the Spring 1983 Electronic Industries Association conference. However, it may be as important to develop tax incentives to stimulate creativity in the manufacturing processes. IBM has identified this problem, and is currently working with industry to find improved manufacturing techniques (Robinson, 1982).

2.2.3 Security vs Information Dissemination

The free flow of information within the research community is essential for maximum creativity and innovation. As stated by the American Academy for the Advancement of Science:

> "Science gets at the truth by a continuous process of self-examination which remedies omissions and corrects errors." (American Association for the Advancement of Science, 1975)

Industry imposes its own restrictions on transfer of information as deemed necessary to protect its commercial interests. The academic community feels strongly about the need for unrestricted flow of information. Almost everyone realizes both that there are times of international stress when R&D information flow must be restricted for purposes of national security, and that such restrictions impose some degree of restraint on creativity. The issue centers on the extent to which information should be suppressed by Government for the purpose of national security. This debate is carried on monthly in the science and engineering literature. In addition, there have been recent meetings between industry and Government representatives (including Dr. Keyworth, the Presidential Science Advisor) to discuss the issue, but with no resolution. Dr. Keyworth has expressed interest in the need for closer interaction between Government (particularly the Defense Department) and the private sector. This issue is far from being resolved.

2.3 New Considerations in Intellectual Property

In an information-oriented society, the nature of intellectual property rights are of great significance. Because of information's unique features, establishing and enforcing information property rights present the policy maker with some distinctive problems. Widespread allegations of information piracy are a sign that technology is turning our laws and customs, which protect intellectual property, into anachronisms. While Congress has been addressing the issue, the need for a clarification of public policy remains, especially concerning video and audio recording, and the protection of computer-related intellectual property. Some factors influencing intellectual-property policy include: (1) the conflict between the First Amendment and Intellectual Property Rights, (2) the lack of a clear moral mandate about who should own information, (3) public indifference toward "information theft" arising from the unique features of information, and (4) the purpose of establishing property rights in intellectual matters. This section explores these aspects of Intellectual Property Policy.

2.3.1 The Increasing Importance of Intellectual Property Rights

The establishment of property rights is one of the central mechanisms by which a society determines its nature. The organization of society, its potential for development, and the distribution of wealth and income among its members are all affected by this institution. What kind of property rights a society establishes determines to a large extent what that society is like, not only economically, but socially and politically as well. In countries based on a free-market economy, clearly defined and enforced private property rights are essential to the smooth and efficient functioning of society.

Information is playing an increasingly important role in our society. People are spending (and will continue to spend) a greater portion of their time doing such things as gathering facts, entertaining, being entertained, expressing ideas, borrowing ideas, acquiring knowledge, reading, writing, thinking, researching, and so on. All this involves working with information or ideas.[9] Tangible

[9] These terms are used interchangeably here to refer in a general way to the variegated activities just mentioned.

physical goods are decreasing as the focus of our activities, and information is becoming the central good and resource of our society. (E.g. see Figure 1)

Because information is now replacing physical goods as the dominant commodity in our society, issues concerning property rights to information are becoming very important. How to distribute rights to information among its members is a crucial issue facing the information society. We can choose to define property rights in information in the next few decades in such a way as either to encourage or retard the development of the post-industrial society. Public policies concerning intellectual property rights will, to a large extent, determine what such a society is like.

2.3.2 Difficulties In Definition and Enforcement

It is exceedingly difficult to decide what kinds of property rights to information are appropriate. There are several reasons why it is especially difficult to determine what the appropriate nature and extent of property rights in information should be. First, the concepts, customs, and laws of property originated with physical property and hence are not easily or always appropriately extended to information. Second, information is an amorphous and nontangible good. It is hard to indentify information and separate it into discrete units to which one can assign exclusive rights. One can not easily quantify information or precisely determine its value, and hence it is hard to assign a price to it and trade it in the market.

Furthermore, it is extremely difficult to exclude other people from information. The ability we have as a society to control who has certain information--and who doesn't--is not only limited by our political values, but also by the very nature of information itself. Unlike physical goods, information can not be controlled simply by taking physical possession of it (or, rather, possession of its physical embodiment).

Consider the following example. I pick a bushel of apples from a tree. In this case, it is easy to identify what it is that I own and to separate it from what is owned by others. I can exclude other people from my apples simply by taking physical possession of them. I can easily break up my possession into units and sell them one at a time.

But if I develop a piece of information, the situation is rather different. Let us imagine that I have written a computer program. It may not be easy to identify exactly what it is that I own, for I may have written it with someone else, and I probably used ideas I had borrowed from other people's programs. I can easily exclude others from it, only if I keep it secret. Once I have divulged it, my ability to exclude others from it has been greatly diminished. If I sell an apple to my neighbor, I do not have to worry about everyone else in the community ending up with apples, thereby destroying the market for the rest of my apples. But if I sell my program to a neighbor, I do have that worry. Very quickly everyone in the community may have the program, and I will be left without a market. Not only is it hard to establish property rights in information, but it is harder still to prevent others from infringing those rights once they are established.

2.3.3 Alleged Widespread Piracy of Information

"Piracy" consists of gaining access to information without the permission of its creator. The majority of--if not virtually everybody in--our society has done something that owners of information would claim violated their intellectual property rights.

If you have done any of the following, you have violated--or have at least purportedly violated--someone's intellectual property rights. If you have taped music, either off records borrowed from friends, from the library, or off radio or T.V., it has been claimed that you are infringing another's intellectual property rights without paying proper compensation (Schrage, 1982). The recording industry attributes much of its recent decline to home taping of music. (Recording Industry Association of America, 1982) If you own a videocassette recorder and have taped T.V. shows in order to watch them at some other time, the movie industry claims you have violated copyright law (Valenti, 1983). There are bills before the current session of Congress which, while exempting home recording from copyright infringement, would insure that the consumer pays more for the taping equipment by requiring its manufacturers to pay a royalty to the movie industry.

If you receive cable or Pay T.V. and are not fully paying for it, you are infringing the rights of T.V. show owners. If you have copied more than one chapter of a book, or two or more articles by the same author, you have exceeded

the copying allowed under the doctrine of fair use. (U.S. House of Representatives, 1976, pp. 68-70) Borrowing another person's copyrighted computer program and using it on your computer is an unauthorized use of that program. (Immel, 1983) If you have ever quit your job with one company and gone to work for another, taking with you and then using specialized information you had learned or developed at the first company, there is a good chance that you have violated trade secret law. Those who have used a substantial number of another's words without proper acknowledgement in footnotes have infringed on the rights of the author who wrote them. One might doubt that there are many of us who live in contemporary U.S. society who have not engaged in at least one of these practices.

Instances of alleged piracy will continue to become more frequent. Advances in technology have exacerbated, and will continue to exacerbate, this problem. New information technologies, which have increased the ability to create and disseminate information, also have made it far easier for users of information to access it without the permission of its creator. In the future, such phenomena as photocopiers in the home and widespread personal-computer access to libraries and data bases will continue to present challenges to our system of intellectual property protection. Technology continues to turn the copyright, patent, and trade secret laws into anachronisms. It continues to call into question the adequacy of our customs concerning rights to nontangible goods.

2.3.4 Recent Legislative Concerns

There has been a good deal of legislative activity on intellectual property rights. Reviewing the legislative history of this subject can give one a good sense for the kind of intellectual property issues that attract enough attention to become questions of national policy.

In 1980, a law was passed that explicitly made computer programs appropriate subject matter for copyright. Public Law 96-517 also allows owners of programs to make an archival copy without infringing copyright. In 1981, Public Law 97-180 was passed. Known as the Piracy and Counterfeiting Amendments Act, it increased penalties for unauthorized mass duplication and selling of records and movies. Last year, Public Law 97-366 exempted veterans and fraternal groups from performance royalty payments to writers and musicians.

In the last session of Congress, numerous bills were introduced that addressed intellectual property rights. H.R. 4727 would have increased penalties for unauthorized reception of subscription telecommunications signals, thus subjecting individuals who own home satellite dishes to significant fines and imprisonment. The perennial bill aimed at establishing performance rights in sound recordings was introduced as H.R. 1805. Song writers have public performance rights that allow them to collect royalties when radio stations (and others) play their songs. Under current law, recording artists have no such rights. This bill would have given those who make records similar public performance rights.

The current 98th session of Congress has also been active in this area. Numerous bills have been introduced dealing with the issues behind the celebrated Sony Betamax case (decided January 17, 1984 by the Supreme Court). Bills H.R. 175 and S. 175 would exempt home tapers of T.V. shows from copyright infringement. Bills H.R. 1030 and S. 31 would also do this, but in addition, they would require manufac turers of video and audio tapes and recorders to compensate copyright owners through payment of a royalty. Questions involved in this issue include: (1) Is home taping of records, audio and video broadcasts, or video cassettes a violation of copyright or is it fair use? Perhaps more to the point, should these activities be considered acceptable or not? (2) What responsibility, if any, do the producers and distributors of video tape recorders have for this activity (if it should be ruled inappropriate)? (3) Should a tax be levied on tapes and recorders, which would go to the producers of the taped material? Wouldn't this be unfair to those who use these items in noninfringing ways? (4) Are there differences between the audio and video industries that could ground a distinction in policy between the two kinds of taping? Since this issue is one of public policy and not simply a legal question, perhaps the administration should take a firm stand on it.

Rental rights bills (H.R. 1027, H.R. 1029, S. 32, and S. 33) would give the right to rent a record or video cassette to the copyright owner. Current law gives this right to the person who owns the record or video cassette. (17 USC 109(a), 1976) The issue here is who should have the rental rights to a copy of a copyrighted work: the owner of the copyright or the owner of the particular copy of the work (the record or video cassette)? The issue arises because the video cassette retail market has been badly hurt by the video cassette rental market (understandably, since a cassette sells for $30-50 and rents for only $5). With

record rental stores springing up around the country, another blow may be inflicted on an already suffering recording industry, as well. It is not clear, however, why there needs to be legislation on this issue. Why couldn't the movie and recording industries sell their products with the stipulation that the rental rights are not being sold and continue to belong to the copyright owner?

Another bill, H.R. 1028, would give copyright protection to semiconductor chips. But this bill addresses only one small (though important) aspect of a major problem concerning the protection of computer-related intellectual property. Although the computer programs were specifically added to the subject matter of Federal copyright law in 1980 (P.L. 96-517), many claim that protection is still inadequate. One problem is that a program that can be legally protected as software (with copyright law) is only doubtfully so protectable when physically embodied in the computer, either as firmware or as hardware. (Apple v. Franklin, 1982; Apple v. Franklin, 1983) Patents are more likely to be the appropriate form of protection for such programs than are copyrights. But patent protection is notoriously difficult to achieve. It may be that computer programs physically embodied in a computer fall between the cracks of laws that protect intellectual property.

Even the ability to copyright computer software may not adequately protect it since copyright involves disclosure and people are then free to use the ideas disclosed (although not their concrete expression). Thus many in the computer industry have taken the route of trade secret to protect their intellectual products. But this method of protection has its own problems both from the perspective of society and the owner. The lack of disclosure can be seen as unfortunate from society's perspective since without disclosure there is no way to build on the achievements of others.

For the owner of the intellectual property, trade secret protection is not completely satisfactory either. It is a well-known fact about the computer industry that employees frequently leave a company in order to join another company or to start their own. When they leave, they often take with them a vast amount of useful and economically valuable information that was supposedly protected by trade secrets.

Given the key role computers will play in our society, it may be an important public policy goal to formulate clear and unambiguous laws for protection of computer-related property. Perhaps support of the Semiconductor Chip Protection Act of 1983 (H.R. 1028) is thus desirable. It may also be in the public interest to increase the penalties for pirating and counterfeiting computer software (see H.R. 6420 of the 97th Congress) as was done for record, tape, and films (P.L. 97-180).

Finally, cable copyright is once again an issue with, H.R. 1388 proposing full copyright liability on local cable companies that import and show distant T.V. signals. As can be seen from this survey, issues concerning intellectual property rights have been an important concern of Congress the last few years. The Copyright Act of 1976 certainly did not settle the issues in this area.

2.3.5 Public Policy Considerations

How should one decide what the appropriate public policies are for intellectual property? The following four considerations are important in evaluating disputes about intellectual property rights.

First Amendment and Intellectual Property Rights

There is a tension between principles underlying public policy concerning this issue. It is the tension between the First Amendment and intellectual property rights. On the one hand, the Constitution requires that we "Promote the Progress of Science and the useful Arts by securing for limited Times to Authors and Inventors the exclusive right to their respective Writings and Discoveries." (U.S. Const. art. I, Sec. 8, Cl 8, 1788) Congress has met this mandate with the patent and copyright statutes. But by giving the creators of information a limited monopoly in its use, we restrict the free flow of information (albeit for the sake of increasing the future flow of information). The copyright and patent monopolies give a power of partial censorship to the owner of intellectual property. On the other hand, the First Amendment to the Constitution declares that, Congress shall make no law abridging the Freedom of Speech or of the Press, thus indicating a strong preference for the free flow of information. Certainly the copyright and patent statutes restrict the freedom of speech and press to some extent.

Thus there are conflicting requirements within our country's political philosophy concerning the free flow of ideas. Public policy concerning intellectual property rights must aim at a delicate balance between the rights of the creators of information to control its use, and rights of the users of information to access it. Policies must not stress the rights of one group to the exclusion of the other.

The Moral Question

It is important to realize that the issue concerning the ownership of information is not only a legal question, but also a moral one. The problem is not simply that our present laws dealing with intellectual property are inadequate. The moral question of who should own a piece of information is often as difficult as the legal question of who does in fact own it. There are not obvious answers to questions about who has the moral rights to own certain information.

Consider the following question: Who should own broadcast music that I receive over my radio and that I am thinking about recording? There are at least five different candidates who could claim--with some legitimacy--that they have moral rights to this music. (1) I have good grounds for claiming rights to it. After all, I received it on a radio that I bought and own. I also had to listen to the commercials and do the work of recording it. (2) The radio station also has a legitimate claim to this music, for they bought the record, played it, and broadcast it over the air. (3) Certainly the musicians who played the music have some rights to it. (4) The record company who recorded, produced, and distributed the album would also seem to have a legitimate claim to this music. (5) We must not forget the song writers, for they wrote the music and the words.

This example shows that from the moral point of view it is often unclear who should have rights to information. Problems concerning intellectual property rights do not just result from inadequate laws for which there are obvious and clear improvements. Not only is it often unclear who does in fact own a piece of information, but it is often unclear who should own a piece of information. Since issues concerning intellectual property rights are not simply matters of law, they should not, for the most part, be decided in the courts. They are issues of public policy which Congress has an obligation to address squarely.

Unique Features of Information

Why are people much more willing to appropriate information without the consent of its owner than they are willing to steal physical goods? Some may answer cynically that people do so simply because they can get away with it. If stealing physical objects were as easy as stealing information with the new technologies, people would do the former just as much as they do the latter.

But there is something deeper here. Unauthorized taking of information does not feel like stealing. The reason is that information is not spatially delimited. Unlike physical objects, one person using information doesn't preclude others from using it as well. Any number of people can use information at the same time. Information is not used up when someone consumes it. Put in the language of economics, the marginal cost of information is zero. Since it costs nothing for others to have information,[10] it does not seem wrong to take it even though so doing may be against the wishes of its owner. (Think of sneaking in to watch a basketball game. It costs no one anything for me to watch it and hence it does not seem so wrong to do it.) Perhaps this is the reason why piracy is so widespread: People do not think it is wrong.

The fact that information is nonexclusive in this way, that the marginal cost of consuming it is zero, is an important factor for public policy with respect to intellectual property. It suggests that the exclusivity features normally associated with private property may not be appropriate with respect to information. If it costs nothing more for everyone to have something than for one person to have it--as is the case with information (leaving aside the cost of distribution)--it seems foolish from a social perspective to give exclusive rights to that good to an individual. Why should only one person enjoy a good when everyone else could also enjoy the same good?

In fact, in our society, private property rights to information are not as exclusive as are private property rights to physical objects. Federal copyright and patent protection for information are contingent on public disclosure. When

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[10] Of course there is an additional communication cost for each extra user. But the cost of the information itself, as opposed to its transmission cost, remains unchanged no matter how many people receive it.

protection is granted, the information is made available for public inspection at the Patent and Copyright offices. Thus our society gives some degree of protection to information creators while insuring that others in society can learn from and build upon these ideas. There may be other ways in which we as a society should also limit the exclusivity of intellectual property rights.

Purpose of Property Rights in Intellectual Matters

Why does society give property rights to information creators? There are two different kinds of reasons usually put forth to justify this practice. The relative importance one places on these alternative rationales for intellectual property rights is likely to affect the concrete decisions one makes concerning policy about such property.

One possible justification for these property rights is that information creators have moral rights to the fruits of their labor. According to this view, intellectual property rights are but the legal acknowledgement of moral rights the creators of information have to their creations. If I make something, I have a moral right to possess it. The law should thus give me a legal property right to it. Call this the "nonconsequential justification." If one holds that this is the primary reason for intellectual property rights, the focus of policy will be on the creators of information. Intellectual property rights are established to legally protect information creator's moral rights to their creations.

The inconsequential justification is to a certain extent implausible. It assumes that no one other than the information creator had any part in creating the intellectual good. But thought does not operate in a vacuum. Intellectual creation is not creation ex nihilo. Ideas are to a large extent the product of a certain time and culture. What I create intellectually or artistically is greatly influenced by my education, the society in which I live, and the world around me. In short, other people play a large role in shaping the intellectual worker's product. Hence there is an important sense in which the fruits of "their" labor are not simply the fruits of <u>their</u> labor alone. The society a creator lives in is a condition of the possibility of his or her creation. The creator thus does not have exclusive moral rights to the intellectual product. The society that nurtured and helped make him or her what he or she is also has some claims on it.

The inconsequential justification conflates the created object which makes a person deserving of a reward with what the reward should be. Intellectual workers who create something socially valuable certainly deserve something for their creative labor. But it is far from clear that what they deserve are property rights in the created product.

The other kind of justification of property rights in intellectual matters is one that is perhaps more often actually used in arguments supporting these property rights. This argument justifies giving property rights to information creators on the grounds that they are necessary as an incentive to stimulate the production of information. Call this the "consequential justification." The argument is that people would not create a desirable amount of information without the economic incentive of receiving property rights to that information. On these grounds, then, the ultimate goal of property rights in information is to encourage the creation and thus the widespread use and dissemination of information. Giving information creators property rights is a means to insure more information for the user. The reasoning behind this justification is somewhat paradoxical. Society gives certain of its members the right to restrict the dissemination of information--which is what a property right in information essentially is--for the purpose of increasing the dissemination of information.

The focus of intellectual property policy justified on this basis is on the benefits to society at large, and on the user of information in particular. Property rights are given to creators only insofar as they achieve the goal of benefitting the users of information. If one thinks this is the only (or primary) justification of property rights in information, then one will extend property rights to creators to the point at which so doing no longer increases the long-run dissemination of information, and no further. One will be suspicious of any extension of property rights which is not clearly needed as an incentive for the production of information.

If this is the only rationale behind intellectual property rights, then any property rights information creators have that are not necessary as incentives will be unjustified. The search for alternative incentives for the creation of information that do not directly constrain its flow (as do property rights) will take on a

good deal of importance.[11] These alternatives will be preferred insofar as they provide equally powerful incentives for the creation of information. For a policy that furthers its own goal without at the same time hindering the goal will, of course, be preferable.

There may be better ways to encourage the production and dissemination of intellectual goods than the method of granting intellectual property rights, giving creators the right to restrict the dissemination and use of information. Public policy should put more effort into finding those incentives for the creation and dissemination of information which are not counterproductive--as are property rights in the created information.

One can see the rationale behind intellectual property rights either as the legal acknowledgement of preexisting moral rights of information creators, or as devices to further the social goal of increased dissemination and use of information. Which of these two the policy maker takes as the fundamental justification behind intellectual property will determine whether it is the information user or creator who will be the focus of intellectual property policy.

It would be hard to overestimate the significance of intellectual property policy for the post-industrial, information-oriented society. Allegations of widespread domestic and international piracy are a symptom of an impending crisis in a system of private intellectual property designed for another era. Congress and the Executive Branch will have to give the courts and society clearer guidance on these matters. Given the new technological era we now are in, a fundamental rethinking and reshaping of our society's policies and customs dealing with intellectual property may be required.

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[11] For example, such incentives could be monetary, or they could involve public recognition and gratitude.

3. CONCLUSIONS

The purpose of this report is not to resolve issues, but to provide an initial introductory step in a project to formulate domestic and international information policy. Nor does the report provide a comprehensive agenda. (For other issues see e.g. Yurow, 1981 and Horton, 1982.) It does, however, suggest a holistic approach to the development of information policy; the assumption being that the synergism created by the new information opportunities is an integral part of the economy and the society.

Intelligence is the unique characteristic of the human being. Information policy is not only concerned with the expanding opportunity to handle the quantity called information, for example through the new telecommunications and computer technologies. but it is concerned with the opportunity for man to explore and extend his intellectual capabilities.

There are many challenges that must be addressed as governments formulate information policy directions. The concentration at the present time is on establishing viable positions in the international marketplace for new information products. In contrast to manufacturing, the development of information services is not so much determined by how nature has distributed natural resources throughout the globe, or even by the cost of labor, but rather the ability of a country to develop its intellectual creativity.

Each nation must resolve information policy issues in terms consistent with its own political philosophy and values. The United States is currently facing a range of seemingly independent information issues at the present time. Education is certainly an important issue, not only for the development of the new technology, but so that the Nation in general will have the opportunity to take advantage of the resultant capabilities and point the direction for market demand. The United States appears to have maintained leadership in critical information technology research. It has, however, had some difficulty in maintaining a price competitive advantage of information oriented goods in the international marketplace.

We are just beginning to examine the issues concerning the character of information itself. Today these are centered on the rights associated with what is called intellectual property--primarily copyright and patents. These include concerns about the domestic and international respect for such protections, and the piracy of comunications signals stimulated by the current ease of reproduction of electronic signals. The tensions that are yet to be resolved include the conflict between the First Amendment freedoms, property rights, and privacy.

In 1968, the United States took a first step in information policy development by setting the stage for opening up communications to meet the diverse information requirements that it was felt would inevitably evolve. (Rostow, 1968) The need for new policies to accommodate new opportunties in the creation of intellectural property was recognized in the 1976 revision to the Copyright Act, and the continual need for modification since then.

The choice exists at this time either to address specific information policy issues in the context in which they arise, or to attempt to set a broader framework for their evaluation, as was done for telecommunications in 1968. In either case, information policy will continue to be an important component in the Nation's economic and social development.

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FORM **NTIA-29**
(4-80)

U.S. DEPARTMENT OF COMMERCE
NAT'L. TELECOMMUNICATIONS AND INFORMATION ADMINISTRATION

BIBLIOGRAPHIC DATA SHEET

	1. PUBLICATION NO.	2. Gov't Accession No.	3. Recipient's Accession No.
	NTIA Report 84-144		

4. TITLE AND SUBTITLE

Policy Implications of Information Technology

5. Publication Date
February 1984

6. Performing Organization Code

7. AUTHOR(S)
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9. Project/Task/Work Unit No.

8. PERFORMING ORGANIZATION NAME AND ADDRESS
U.S. Department of Commerce
NTIA/ITS
325 Broadway
Boulder, CO 80303

10. Contract/Grant No.

11. Sponsoring Organization Name and Address
U.S. Department of Commerce, NTIA

12. Type of Report and Period Covered

13.

14. SUPPLEMENTARY NOTES

15. ABSTRACT *(A 200-word or less factual summary of most significant information. If document includes a significant bibliography or literature survey, mention it here.)*

Today, three-quarters of the U.S. employment and one-half of the Gross National Product (GNP) are associated with services. In 1981, services employment predominated, for the first time, over both agriculture and manufacturing, even in the Third World countries. The increasing importance of services to the economy and the society has been stimulated by the greater availability of information and communications products. This report presents the initial analysis of a project devoted to formulation of national information policy as necessary to accommodate the new opportunities presented by advanced information technologies, and the impact on the economy and society. After defining the meaning of information policy, the report discusses current issues concerning domestic industry growth, maintaining international leadership, and new considerations regarding intellectual property.

16. Key Words *(Alphabetical order, separated by semicolons)*

economic development; education; information policy; intellectual property; international trade; research and development; services economy; telecommunications policy

17. AVAILABILITY STATEMENT

☒ UNLIMITED.

☐ FOR OFFICIAL DISTRIBUTION.

18. Security Class. *(This report)*
Unclassified (U)

20. Number of pages
44

19. Security Class. *(This page)*
Unclassified (U)

21. Price:

☆ U.S. GOVERNMENT PRINTING OFFICE: 1984—778-101/9175 REGION NO. 8