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OF THE

COMMITTEE ON WAYS AND MEANS
U.S. HOUSE OF REPRESENTATIVES

HIGH TECHNOLOGY AND JAPANESE INDUSTRIAL POLICY:
A STRATEGY FOR U.S. POLICYMAKERS



OCTOBER 1, 1980

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Washington, D.C., October, 1, 1980.

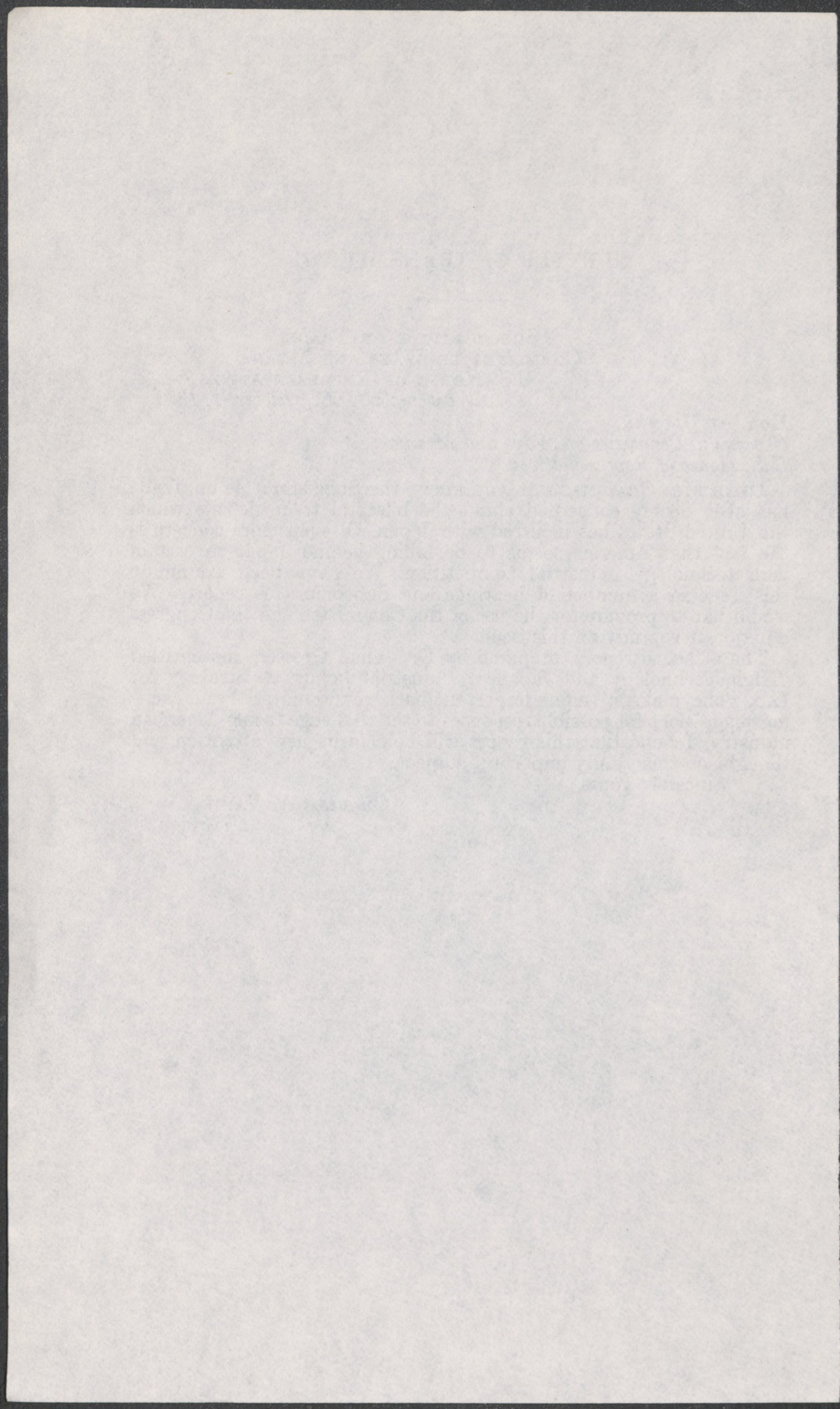
HON. AL ULLMAN,
*Chairman, Committee on Ways and Means,
U.S. House of Representatives.*

DEAR MR. CHAIRMAN: As you know, the Subcommittee on Trade has been deeply concerned about the bilateral trade deficits which the United States has incurred with Japan. Of even more concern is the fact that America seems to be falling behind Japan in certain high technology industrial competition. We have been examining this issue in a number of hearings and Subcommittee reports. We would like to provide for the use of the Committee and the Congress a major, new study on this issue.

The attached report, prepared by Dr. Julian Gresser, and entitled "High Technology and Japanese Industrial Policy: A Strategy for U.S. Policymakers," offers important background material and exciting suggestions for possible responses to the challenge facing American industry. I hope that this report will help focus new attention and thought on this vitally important subject.

Sincerely yours,

CHARLES A. VANIK,
Chairman.



HIGH TECHNOLOGY AND JAPANESE INDUSTRIAL POLICY: A STRATEGY FOR U.S. POLICYMAKERS

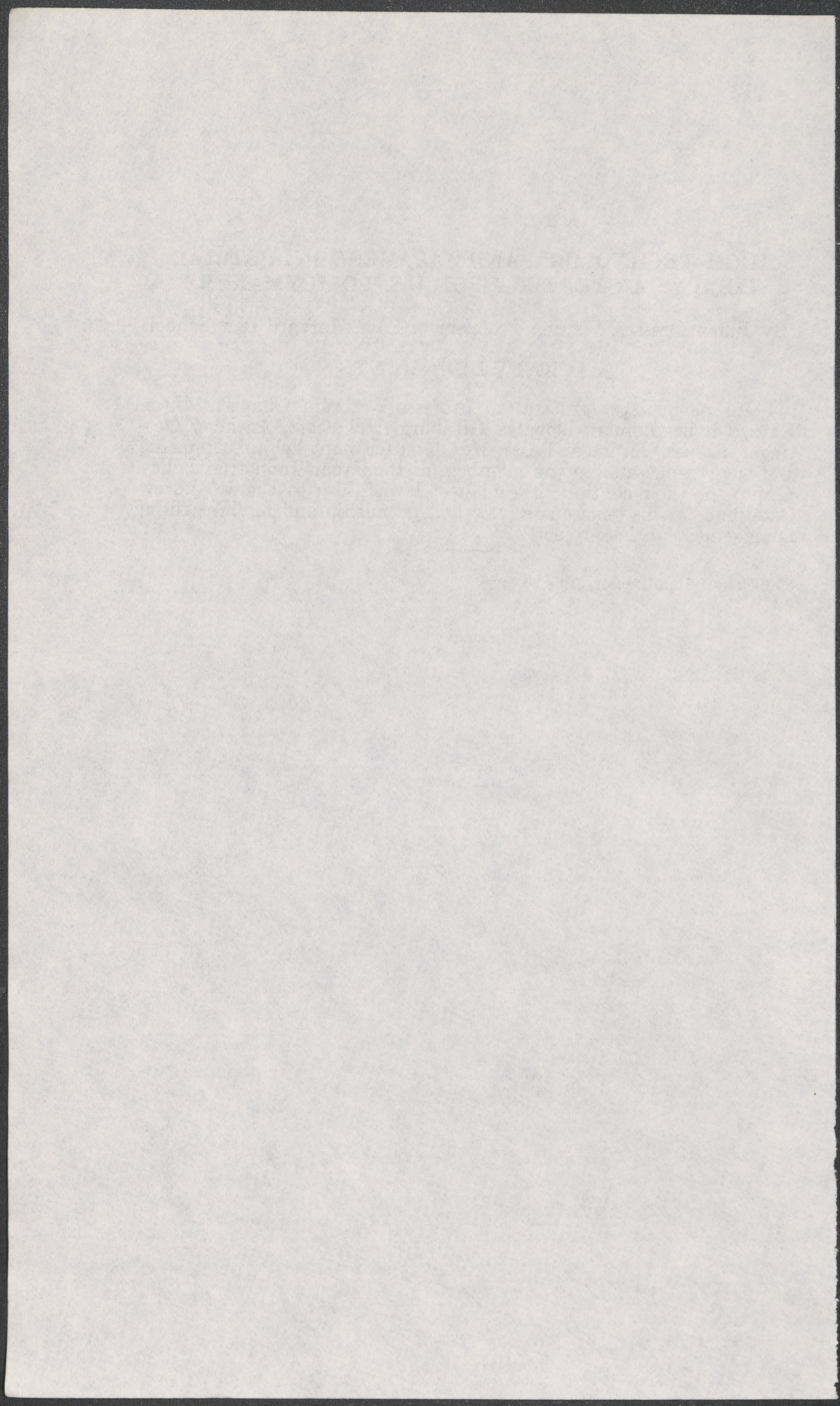
(By Julian Gresser, Visiting Professor of Law, Harvard Law School)

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I am particularly grateful to Professors Abram Chayes, Milton Katz, Oliver Oldman, Douglas Ginsburg, Hal Scott, Anthony Oettinger, Robert Gordon and Alan McAdams for many helpful comments and suggestions and to the members of the Japan Industrial Policy Group for their continuing guidance. I wish also to thank Andrew Osterman for his generous advice and friendship and for his skillful management of this project.

© 1980 by Julian Gresser, June 26, 1980.

(v)



ANTECEDENTS

This study, as perhaps many of its kind, was conceived in the gloom of an emerging crisis. Fortune Magazine had just published its controversial article, "The Japanese Spies in the Silicon Valley" (Fortune, Feb. 27, 1978), which suggested that Japanese and other foreign marauders were stealing the American semiconductor industry's carefully watched secrets. A new and vicious trade war with Japan seemed imminent.

In 1978 and 1979 the Congress held a series of hearings on Government policy and innovation in the semiconductor and computer industry, United States-Japan trade, and related subjects. These hearings led to several important reports: "Trade between Japan and the United States: The Setting, the Current U.S. Position and U.S. Prospects" (Boston Consulting Group Report to Anthony Solomon, Undersecretary of the Treasury, April 1978); "Industrial Technology" (a summary of hearings before the Senate Committee on Commerce, Science, and Transportation, Oct. 30, 1978); a "Report of the Task Force on United States-Japan Trade" (Subcommittee on Trade of the House Ways and Means Committee, Jan. 2, 1979); "The U.S. Semiconductor Industry" (U.S. Department of Commerce, September 1979); "U.S.-Japan Trade: Issues and Problems" (Report by the Comptroller General, Sept. 21, 1979); and "Competitive Factors Influencing World Trade in Integrated Circuits" (a report of the International Trade Commission to the Senate Subcommittee on International Trade of the Committee on Finance and the Subcommittee on International Finance of the Committee on Banking, Housing and Urban Affairs, November 1979). These studies warned that the American semiconductor, computer, and telecommunications industries would soon meet intense competition from foreign, particularly Japanese, firms.

The State Department commissioned this study in January 1979 with two motives. The first motive was to examine the difficulties ahead in semiconductors, computers, and telecommunications from a broader structural and institutional perspective than such trade conflicts usually receive. The second was to use these industries as a case study to establish an analytical framework to address future generations of United States-Japan trade, investment, and technology transfer problems.

In preparing this report the first step was to assemble a team of experts on solid state microelectronics, trade and investment, and United States-Japan relations within the Government to exchange information and ideas on our problem. We called this body the Japan Industrial Policy Group. The group's membership now totals about 40 individuals of diverse backgrounds, skills, experience and interests. It includes the key staff persons from the major Federal agencies and about eight congressional committees and subcommittees. Meetings have been kept informal and the traditional clearance process has been suspended to assure an open and productive dialog. The group has proved an invaluable forum for exploring all aspects of trade and industrial policy.

My report essentially follows the contours of our discussions. Initially we focused on the Japanese semiconductor, computer, and telecommunications industries, but it soon became obvious that these industries now occupy a strategic position in Japan's overall industrial policies. The history of how Japan's industrial future came to be linked with the computer is the subject of Part I.

VIII

We next turned to defining our problem. Initially we focused on the broad range of industrial uses of semiconductors and computers and attempted to assess the infrastructural consequences of increasing foreign, particularly Japanese, competition. Competition in itself did not seem cause for alarm. Almost everyone recognized the substantial benefits to U.S. producers from foreign competition and to American consumers from lower prices, high quality foreign products. Yet we soon found that differences in industrial structure and policy between the United States and Japan are distorting competitive forces. And that existing trade remedies will not correct this distortion. Part II develops our conclusion that the problem demands a new perspective.

At present the group continues to debate the wisdom of an industrial policy for the United States. Some members believe that such a policy would further bloat the Federal bureaucracy and license even greater bungling and intrusion into the market. Others, however, feel the United States can skirt the pitfalls of the past and seize the benefits these policies confer in Japan and other countries. Part III contains the elements of such a policy.

EXECUTIVE SUMMARY

I. JAPAN'S INDUSTRIAL POLICY AND THE DEVELOPMENT OF THE JAPANESE SEMI-CONDUCTOR, COMPUTER, AND TELECOMMUNICATIONS INDUSTRIES

1. All of the major Japanese semiconductor, computer, and telecommunications firms (Nippon Electric, Fujitsu, Hitachi, Toshiba, Mitsubishi Electric, Oki Electric Industry) were established before World War II and in some cases before the 20th century. The key to understanding the Japanese semiconductor, computer, and telecommunications industry is its structure. Each of the major manufacturers is a longstanding member of one or two cohesive, corporate groups or keiretsu that are bound by equity, management, financing, and buying/selling relationships. Other intra-industry linkages are also important such as vertical integration, the pivotal role of the banks in the keiretsu, inter-keiretsu affiliations, and the developing ties between Japanese and foreign firms.

2. The history of the Japanese computer industry in the post-World War II period may be divided into three periods. In the first period (1951-63) the industry received modest governmental attention and grew slowly. In the second period (1964-75) the industry gained increasing strategic importance, received extensive governmental protection and support, and grew rapidly. In the present period, which began with liberalization in 1976, the industry has come to guide Japan's industrial development. Although the government's postliberalization program simply extends the policies of an earlier era, there is now a crucial difference: the semiconductor and computer industry is repositioned to the center of a matrix of new "flagship" industries.

Between 1951 and 1976 Japan fostered the development of the semiconductor, computer, and telecommunications industry principally by: (1) institutional modifications; (2) industry realignment; (3) financial incentives; and (4) market protection.

Institutional modifications included the establishment of a new Machinery and Information Industries Bureau with MITI, new advisory bodies, specialized governmental laboratories and other bodies. Industry realignment and collaboration was facilitated by various amendments to the antitrust laws. Financial incentives included preferential government procurement, credit allocation, and special tax incentives. Foreign penetration of the home market was managed at least until 1976 by tariffs, quotas, registration requirements, merger policy, and administrative guidance over market share and pricing.

3. The preeminent national concern in Japan since the 1950's has been economic security. Although its definition may have changed, government planners have continued to identify economic security with the maintenance of a stable supply of raw materials (particularly energy sources) and access to foreign markets. The concept of economic security is as important to most Japanese as the concept of military (national) security is to most Americans.

Since the 1960's Japan has sought to assure economic security against the exigencies of an uncertain, hostile world by structural transformation. This policy has involved strengthening depressed or declining industries, expanding mature industries, and nourishing inchoate, promising industries. In the 1960's and early 1970's steel and automobiles commanded governmental attention. Today higher value-added, knowledge-intensive industries like electronics dominate. This process links the future of Japanese economic security to the computer.

Japan's industrial policies for the 1980's coincide exactly with the computer industry's coming of age. Since many Japanese computer and semiconductor products match or surpass their foreign competitors, there is no longer need for the formal regulatory controls that preceded liberalization. Market forces will prevent foreign domination of the home market and should permit Japan's acquisition of a larger world market share.

In the 1980's Japan will continue to develop a host of new industries such as aircraft and aerospace, telecommunications, robotics, ocean resources, nuclear and other forms of energy, and biological engineering. The computer increasingly will determine the design, manufacture, and operation of these industries and will improve efficiency by eliminating excess labor and reducing costs. These vanguard industries will soon establish Japan's preeminence in the changing international economic order.

II. THE PROBLEM

1. Our present piecemeal, uncoordinated approach will not meet the challenge presented by foreign competition in high technology, particularly semiconductors, computers, and telecommunications. Although there is no evidence in this writer's opinion that a foreign takeover is imminent, current trends in trade and investment bear watching. A new perspective is required.

2. The present piecemeal approach is inadequate because of: (a) the peculiar infrastructural importance of semiconductor, computer, and telecommunications technology. The influence of the industries may be compared with that of the German dyestuffs industry in the 19th century; (b) the prevalence of forward pricing and second sourcing that deny entrepreneurs part of the benefits of their innovations; (c) the military applications of semiconductors, computers, and telecommunications, and the probability that foreign firms (and their governments) may deny the United States state of the art technology.

3. Statistics on international trade and investment suggest: (1) Japanese and other foreign firms are gradually penetrating the U.S. market, while U.S. firms are losing market share in the international, particularly the Japanese market. In interpreting this trend, we should consider the increasing costs of productive equipment, the present financial difficulties of many smaller semiconductor firms, the difficulties of recruiting able and experienced electrical engineers, the financial leverage enjoyed by foreign firms, the vertical integration of the Japanese industry and, the recent acquisition by Japanese firms of approximately 42 percent of the bellwether 16K RAM market.

4. Existing legal remedies for foreign trade barriers and unfair competition under the new MTN codes, existing treaties, Japanese and U.S. law are inadequate, although the U.S. industry has to date failed to fully exploit its existing legal options.

III. A STRATEGY FOR U.S. POLICYMAKERS

1. The United States can best respond to the problems identified in Part II by constructing a new approach to American industry. The strategy should include:

a. A program to enhance the productivity and international competitiveness of high technology industries, to begin with semiconductors, computers, and telecommunications and to be expanded to other industries where the United States has, or is expected to have, a competitive advantage. This program would involve:

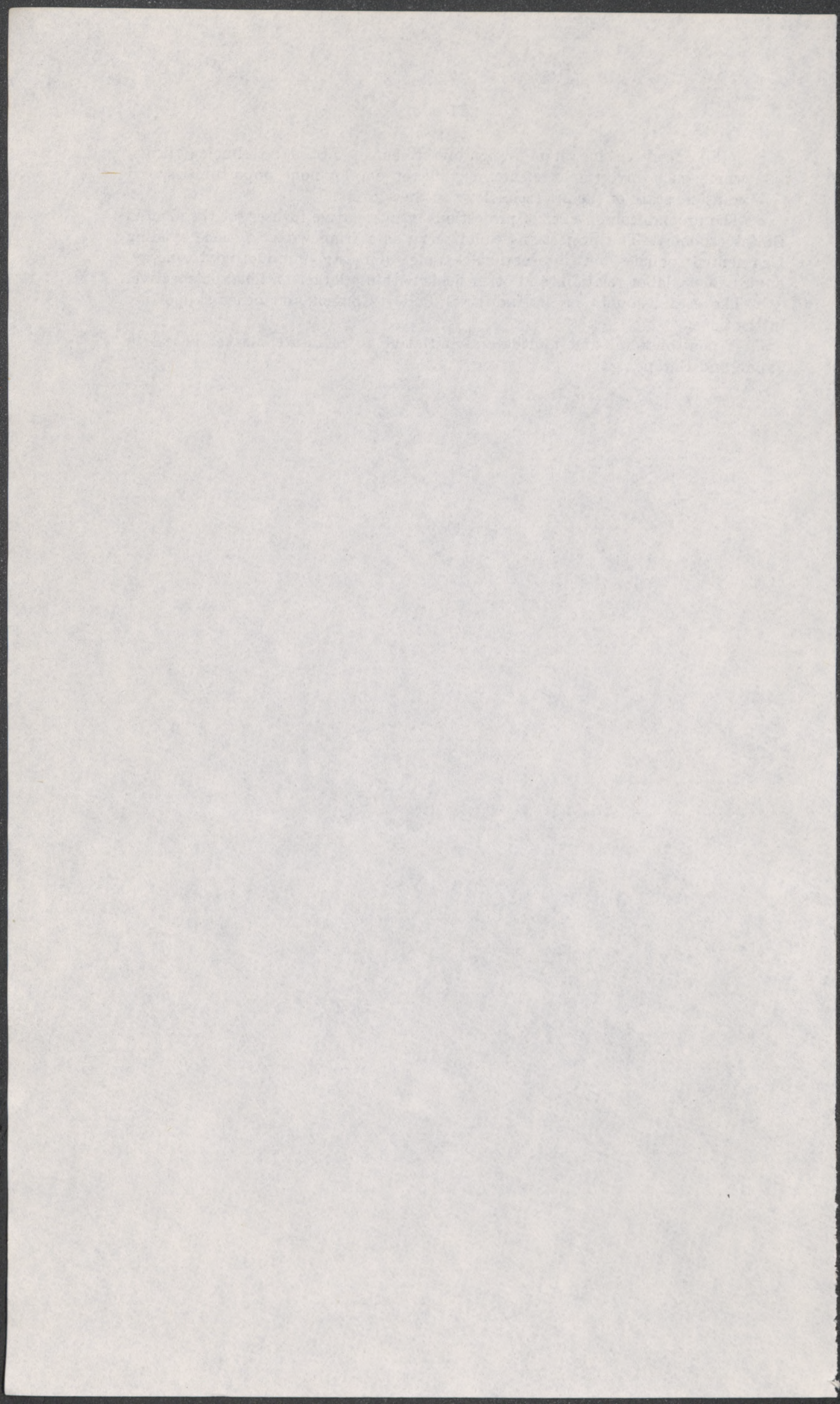
- (i) limited Federal contracts for research on generic technology;
- (ii) removal of various export disincentives;

(iii) incentives for direct foreign investment in U.S. high technology firms, where such investment creates significant employment opportunities and transfers state of the art technology to these firms.

b. The preparation of a set of projections of alternative futures for the United States economy. The projections could serve as a framework to place existing fragmented policies on international trade, domestic productivity, energy, environment, labor relations and other fields within a larger national perspective.

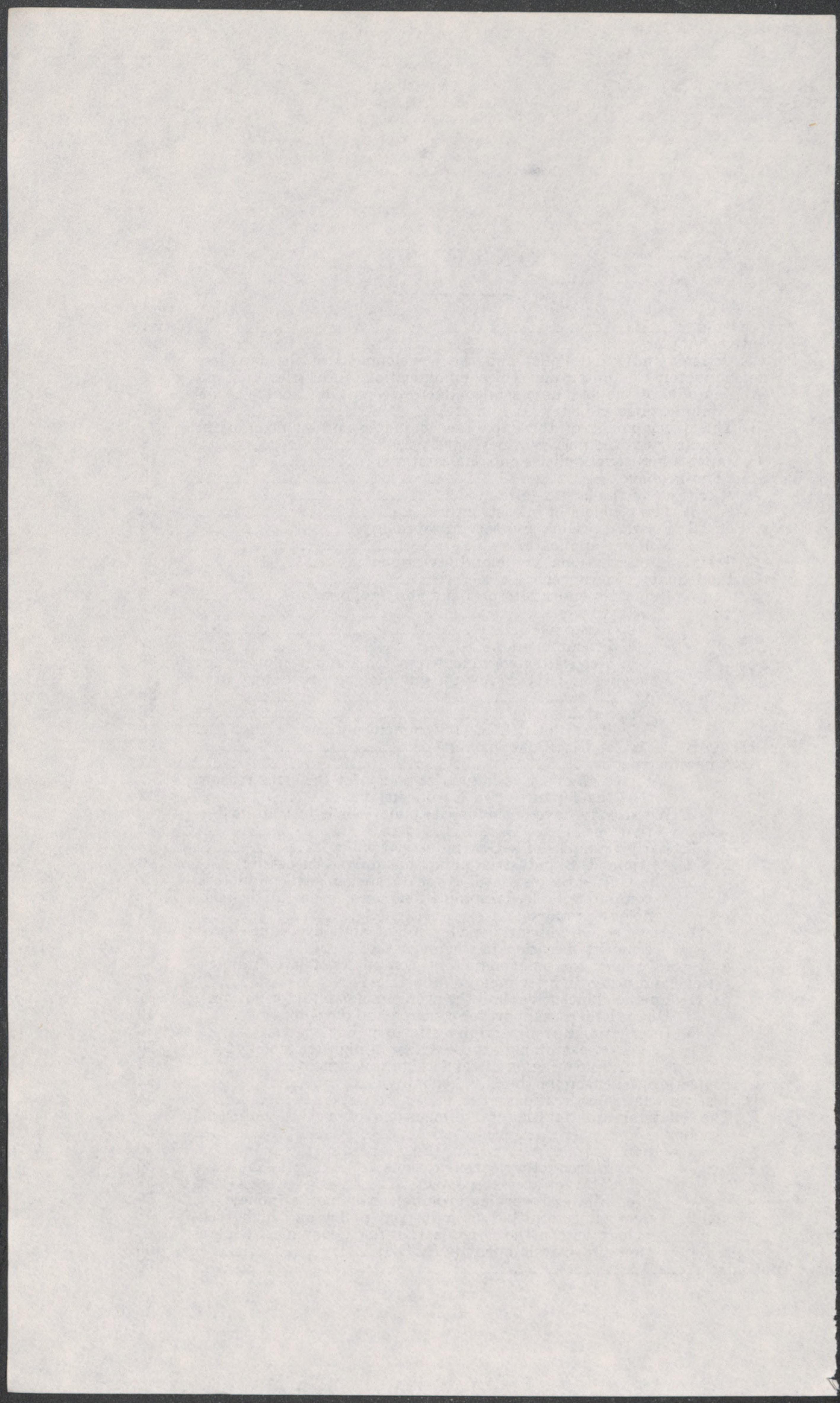
c. The establishment of an Industrial Policy Council and other supporting institutions.

d. A new bilateral and multilateral initiative to facilitate market access in Japan and Europe.



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Part I: Japan's Industrial Policy and the Development of the Japanese Semiconductor, Computer, and Telecommunications Industry

A. A PROFILE OF THE JAPANESE SEMICONDUCTOR, COMPUTER, TELECOMMUNICATIONS INDUSTRY (1)

The Japanese semiconductor, computer, and telecommunications industry is dominated by six firms (2) all of whom were established before World War II. Over the past 80 years the largest Japanese manufacturer for satellite communications, earth stations, and microwave communication equipment has been the Nippon Electric Co., Ltd. (NEC). Established on July 17, 1899, as a joint venture between Western Electric of the United States and Nichiden Shokai, a trading company, NEC was renamed the Sumitomo Communications Industry Co. in 1932 and has since been closely associated with the Sumitomo group. In 1977 NEC was the world's third largest manufacturer of semiconductors. Although in the early 1960's NEC was also Japan's preeminent computer manufacturer, recently its computer division has been the least profitable.

Fujitsu, Ltd., began as the telephone division of Fuji Electric (a joint venture of Furukawa Electric and Siemens). From 1935 to 1960 Fujitsu remained a small communications equipment manufacturer and supplied most of its products to the Nippon Telegraph & Telephone Public Corp. (NTT). In the early 1960's Fujitsu began an intensive program of computer R. & D. and today Fujitsu is Japan's leading computer manufacturer. A principal purchaser of Fujitsu's communications equipment is NTT. Since 1975 Fujitsu has also increased its investment in semiconductor production, focusing on LSI equipment for computers and communications equipment.

Hitachi, Ltd., began in 1910 as an electrical equipment repair shop for the Hitachi Mining Co., from which it was separated in 1920. During the Great Depression of 1929 the firm secured financial support from the Nissan Group with whom it has since retained close business relations. Hitachi's hallmark is its diversity, technological versatility, and independence. The company conducts comprehensive R. & D. for its various divisions, which include electronics (computers, IC's, communication equipment, measurement instruments), heavy electrical machinery, household electrical appliances, industrial machinery, nuclear power and transportation equipment. Today Hitachi is Japan's third largest company after Nippon Steel and Toyota and is the nucleus of its own conglomerate (keiretsu), the Hitachi Group.

Toshiba Corp., was established in 1879 as Tanaka Seisakusho, Japan's first telegraph equipment manufacturer. In 1893 it obtained the financial backing of the Mitsui Bank and has since remained a member of the Mitsui Group. In 1978 Toshiba was the second largest manufacturer of heavy electrical machinery (after Hitachi) and ranked

See references at p. 23.

first in nuclear power, steam and hydraulic power, fluorescent lamps, and medical instruments. Although recently the company's sales of large computers and semiconductor products have been less profitable, Toshiba ranked second in 1977 after Mitsubishi Electric in cumulative shipments of small systems.

Mitsubishi Electric Corp. began in 1910 as the electrical machinery plant of Mitsubishi Shipbuilding, a precursor of Mitsubishi Heavy Industries. Mitsubishi Electric Corp. was formed in 1921 as part of the Mitsubishi Group, an agglomerate of 11 major Mitsubishi companies. Mitsubishi Electric was the last of the six major firms to enter the computer field. It is reported to lead Japan in the manufacture of small office computers.

Oki Electric Industry Co. Ltd. (Oki), began in 1881 as a telephone equipment manufacturer and has continued as one of Japan's three major communication equipment companies. Like NEC and Fujitsu, Oki has enjoyed the consistent support of NTT. Since the mid-1970's Oki's computer sales have fallen off, and in October 1978 Oki announced that it would close its major plant in Tokyo in an effort to reverse a 2-year deficit.

The Nippon Telegraph & Telephone Public Corp. (NTT) is a government-owned corporation established in 1952 under the jurisdiction of the Ministry of Posts and Telecommunications (MPT). The budget, services, tariffs and overall policies, as well as the appointment of its top officials, are subject to the review and approval of the Japanese Government. NTT holds a legal monopoly over Japan's domestic telephone, telegraph, and data communications lines and switching networks. NTT designs its own equipment which is built to its specifications, usually by its major contractors, Fujitsu, Hitachi, and Oki. In Japan fiscal year (JFY) 1978 NTT spent ¥62 billion and in JFY 1979 approximately ¥70.2 billion on research and development, or about 2 percent of its revenues. NTT maintains three electronics communications laboratories (ECL) for research on computers, VLSI's optical fiber cable communications, and other advanced technologies.

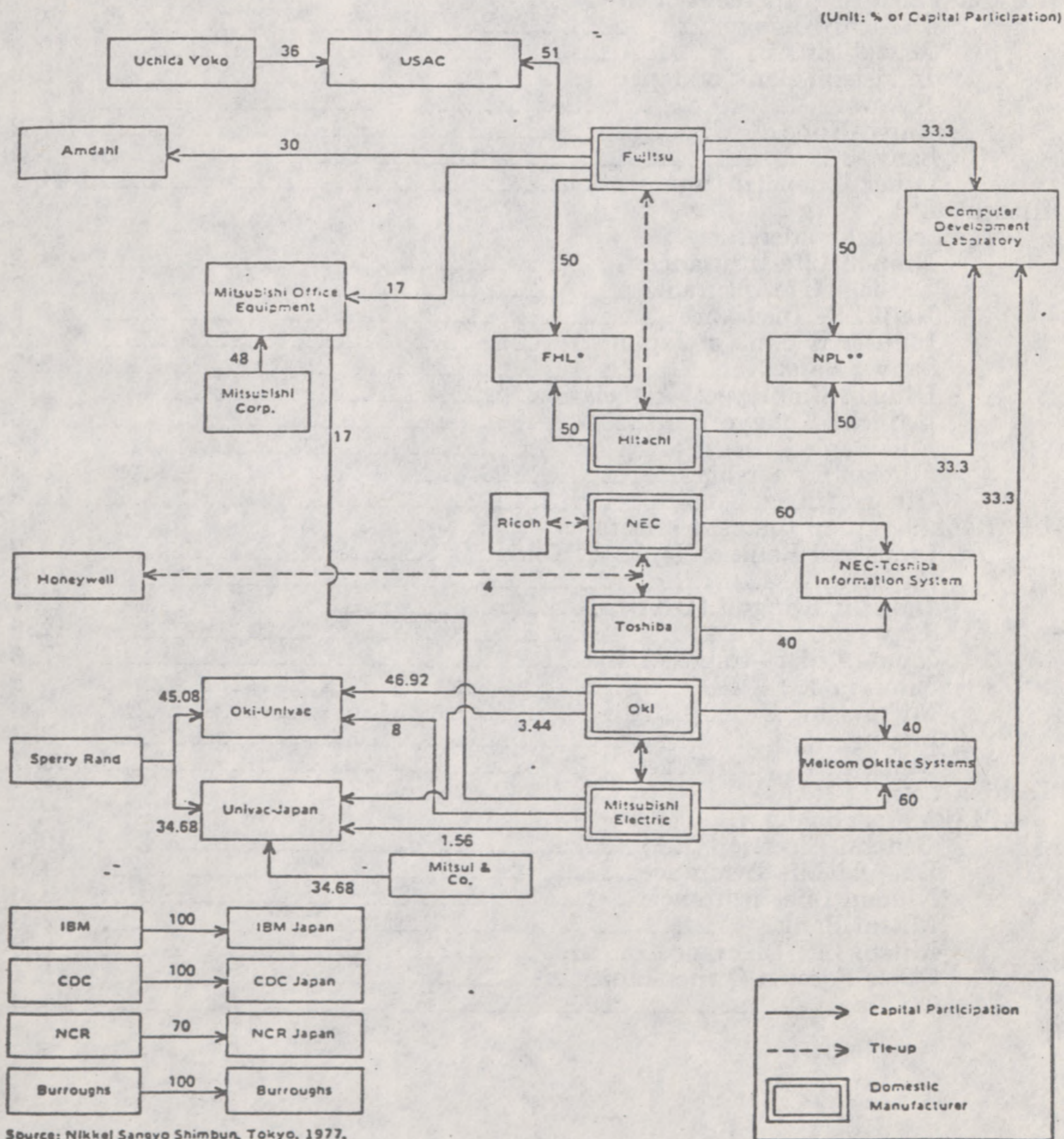
The key to understanding the Japanese semiconductor, computer, and telecommunications industry is its structure. As noted, each of the major manufacturers is a longstanding member of one or two cohesive "corporate groups" (keiretsu) that are bound by equity, management, financing, and buying/selling relationships. For example, NEC belongs to the Sumitomo group and is largely dependent on Sumitomo for its loans. NEC also has its own group consisting of 142 companies that generated total revenues of ¥700 billion in JFY 1976. Fujitsu belongs to the Furukawa group, which in turn belongs to the Dai-Ichi Kangyō Bank (DKB) group. Hitachi leads its own independent keiretsu. In JFY 1977 the Hitachi keiretsu consisted of 40 consolidated subsidiaries (with Hitachi holding over 50 percent equity) and 434 nonconsolidated subsidiaries (with Hitachi holding 20 to 50 percent equity). The Toshiba keiretsu consists of 37 consolidated subsidiaries plus hundreds of affiliated subsidiaries and subcontractors. Mitsubishi Electric belongs to the Mitsubishi group and depends on the group for its financing, while Oki belongs to the Fuji Bank (or Fuyō) group. NTT heads its own keiretsu called the "Denden group." NTT has a close working relationship with NEC, Fujitsu, Oki, and Hitachi. As of 1978, the president and one director of Oki, two directors of Fujitsu, one director of NEC and Hitachi, and a

number of directors of their subsidiaries, were all former NTT executives. In 1977 the four major suppliers filled nearly 70 percent of the NTT requirements for communications equipment.

In many cases the keiretsu creates business opportunities for its members. In the mid-1960's the Dai-ichi Bank (before its merger with the Kangyō Bank) replaced its IBM online banking system with a Fujitsu product. Hitachi introduced its HITAC system at the Sanwa Bank and the Industrial Bank of Japan. The Sumitomo group favors NEC customers and Oki sells huge quantities of terminals to the Fuji Bank.

It is important to understand the influence of the banks in the keiretsu. Chart 1 indicates the relationship of the six major computer companies, and Table 1 lists each company's major stockholders and principal supporting banks in 1978. Unlike some other industrialized countries, Japanese banks often encourage rather than restrain a client company's initiative.

CHART 1.—Relations between Japanese computer manufacturers



From: "The Japanese Semiconductor Industry: An Overview" BA Asia Ltd. Consulting Group (1979).

TABLE 1.—Major stockholders and banking groups of six major computer companies as of 1978

	<i>Percent</i>
Nippon Electric Co., Ltd.:	
Major stockholders:	
Sumitomo Life Insurance.....	9.5
Sumitomo Bank.....	6.9
Nippon Life Insurance.....	3.9
Sumitomo Marine & Fire Insurance.....	3.9
Sumitomo Electric Ind.....	3.7
Foreign Ownership.....	2.0
Other.....	70.1
Fujitsu, Ltd.:	
Major stockholders:	
Fuji Electric.....	22.6
Asahi Life Insurance.....	9.9
Dai-ichi Kangyo Bank (DKB).....	9.5
Industrial Bank of Japan.....	3.6
Fuji Real Estate.....	2.6
Toyo Trust & Banking.....	2.1
Foreign Ownership.....	3.0
Others.....	46.7
Banking group (percent of total):	
Dai-ichi Kangyo.....	15.4
Mitsubishi.....	10.6
Industrial Bank of Japan.....	8.9
Kyowa.....	7.3
Taiyo-Kobe.....	7.2
Sanwa.....	6.5
Other Financial Organizations.....	44.1
Hitachi, Ltd.:	
Major stockholders:	
Nippon Life Insurance.....	4.2
Dai-ichi Life Insurance.....	2.7
Neiji Life Insurance.....	2.6
Industrial Bank of Japan.....	2.3
Sanwa Bank.....	2.2
Hitachi Employees' Association.....	2.1
Dai-ichi Kangyo Bank.....	1.9
Fuji Bank.....	1.9
Foreign Ownership.....	8.8
Others.....	71.3
Banking group (percent of total):	
Industrial Bank of Japan ("Kohgin").....	13.2
Fuji.....	13.1
Dai-ichi Kangyo (DKB).....	12.7
Sanwa.....	12.6
Japan Export-Import Bank.....	7.6
Sumitomo.....	5.5
Mitsubishi.....	5.3
Mitsui.....	3.3
Others.....	26.7
Toshiba Corp.:	
Major stockholders:	
General Electric (U.S.).....	10.6
Dai-ichi Life Insurance.....	4.9
Nippon Life Insurance.....	3.6
Mitsui Bank.....	2.3
Mitsui Life Insurance.....	2.0
Other Foreign Ownership.....	11.4
Others.....	65.2

TABLE 1.—Major stockholders and banking groups of six major computer companies as of 1978—Continued

Oki Electric Industry, Co., Ltd.:	
Major stockholders:	
Yasuda Life Insurance.....	9.0
Fuji Bank.....	8.7
Meiji Life Insurance.....	8.0
Dai-ichi Life Insurance.....	8.0
Yasuda Fire & Marine Insurance.....	3.4
Yasuda Trust & Banking Corp.....	2.2
Foreign Ownership.....	0.6
Others.....	60.1
Mitsubishi Electric Corp.:	
Major stockholders:	
Meiji Life Insurance.....	5.3
Nippon Life Insurance.....	4.7
Mitsubishi Bank.....	3.4
Westinghouse Investment.....	3.3
Mitsui Trust & Banking Corp.....	3.1
Dai-ichi Life Insurance.....	2.5
Mitsubishi Heavy Industries.....	2.5
Mitsubishi Corporation.....	1.7
Other Foreign Ownership.....	5.4
Others.....	68.1

The bank's behavior is influenced by four factors. First, the major banks compete to secure a steady, expanding outlet for depositors' funds. Competition is particularly intense because of the strong propensity to save in Japan and the Japanese investor's preference for savings deposits over stocks or other securities. Second, Japanese companies are heavily leveraged, which perpetuates their dependence on borrowed money to meet their financial needs. Third, because the banks in Japan are closely regulated by the government, expanding the volume of lending is the most viable course of revenue growth. The banks tend to select high growth companies, preferably firms belonging to a designated priority industry, which will benefit from tax and other privileges. Fourth, equity money is twice as expensive as borrowed money at the present corporate tax rate (about 50 percent). Since dividend payments are counted as profits, while interest payments can be deducted as expenses, many companies favor debt over equity. Equity financing is also less attractive because Japanese companies issue new stock to existing stockholders at par value rather than at its market price.

The pivotal position of the banks and the interlocking directorates of the major companies within the keiretsu have tended to dwarf the influences of the individual Japanese stockholder in recent years. The dominance of the corporate shareholder in large part explains why the stockholder in many of the large Japanese companies tolerate low profits to equity ratios for long periods.

Other intra-industry linkages are also important. One is vertical integration. For example, most of the major computer firms include semiconductor and telecommunications divisions. This has permitted computer and communications technology to be developed in tandem in design, digitalization, and solid state conversion (3). By contrast,

the precursors of the major computer manufacturers in the United States and Europe were mostly business machine companies, which only later evolved into computer companies.

Each of the major computer companies has also launched cooperative ventures with one or more of the other principal firms, and there are numerous affiliations between their respective keiretsu. For example, in May 1974 NEC formed NEC-Toshiba Information Systems (NTIS) to coordinate marketing and servicing of ACOS systems. The entity was capitalized at ¥1 billion with NEC holding 60 percent equity and Toshiba 40 percent. In April 1976, NTIS's articles of incorporation were amended to emphasize super LSI development and a super LSI research lab was established within NTIS. In June 1974 Fujitsu and Hitachi established ACOM-HITAC, a new 50-50 venture to coordinate marketing; Panfacom Ltd., another joint venture of Fujitsu and the Matsushita Group, provided mini and micro computers to the company's six stockholders (Fujitsu, Fuji Electric, Fuji, FACOM Corp., Matsushita Communications Industrial, Matsushita Electric, Matsushita Communications Systems) and to end users. In 1975 Fujitsu, Hitachi, and Mitsubishi Electric also established a joint venture company, Computer Development Industries, Ltd., to perform R. & D. on super LSI and the next generation computer prototypes.

Recently the Japanese industry has expanded its operations and linkages with foreign companies in the industrialized and developing world. Chart 2 describes the principal relationships between Japanese and foreign manufacturers as of December 1978.

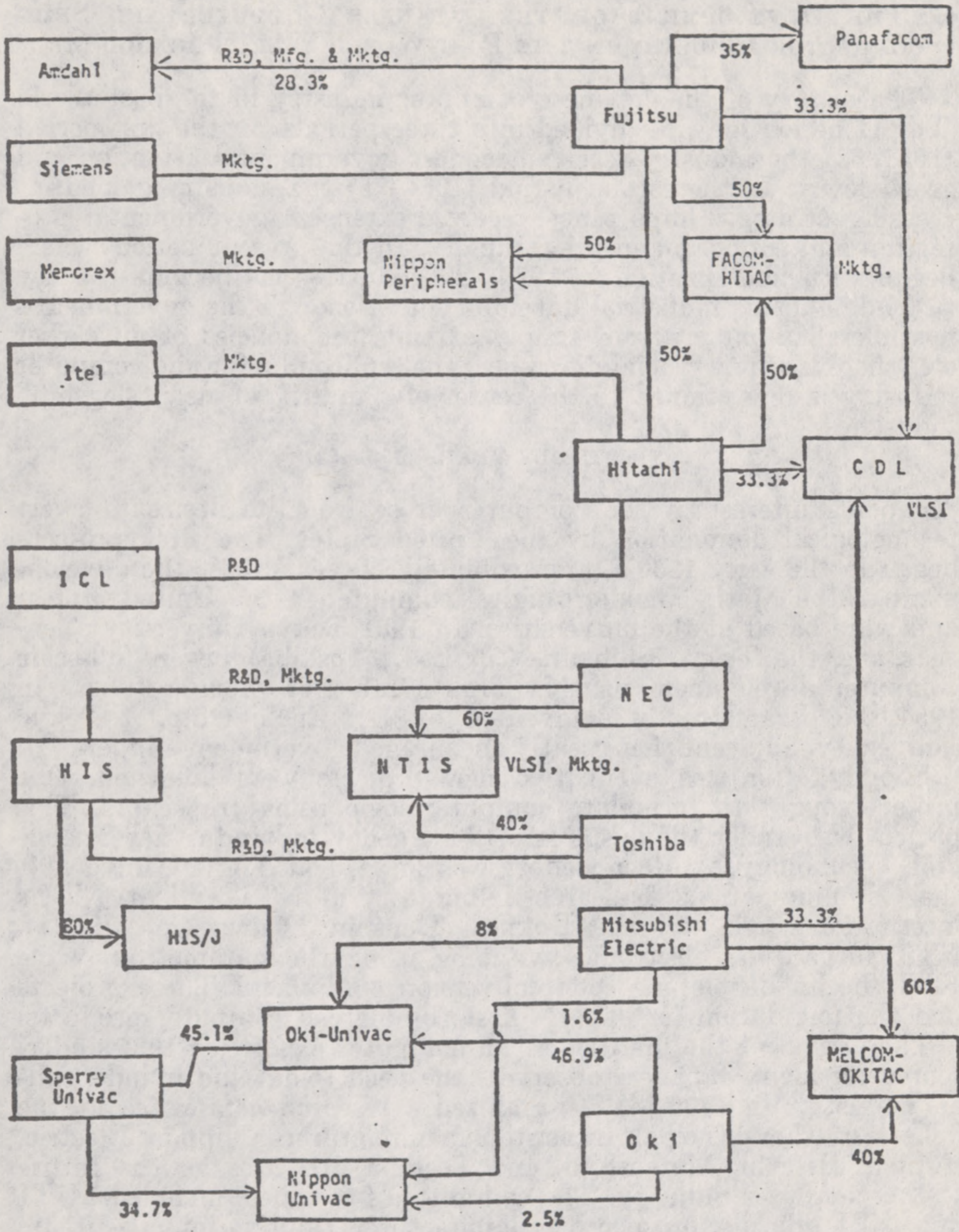


CHART 2.—Relationship between the major Japanese and foreign manufacturers

B. THE DEVELOPMENT OF THE JAPANESE COMPUTER AND SEMI-CONDUCTOR INDUSTRY IN THE POST-WORLD WAR II PERIOD (4)

The history of the Japanese computer industry in the post-World War II period may be divided into three periods. In the first period (1951-63) the industry received modest governmental attention and grew slowly. In the second period (1964-75) the industry gained increasing strategic importance, received extensive governmental protection and support, and grew rapidly. In the present period, which began with liberalization in 1976, the industry has become the key to guide Japan's industrial development. Although the government's postliberalization program simply extends the policies of an earlier era, there is now a crucial difference: the semiconductor and computer industry is repositioned to the center of a matrix of new "flagship" industries.

THE EARLY YEARS (1951-63)

Japan's interest in the computer arose from its desire to avert technological domination by the United States. The first projects began in the early 1950's (approximately 10 years after the development of the Mark I modern digital computer in the United States) and were based at the universities. In 1951 Tokyo University scientists and the Tokyo Shibaura Co. Ltd. (Toshiba) began full-scale computer development using a large number of vacuum tubes. In 1954 the parametron was invented by Dr. Eiichi Goto of Tokyo University, an event that greatly encouraged government support (5).

Shortly after this event two new projects were launched. One project sought to formulate computer logic using transistors. This project was under the auspices of the Agency for Industrial Science and Technology. A second effort was located at Tokyo University, the Communications Research Laboratory at NTT and at NTT's international affiliate, the Kokusai Denshin Denwa Co. (KDD). NTT focused on electronic switching using the parametron, while KDD began developing code conversion equipment. These projects laid the foundation for Japan's first commercial computer products.

The arrival of the first American computer exports in 1954 underscored for many Japanese observers the need to develop an independent industry. In 1955 MITI organized a research committee at the behest of the principal transistor manufacturers (Nippon Electric, Fujitsu, Hitachi, Matsushita, and Toshiba), to consider the future of the computer industry. The committee's members included MITI and NTT officials, prospective manufacturers, and various scientists; and its budget for the first year was \$2,200 (6). The committee's conclusions sketched the course of future policy: industrial growth should be encouraged; foreign technology should be acquired; and imports of computers should be limited.

Implementation of these objectives soon began. The Electronics Industry Provisional Development Act of 1957 authorized: direct subsidies for the research and development of promising technology; loans to products just entering commercial production; accelerated tax depreciation on plant and equipment and a special tax credit for research and development; selective exemptions from the antitrust laws to permit cartels for the control and allocation of raw materials, production, and joint research (7). A new electronics industry division

was established within MITI's Heavy Industry Bureau, and an Electronics Industry Deliberation Council was created to serve as a liaison with the industry.

Although the government's program was principally under MITI's jurisdiction, MITI did not attempt to regulate directly; instead, market forces, lubricated by government support, were to drive the industry's development. Moreover, the total subsidies awarded the computer industry during 1957-61 were extremely modest (approximately \$1 million). One commentator notes that total subsidies, tax savings, and loans from the Japan Development Bank (a long-term credit institution under the jurisdiction of the Ministry of Finance) were less than \$25 million (8).

The period 1957-60 marks the introduction of the first commercial Japanese computer projects. In 1957 both NEC and Hitachi began marketing a series of small business computers using the parametron (known as the NEAC-1200 and HIPAC-1 series, respectively). In 1958 NEC and Hitachi introduced refinements of these models at the first International Information Processing Conference (AUTOMAS) held in Paris under the auspices of UNESCO. These machines may have been the world's first commercial computers that used transistors (9). Not long after, however, IBM introduced its IBM-1401 model, which launched the second generation of computers.

Despite their progress, many Japanese industry leaders still feared a foreign takeover. By 1960, foreign imports claimed 70 percent of the Japanese digital computer market, and IBM (to a lesser extent Sperry Rand) controlled the basic patents to electronic data processing equipment. IBM, it was felt, would unduly influence the development of Japan's computer industry. To repel this threat the Japanese Government raised the basic tariff rate from 15 percent to 25 (10), toughened allocations of foreign exchange for imported computers, and inaugurated vigorous buy-Japan procurement policies. MITI conditioned IBM's right to manufacture in Japan and remit profits on the company's agreement to license its basic patents to all interested Japanese manufacturers.

Financing remained a problem. Although the six domestic manufacturers enjoyed easy access to commercial credit and a special tax exemption for "strategic industries," the development of the computer was an expensive and risky undertaking. MITI encouraged the industry to pool its resources. The FONTAC project, sponsored by the Agency for Industrial Science and Technology, served as a prototype for later efforts. Fujitsu took responsibility for software; and Oki and Nippon Electric shared the burden of hardware development. The project lasted 3 years.

In 1961 MITI also persuaded the industry to establish a \$3 million joint venture called the Japan Electronics Computer Corp. (JECC). The corporation was financed by private industry and by loans from the Japan Development Bank. JECC purchased computers from the manufacturers and rented these computers to end-users; the manufacturers agreed to repurchase obsolete equipment. Losses resulting from the repurchase of obsolete equipment could then be partially set off against a special tax reserve fund (11).

The establishment of JECC gave substantial relief to the Japanese industry, particularly in the early years. IBM and the other foreign firms had been renting their machines at one-fortieth to one-sixtieth of

the purchase price (including maintenance costs) per month, and this practice had enticed many Japanese firms to purchase foreign machines. JECC thus served two functions. It met the financial needs of its Japanese members and it discouraged foreign competition. IBM and other foreign manufacturers were excluded from JECC (indeed, many firms like IBM did not need to participate) and more important, Japanese systems containing more than an established percentage (approximately 25 percent) of foreign-made components were made ineligible for JECC financing.

THE RISE OF THE INFORMATION INDUSTRY (1964-75)

In 1964 IBM introduced its new System 360, which was acclaimed as the third generation of computers. IBM's announcement coincided more or less with General Electric's acquisition in Europe of the largest French manufacturer, Machines Bull. These events showed Japan's Government and business leaders that, despite their efforts, Japan was falling farther behind.

The Government's first action was to request the Electronic Industry Deliberation Council, an advisory body to MITI, to prepare a report that set forth the basic elements of the response required: achieve independent technological excellence, increase domestic market share, expand government industry cooperation, initiate development of a "super" computer, strengthen JECC, rationalize production of peripheral equipment, and educate new technicians. Most of these goals were later accomplished.

Institutional change was also needed. MITI established a data analysis center within its bureau for intelligence and policy, and organized a subcommittee on the information industry in the Industrial Structure Deliberation Council. The six computer manufacturers and JECC were also encouraged to establish a private institute, the Japan Information Processing Development Center, and in 1965 the Japan Federation of Economic Organizations (Keidanren) formed its own computer policy review committee.

Between 1966 and 1975 the government worked closely with the industry to develop "target" technologies. One important effort (1966-71) was the development of a "super/high performance" computer. The project was under MITI's Electro-Technical Laboratory (ETL) and cost ¥10 billion. The participating companies divided responsibilities: Hitachi (prime contractor), Fujitsu and NEC took computer main frames; Toshiba, Oki, and Mitsubishi had responsibility for optical character recognition (OCR)(12), kanji display and graphic cathode ray tubes (CRT) displays(13); Hitachi and Fujitsu developed disk drives(14); NEC and Hitachi developed computer language compilers(15), operating systems, and utility programs; Tokyo University began researching high speed logic circuits.

A second effort was the NTT (Dendenkōsha) Information Processing System (DIPS) project initiated in 1968 by NTT in collaboration with Fujitsu, Hitachi, and NEC. The purpose of the project was to connect large scale online (time sharing) computer systems to electronic exchange and transmission systems. In 1973 NTT announced that the project had developed a model with three times the power of other existing Japanese systems (16).

The ¥35 billion PIPS (Pattern Information Processing System) project (1971-80) continued the work of the earlier super high speed performance project. PIPS was charged with developing a "fourth generation pattern information" system that could recognize Japanese characters, three dimensional objects, and human speech. The DIPS, PIPS, and super computer program contributed to closing the gap with IBM in hardware (17).

Although hardware remained the most important priority during the 1960's, MITI also recognized a need to perfect software and train personnel. In 1970 the Information Technology Promotion Agency was organized to marshal \$720 million through the government's and manufacturers' financial investment and loan program. The majority of the agency's funds were used to guarantee loans to private software companies and the remainder to develop and diffuse advanced software. During this period a new research center, the Information Technology Institute, was established within the Japan Information Processing Development Center. The Institute inaugurated regional programs to train systems analysts, senior programmers and other specialists. These efforts contributed directly to the rise of the Japanese software industry during the 1970's (18).

Although the government gave priority to the development of the computer industry, semiconductors also became increasingly important after 1960. Government policies toward the semiconductor industry were from the outset linked to the computer because the major computer manufacturers were also the major semiconductor producers. In semiconductors MITI's overriding objective was to limit foreign competition and acquire foreign know-how and technology. From the start the government discouraged foreign purchases of stock in Japanese semiconductor firms, rejected all foreign requests to establish wholly-owned manufacturing subsidiaries and joint ventures with over 50 percent foreign equity, and discouraged foreign purchases of stocks in Japanese semiconductor firms.

A well-known case was Texas Instrument's effort to form a wholly-owned manufacturing outlet in Japan. After years of negotiations, Texas Instruments at last reached a settlement with the Japanese Government. In exchange for MITI's permission to establish a 50:50 joint manufacturing venture with Sony, Texas Instruments reportedly agreed to license its vital integrated circuit patents to Nippon Electric, Hitachi, Mitsubishi, Toshiba, and Sony, and to limit its production to 10 percent or less of the Japanese integrated circuit market (19).

By 1969 it was obvious that the six major computer and semiconductor manufacturers were operating inefficiently. MITI well understood that if the Japanese firms continued to produce similar systems for a domestic market a fraction of the size of the U.S. market, the Japanese industry would not be able to compete internationally despite the most generous government assistance. MITI therefore decided to expedite the development of core technologies and to realign the industry.

The 1971 Law for Provisional Measures to Promote Specific Electronic and Machinery Industries (Kidenhō), provided legal authority for targeting "state of the art" technologies. Three categories were designed as strategically important: (1) technologies demanding a special R. & D. investment (including all technology

where Japan was substantially behind the United States—e.g., digital computers, integrated circuits; (2) technologies where it was thought a large volume of production would yield economies of scale (magnetic disks (20) and facsimile equipment) (21); and (3) technologies where modernized production techniques were becoming increasingly necessary to improve quality and performance and to reduce production costs.

MITI's policy of realignment had two objectives: first, to reduce the risk of foreign takeovers once capital liberalization began (which even in 1969 was deemed inevitable); and second, to expand production and encourage specialization in order to increase exports and diversify markets.

Realignment, however, did not please the industry. Independent, proud, and fiercely competitive, each of the manufacturers resisted relinquishing autonomy. There were also other reasons: the companies' inability or unwillingness to dismiss lifetime employees; the difficulty of restructuring relations with commercial banks; rigidities of vertical integration that inhibited mergers and spinoffs; and the restraints imposed by licensing arrangements with American producers.

Despite these impediments MITI's policies eventually prevailed. In 1969, exercising its authority under the 1957 Electronics Act, MITI cartelized the production and design of some peripheral equipment. Peripherals were selected because MITI believed that further innovation in this sector was unlikely. The cartel was directed through a steering committee of the major manufacturers under MITI's supervision.

In 1971 the six major manufacturers also agreed to form three groups: (1) Fujitsu and Hitachi, (2) NEC and Toshiba, and (3) Mitsubishi Electric and Oki. During 1972-76 each group received subsidies totaling ¥57.47 billion for research and development; and an additional ¥4.63 billion was paid to the peripheral equipment manufacturers (which included the six major companies). On the eve of liberalization the industry again regrouped. Mitsubishi joined Fujitsu and Hitachi, while OKI Electric split off to specialize as a terminal manufacturer.

These industry groupings are of interest. The Hitachi-Fujitsu association paired two technically and financially strong companies. In the NEC-Toshiba alignment the relationship of the American cross licensees may have been more important than the financial strength of the companies. In the United States the computer division of General Electric, the Toshiba licensee, had merged with Honeywell, NEC's licensee. The Mitsubishi-Oki arrangement linked the financially strongest company (Mitsubishi) to the firm with perhaps the closest ties with the United States via its joint venture, Oki-Univac.

The alliances also produced a shake out. Although the Oki-Mitsubishi collaboration produced the COSMOS computer series, Oki decided to withdraw in 1975. As noted Oki has since concentrated on peripherals and is reported to be doing well. Some observers view the Mitsubishi's pairing with Hitachi and Fujitsu to be temporary and limited to the purposes of the VLSI project. Mitsubishi is expected to withdraw, perhaps restricting its cooperation to research on data processing and small business systems. The NEC-Toshiba alliance has produced the ACOS computer series (100, 200, 700, 900) and is

reported to be proceeding well, although Toshiba may soon withdraw and transfer its employees to other divisions.

Fujitsu's and Hitachi's attempt to build the "M" series suggests the conflicts that have at times attended MITI's efforts to promote intraindustry cooperation. Initially Fujitsu was to be responsible for the "M"-160 and "M"-190, and Hitachi was to develop the "M"-170 and "M"-180 models. The arrangement, however, collapsed when Fujitsu announced its new M-180-2 model and Hitachi retaliated with the M-162 and M-200 (22).

Yet Fujitsu and Hitachi's cooperation has not been entirely fruitless. In September 1973 the two companies formed a 50:50 joint venture, the Nippon Peripherals, Ltd. (NPL), to conduct R. & D., and manufacture and market peripherals and terminals. NPL has signed agreements on an OEM basis with Memorex, NCR Japan, Mitsubishi Electric and other domestic Japanese manufacturers, and in recent years has greatly expanded its overseas sales.

LIBERALIZATION AND ITS AFTERMATH

On December 24, 1975, the Japanese Government inaugurated a new round of trade liberalization. Foreign capital investment was greatly expedited and the burdensome import quota system was eliminated. Trade and investment in computers was completely liberalized on schedule by April 1976. On the eve of the announcement of its new policy the Cabinet released the following statement:

Because the computer industry is becoming increasingly important to the future of our economy, society, and the people's daily life, we have tried to foster and strengthen this industry. On the occasion of the import liberalization, to go into force on December 24, 1975, the Government (will continue to) cherish the independence and future growth of Japan's computer industry, and will keep an eye on movements in the computer market so that liberalization will not adversely affect domestic producers nor produce confusion. The Government and the local public organizations, industrial and financial circles shall endeavor to recognize and understand this situation correctly (23).

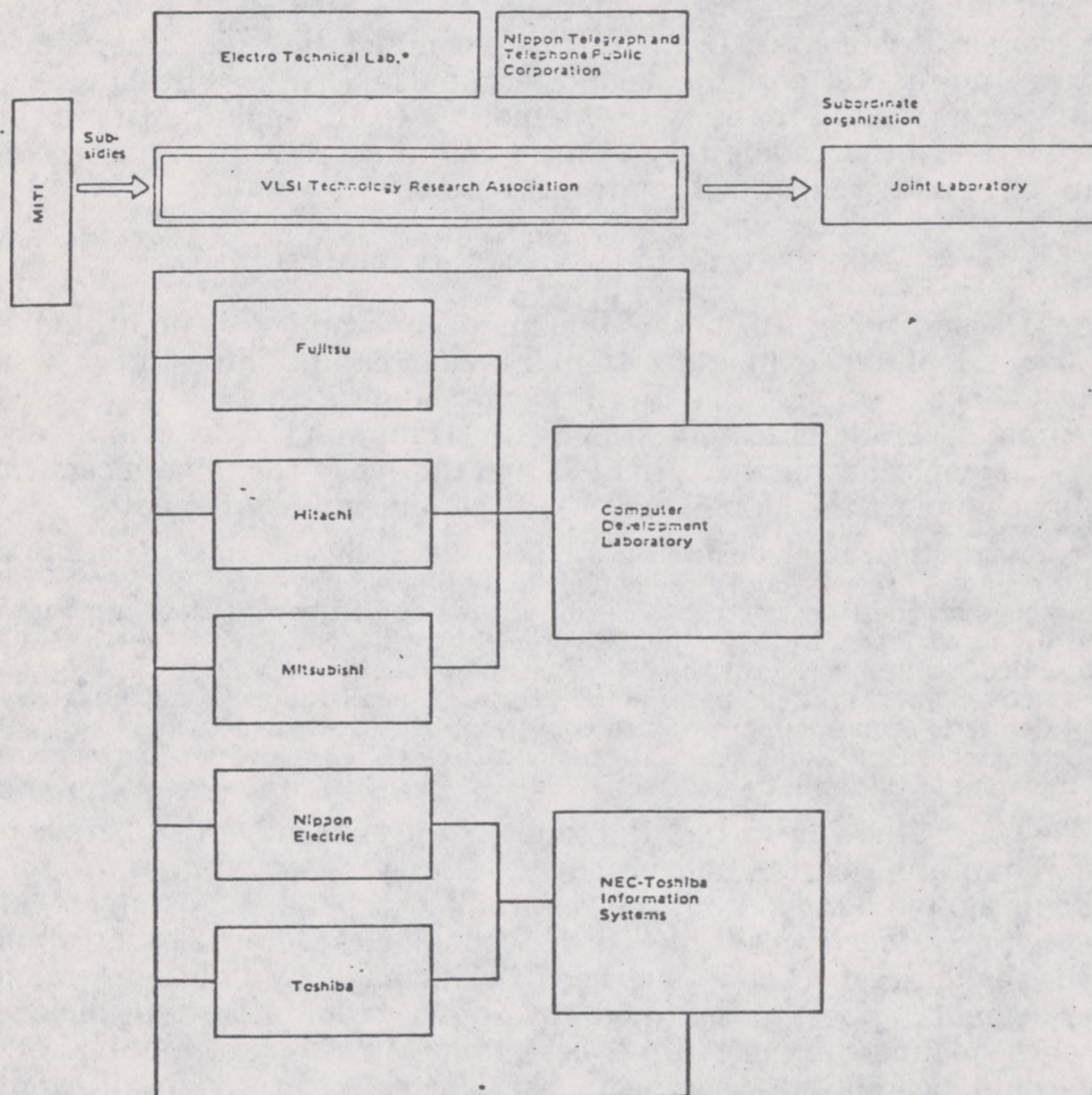
The Cabinet resolution set the tone for the government's liberalization "countermeasures" policies that continue today.

To mitigate liberalization, the government expanded its support for research and development of "core" technologies; foreign penetration of the Japanese market was checked, principally by limiting foreign procurement opportunities and by other administrative means. Japanese planners reasoned that these administrative restraints gradually could be relaxed, because market forces naturally would limit foreign participation, when Japanese industry became more competitive. By the early 1980's it was hoped Japan's industry could begin its own drive for the world market.

The most famous and controversial project since liberalization has been NTT's and MITI's collaboration in large scale integrated circuits (LSI). In April 1975 NTT formed a LSI group with Hitachi, Fujitsu, and NEC at a cost of ¥20 billion to maintain telecommunications at a high level. Once the project was underway, MITI proposed consolidating NTT's efforts with MITI's own research, which was then conducted jointly with five major manufacturers at MITI's Electro-Technical Laboratory. Initially NTT rejected the idea, primarily because it was reluctant to alter its telecommunications research to suit the more general needs of computer development.

Nevertheless, on July 15, 1975, MITI and NTT agreed that part of the two efforts could be joined. In March 1976 the VLSI Technology Research Association was formed and commenced a 4-year program with a budget of ¥70 billion. Basic research was conducted at the joint laboratory of the association, while the Joint Computer Development Laboratory and the Information Systems Laboratory took responsibility for applied research. The structure of the VLSI research program is set forth on Chart 3.

CHART 3.—Organization of the VLSI program



*The Agency of Industrial Science and Technology.

By the end of 1979 the VLSI Association had succeeded in developing 700 patentable technologies that include: (1) electron beam lithography using variable shaped rectangular beams (April 1977); (2) multiple-walls with self-aligned manufacturing technology (November 1977); (3) a raster-scan electron beam exposure system (March 1978). Some of these generic technologies have already been commercially exploited (24).

The most recently announced new program addresses the software gap. In July 1979 a new body, the Electronic Computer Basic Software Technology Research Association (ECSTRA) was organized to

promote cooperation within the industry and between the government and industry. The major participants in the software program include: Fujitsu, Hitachi, Nippon Electric, Mitsubishi Electric, Toshiba, the Computer Development Laboratories owned by Fujitsu, Hitachi, and Mitsubishi, and NEC-Toshiba Information Systems (a joint venture established by NEC and Toshiba). The costs of this project are estimated at ¥47 billion to be shared equally by the government and the participating companies. Although MITI has encouraged each firm to focus its research on an assigned subject and to share its results, there is some question that so clear a division of labor has proved feasible. One part of the program will develop technology to process data in the Japanese language (25).

The government has also continued its policy of supporting the development of key technologies in its 1978 amendments to the electronics law. For example, under the 1978 Law for Provisional Measures for the Promotion of Specific Machinery and Information Industries, three categories of projects have again been selected: (1) prototype R. & D. (high performance digital computers, laser equipment, integrated circuits—a total of 35 items); (2) commercial production (high performance remote processors, high performance facsimile equipment, bubble memories; mass storage systems (MSS), liquid crystal displays—a total of 12 items); (3) manufacturing improvement (digital computers, electronic switching systems, magnetic recording media—a total of 41 items). The 1978 law will continue in force until June 30, 1985 (26).

It may be useful at this point to review the principal measures Japan employed to promote the semiconductor, computer, and telecommunications industry between 1951 and 1976. First the Japanese Government understood that a specialized infrastructure was necessary. The new institutions would supplement existing generalized associations such as the keiretsu and the Keidanren. As noted, the government created a new Machinery and Information Industries Bureau within MITI (27), established new advisory bodies (28) and specialized governmental laboratories (29), and helped organize various specialized institutions such as the Information Technology Promotion Agency (30). Finally, Japan's government and business leaders recognized early on the importance of training technicians and cultivating experts in the new information industry (31).

Second, as described, MITI attempted to rationalize the industry and promote collaboration by selective exemptions to the antitrust laws and by subsidies allocated to the development of targeted technologies.

Third, the government extended financial benefits to the industry through preferential government procurement (32), credit allocation (33), and tax incentives. Tax incentives included a special depreciation for productive facilities (34), a special depreciation for purchasers (35), tax credits for R. & D. (36), special tax provisions relating to JECC (37), tax breaks for the software industry, including a deferral (38), a warranty system, a tax credit for the expenses of training information processing engineers (39), a special depreciation for users (40) and various tax incentives to promote the export of high technology products (41). Table 3 records part of the subsidies, loans, and other funds dispensed to the information industry for JFY 1971-79.

TABLE 2.—*Export promoting tax measures*

Dates when measure was in operation	Measure
1953-1964	<i>Export income deduction.</i> This measure directly shielded export income from taxation.
1953-1959	<i>Export loss reserve system.</i> A reserve against the possibility of cancelled export contracts was non-taxable.
1953-1959	<i>Special depreciation for overseas offices of trading companies.</i> All depreciable assets in a new office overseas were subject to a 50 percent write-off the first year.
1959 to present	<i>Technology export income deduction.</i> Companies are allowed to deduct a portion of royalties paid from abroad from their taxable income. The objective is to stimulate saleable technology development.
1964-1972	<i>Overseas market development reserve.</i> A small portion of the revenue from current exports can be put into reserves from taxable income. Like all Japanese reserves, this must later be returned to the income stream. This provision still applies for small businesses.
1964 to present	<i>Overseas investment loss reserve.</i> A small percentage of current foreign investment expenditure each year can be put into reserve to insure against investment losses. This reserve fund is non-taxable.
1964-1972	<i>Export accelerated depreciation.</i> Accelerated depreciation was allowed on capital investment where the output was to be exported. The degree of acceleration depended on the proportion of plant and equipment devoted to export.
1968-1978	<i>Export special depreciation.</i> This is an overlay acceleration on the previous provision.
Early 1950's to present	<i>Free trade zone investment loss reserve.</i> This measure is a variation on the overseas investment loss reserve extended for free trade zones.

Source: Ira C. Magaziner and Thomas M. Hunt, "Japanese Industrial Policy" (1980).

TABLE 3.—JAPANESE GOVERNMENT'S FINANCIAL SUPPORT TO THE INFORMATION INDUSTRY, JFY 1971-79

[Unit: Millions of yen or millions of dollars¹]

	1971 and 1972	1973	1974	1975	1976	1977	1978	1979 ²	Total
A. Subsidies for promotion of computer industry (million yen):									
1. Next generation computer development.....	5,210	17,740	19,650	14,575	11,425	8,640	10,052	2,300	2,300
2. 3.75 series computer development.....	1,271	1,627	2,184	3,370	3,390	2,916	2,514	7,190	68,600
3. VLSI development.....					500	850	1,112	2,954	29,382
4. Pattern information processing system.....								1,704	20,226
5. Software production techniques.....									4,166
6. Information Technology Promotion Agency (IPA) operations.....	1,620	785	995	1,322	1,233	1,198	1,167	1,195	9,515
Subtotal.....	8,101	20,152	22,829	19,267	20,048	13,604	14,845	15,343	134,189
B. Subsidies for technical system for public welfare (million yen):									
1. Health care network system.....		110	211	313	461	440	192	218	1,945
2. Living visual information system.....	31	220	553	804	553	439	39	39	2,678
3. Foreign trade information system.....				63	108	42	33		246
4. Comprehensive automobile traffic control system.....		200	840	2,007	2,151	1,471	585	211	7,465
5. Farming information system.....								25	25
Subtotal.....	31	530	1,604	3,187	3,273	2,392	849	493	12,359
Subsidy total:									
Million yen.....	8,132	20,682	24,433	22,454	23,321	15,996	15,694	15,836	146,548
Million dollars ¹	26.4	79.5	81.4	74.8	77.7	64.0	68.2	79.2	551.2
C. Loans (million yen):									
Japan Development Bank loans ³ to the JECC.....	61,000	11,500	32,500	46,000	47,000	52,000	56,000	45,000	351,000
3 long-term credit banks' loans provided through IPA to software companies.....	24,000	13,300	9,000	12,000	13,000	11,000	8,000	11,000	101,300
Loans total:									
Million yen.....	85,000	24,800	41,500	58,000	60,000	63,000	64,000	56,000	452,300
Million dollars.....	276.0	95.4	138.3	193.3	200.0	252.0	278.3	225.0	1,658.3
Applicable conversion rate (yen).....	308	260	300	300	300	250	230	200	-----

¹ See applicable conversion rate, above.

² JFY 1979 figures are MITI's request to be submitted to the Ministry of Finance in September 1978, who in turn will submit them to the Diet for approval in 1st quarter 1979.

³ Loans through Japan Development Bank: Interest rate—7.5 to 9.2 percent (through JFY 1976), 6 to 7 percent (JFY 1977 to present); term—1 to 25 yr (normally 7 to 10 yr); interest rate for the JECC—7.5 percent (through JFY 1976), 6.8 percent (JFY 1977), 6.5 percent (JFY 1978). JDB's loans to the JECC in JFY's 1977 and 1978 include loans for software development equipment and improvement of the computer industry structure.

Finally, the Japanese Government deployed its trade policy to serve its larger industrial objectives. Foreign penetration of the home market was managed at least until 1976 by high tariffs, quotas, and registration requirements (42), merger policy and other controls on direct foreign investment (43), customs practices and procedures, "buy-Japan" and other exclusionary policies and practices (such as NTT's procurement policies) (44), and administrative guidance of pricing (45) and the diffusion of technology (46).

It is difficult to assess the cumulative and individual effectiveness of the above measures. By their own admission, Japanese Government officials recognize that Japan has "equalized" in computer hardware and is fast gaining on the United States in software (47). Without doubt the above programs, incentives, and other measures have in toto contributed to Japan's successes. Yet it is hard to identify which measure (or class of measures) has been most decisive. It is all too easy to credit subsidies for the success of the Japanese industry, but subsidies as Table 3 suggests have been relatively modest. Indeed financial incentives are only one, albeit an important, class of tools deployed to enhance the competitiveness of the industry.

At the same time it is clear that the Japanese Government's policies toward the information industry have not been costless. Japan's high tariff and other protective measures have raised the costs of foreign imports to Japanese consumers; Japanese procurement policies have required government agencies to employ (at least until recent years) inferior Japanese domestic products. Such policies have often provoked intense opposition. As noted the industry resisted realignment and on occasion groups such as the Japan Trade Association of Computers Systems (JTACS) have petitioned MITI to reduce Japanese tariffs on items like peripherals.

Japan's overall trade objectives have also at times required the sacrifice of an individual company's success. For example, there is some evidence that already in the early 1970's Fujitsu could have penetrated the U.S. market, but that MITI discouraged Fujitsu's initiative. MITI officials apparently felt that Fujitsu's success might have incited a U.S. demand to liberalize the home market before the Japanese industry as a whole was ready to meet such intensified foreign competition.

It is instructive therefore to consider Japan's specific assistance to the information industry within its larger industrial policy context. Only in this way can we fully understand how the sacrifices of an individual company like Fujitsu are justified and how the costs and benefits of the industry's development are distributed.

C. JAPAN'S INDUSTRIAL POLICIES AND THE COMPUTER

After World War II the most pressing priority of Japan's leaders was to revitalize the economy. The government's early strategy (1945-55) was to focus on a few basic industries, such as coal, steel and fertilizers (48), and later textiles and light machinery (sewing machines and radios). These sectors gradually matured into export industries.

The primary purpose of the second period (approximately 1955-70) was to accelerate economic growth by focusing on industries such as petrochemicals, heavy machinery, and automobiles with high pro-

ductivity and demand elasticity. To these industries the government extended special loans, tax credits, and other benefits. These measures helped Japan attain the highest growth rate in the industrialized world by the late 1950's (49).

Yet a host of new problems suggested that Japan's prosperity would be short lived. Pollution smothered Japan's urban centers, and groups of pollution victims rampaged throughout the country (50). Japan faced the perennial problem of acute limitations on her natural resources, while her leaders struggled with how to meet the nation's commitment to liberalize her trade with the world community.

The solution was structural transformation. If industry were encouraged to concentrate on capital intensive, higher value-added products, the country could maintain its rate of growth and skirt the economic, governmental, and political troubles ahead. This was the thesis of the first comprehensive analysis of industrial structure released by a special MITI task force in October 1964. Although the group's report noted the coming importance of certain key technologies such as computers, semiconductors, and data processing equipment, the electronics industry was simply not deemed critical to the solution of the problems of the 1960's.

The oil crisis of the mid-1970's, however, showed that existing industrial policies needed to be refined. How was Japan to recover from the oil crisis, pursue industrial development, coexist with her trading partners, yet assure the people's aspirations for a richer life? By 1974 the government considered "knowledge intensification" to be the primary means of sustaining high economic growth, maintaining industrial competitiveness, strengthening weaker industries, and overcoming limitations in natural resources (51).

In July 1979 MITI released its "Draft Trade and Industrial Vision for the 1980's," which is essentially a master plan (52). Its overriding objective is economic and energy security. Security will permit the nation to realize its loftiest social objectives and buffer the pains of passage to full international economic partnership.

The key to MITI's vision is the computer.

First, the computer industry (including semiconductors, components and manufacturing equipment) is growing rapidly, and is projected to expand, generating jobs and revenue. It is an industry of established excellence.

TABLE 4.—JAPAN'S MARKET IN SEMICONDUCTORS, COMPUTERS, AND TELECOMMUNICATIONS

[Dollar amounts in billions]

	1976	1977	1978	1979 ¹	1980
Computers ²	\$2.09	\$2.68	\$4.33	.....	³ \$5.23
Semiconductors.....	1.53	1.77	2.4	\$0.28	3.6
Telecommunications.....	.....	.....	⁴ 2.4	2.8	3.6
Total.....	.....	.....	9.13	.....	12.43

¹ Assumes no significant change in exchange rate in slight recession in 1979.

² Includes Japanese production for computers and computer equipment but excludes software; statistics expressed in dollars at exchange rate in year given.

³ Not currently available.

⁴ Includes equipment (wire type); excludes radio communication.

Note: These statistics are based on a preliminary assessment by the Department of Commerce.

Second, the computer will play a key role in revitalizing Japan's currently depressed industries and in strengthening its mature industries. In shipping, for example, the computer and automated equipment will replace excess labor (which will be retrained and transferred to other sectors) and systematize operations. This will reduce costs and improve services, and, it is hoped, revitalize this stagnant industry. The semiconductor and computer will improve fuel efficiency and perform similar function in automobile production.

Third, the semiconductor and computer are becoming increasingly essential to a host of new industries. These include: telecommunications, aircraft and aerospace, automobiles, robotics, machine tools, ocean development, nuclear and other forms of energy and biological engineering. The synergism of these new industries and their dependence on the computer will create vast economies of scale that will generate multiplied benefits for the Japanese economy. The computer will make all Japan's vanguard industries internationally more competitive, because computer technology will eliminate excess labor, reduce costs, determine design, and rationalize manufacturing and operations (53).

Fourth, Japan's government planners see the computer as a means of enhancing the quality of life. One project will electronically link hospitals, clinics, and examination centers throughout the country. This data retrieval system, it is hoped, will improve diagnoses and treatment and mitigate regional disparities in medical care (54).

Japan's structural transformation policies also promote energy conservation and pollution control. It is important for U.S. policymakers to grasp how these policies can be mutually reinforcing because in the United States energy conservation and environmental protection are conceptually divorced from current concerns over domestic productivity and international competitiveness. First, the information industries themselves are low polluting. Second, a major goal of government R. & D. in the 1980's will be the development of energy-saving technologies for industrial use such as MHD (magnetohydrodynamics) power generation; high efficiency gas turbines; exhaust heat recovery systems; and electric fuel and storage systems. Third, the systematization of operations throughout industry will in cases such as the steel industry foster energy conservation and pollution control. Finally urban life will generally be ameliorated. A current project will design an "Urban Energy Conservation System" to improve municipal waste treatment, promote energy conservation in building design, reduce the costs of constructing and operating new gas and solar facilities, and rationalize the distribution of insurance, recreation, and other urban services (55).

A word must be said about how MITI's long term vision was conceived and what relation this master plan bears to the market. The vision was initially drafted by a special group, the Industrial Policy Research Committee within MITI. The group was divided into seven subcommittees concerned with: international relations, economics, industry, energy and resources, technological developments, small and medium industries, and regional and social developments. These subjects were discussed from different perspectives: the free market, governmental intervention, enhancement of social welfare, and economic security.

The draft report was thereafter debated by the members of the Industrial Structure Council, the principal advisory body to MITI. Its members include prominent economists, lawyers, sociologists, university professors, retired government officials, and representatives of labor unions, small enterprises, local governments, consumer and other groups. After the Industrial Structure Council completed its review (56), MITI officials next solicited a broad cross section of comments from members of the public. A final version of the report was released in August 1979.

It would be a mistake to conclude that MITI's vision for the 1980's reflects a uniformity of opinion, or even a consensus, or that the document represents a rigid prescription for the Japanese economy. Indeed the Ministry of Finance has already pointed out important jurisdictional and financial problems, and the debate on the overall direction of the nation continues. Yet despite the current controversy, the preparation of the vision has been useful in promoting general acquiescence in MITI's objectives, if not active support for these objectives.

Essentially the vision accelerates market forces rather than replaces them. It peers 10 to 20 years ahead to anticipate problems that many industrial entrepreneurs do not have the time or interest to consider. It provides Japanese companies with a benchmark to adjust to market perturbations with flexibility, speed, and as little friction as possible; it facilitates intersectoral adjustments and tradeoffs and the coordination of policies for energy, trade, environmental protection, R. & D., domestic productivity, and labor relations. It also provides a framework for formulating and coordinating subsequent government decisions such as whether to assist one industry and deny another; how such industries should be strengthened; when assistance to a mature industry should be terminated (57); how the social and economic dislocations of industrial restructuring can be minimized; and how future economic crises might be resolved. Chart 4 provides a simplified picture of how implementation of Japan's sectoral policies are related to other important national objectives.

CHART 4.—An example of the industrial structure sophistication program and policy tools

Direction of Policies	Policy Tools	Presentation of the Long Term Vision	Establishment of Institutional Frameworks (contracts, standards, and others)	Inducements				External Measures	Extension of Promotion, Adjustment and Control by Law (Examples of Established Laws)
				Loans	Taxation Measures	Subsidies	Direct Implementation by the Government			Administrative Guidance
a. Response to national needs		o		o		o			
b. Countermeasures against constraints									
	Resources and energy conservation	o	o Target for lowering energy base units	o	o	o	o Investment adjustment	o International cooperation in technology and others	o Antipollution Laws and others
	Environmental standards and others	o	o Environmental standards and others	o	o	o	o Reduction of resource waste and others		
c. Nurturing leading industries		o		o	o	o	o	o	o Aircraft Industry Promotion Law o Machinery and Electronic Industries Promotion Law
d. Promotion of core technology		o		o	o	o	o	o	
e. Promotion of industry relocation		o		o	o	o			o Industrial Relocation Promotion Law o Factory Location Law
f. Internationalization		o	o Ensuring prospects in international business behavior	o	o		o Adjustment of overseas investments and others	o Adjustment of relations with host nations	
g. Structural improvement of specific industries and adjustment of industries		o		o	o	o			o Law for the structural improvement of textile industries
h. Sophistication of small enterprises		o		o	o				o Small and Medium Enterprise Basic Law o Small and Medium Enterprise Modernization Promotion Law
i. Formation of a stable industrial structure, combining the above points		o					o As a long-term, comprehensive guideline for investment adjustment		
j. Short, medium-term problems which should be taken into account in the process of implementing of industrial structure policies									
	Stabilization of prices	o					o In case of emergencies		o Electricity Utility Industry Law o Petroleum Industry Law, etc.
	Stabilization of supply-demand in basic commodities	o					o Introduction of rationing and others		
	Controlling export flood	o					o Export adjustment and others		o Foreign Exchange Law o Foreign Trade Control Law

Note: "o" indicates that the measure is being implemented.

Source: Japan's Industrial Structure (JETRO), 1975.

SUMMARY

The preeminent national concern in Japan since the 1950's has been economic security. Although its definition may have changed, government planners have continued to identify economic security with the maintenance of a stable supply of raw materials (particularly energy sources) and access to foreign markets. The concept of economic security is as important to most Japanese as the concept of military (national) security is to most Americans.

Since the 1960's Japan has sought to assure economic security against the exigencies of an uncertain, hostile world by structural transformation. This policy has involved strengthening depressed or declining industries, expanding mature industries, and nourishing inchoate, promising industries. In the 1960's and early 1970's steel and automobiles commanded governmental attention. Today higher value-added, knowledge-intensive industries like electronics dominate. This process links the future of Japanese economic security to the computer.

Japan's industrial policies for the 1980's coincide exactly with the computer industry's coming of age. Since many Japanese computer and semiconductor products match or surpass their foreign competitors, there is no longer need for the formal regulatory controls that preceded liberalization. Market forces will prevent foreign domination of the

home market and should permit Japan's acquisition of a larger world market share.

In the 1980's Japan will continue to develop a host of new industries such as aircraft and aerospace, telecommunications, robotics, ocean resources, nuclear and other forms of energy, and biological engineering. The computer increasingly will determine the design, manufacture, and operation of these industries and will improve efficiency by eliminating excess labor and reducing costs. These vanguard industries will soon establish Japan's preeminence in the changing international economic order.

REFERENCES

(1) The best study of the industry is "The Japanese Semiconductor Industry: An Overview," The Consulting Group BA Asia Ltd., January 1979. See also, Ishimura, IC Sangyō Dai Sensō (The Great IC Industry War) 1979; and Nichibeï, Handotai Sensō (The U.S.-Japan Semiconductor War) (1979).

(2) Originally the six major firms were joined by Matsushita Electric Co. But Matsushita was never part of the inner core, and in 1964 the company withdrew from the data processing business. Matsushita, like Sony, did not participate in the VSLI program. Matsushita has, however, collaborated with Fujitsu in the manufacture of minicomputers.

(3) See Koji Kobayashi, Keynote Speech, "The Japanese Computer Industry: Its Roots and Development," 3rd USA-Japan Computer Conference (undated). See also Chart 6.

(4) See generally U.S. Department of Commerce, "Japan—The Government-Business Relationship," February, 1972, pp. 78-101.

(5) See Kobayashi reference 3.

(6) See reference 4.

(7) A similar provision appears in Articles 6 and 11 of the Law on Provisional Measures for the Promotion of Specific Machinery and Information Industries (Kijohō), July 1, 1978.

(8) See reference 4.

(9) Kobayashi reference 3.

(10) According to Japanese Government officials, the effective rate remained at 15 percent.

(11) In 1978 JECC's capitalization was ¥64.7 billion and JECC's principal owners (with equity percentages as of April 30, 1978) were Fujitsu (29.2 percent), NEC (26.1), Hitachi (17.4), Toshiba (9.3), Oki (8.1), Mitsubishi (5.4) and NTIS (4.6).

JECC pays 44 times the JECC rental price to the manufacturer at the time of the system's installation, and then leases the system to the customer at the JECC rental price. JECC pays the system's maintenance charges to the manufacturer. The manufacturer must repurchase the system from JECC at the undepreciated book value, should use of the system be discontinued before it is fully depreciated. A customer can cancel an agreement upon giving 3 months prior notice and after the completion of the initial twelve month installation period (minimum noncancellable period is 15 months). In the beginning JECC used a 72 month straight-line depreciation schedule; later, the period was shortened to 62 and then 60 months. Although 72 months is legally required, JECC appears to have obtained a special shortened period to accelerate depreciation further in order to offset the fixed percentage declining balance method used by IBM and other foreign manufacturers.

(12) A machine that automatically prints characters.

(13) Essentially a TV tube used to display kanji.

(14) A memory unit based on using magnetic discs.

(15) Translates program from a source language (e.g. FORTRAN) into an object language.

(16) Some observers question the extent of public demand for this model.

(17) PIPS has received mixed reviews. Some observers feel that its product was not so advanced. One commercial spin-off is a type of voice recognition unit which NEC reportedly has built commercial products.

(18) Although there were less than ten "software houses" in Japan in 1972, today there are more than a thousand.

(19) John E. Tilton, "International Diffusion of Technology: The Case of Semiconductors" (1971), pp. 136-160.

(20) A memory unit; in general its capacity is greater than a computer, although it is slower.

(21) Facsimiles take pictures of a page and are linked to phone lines.

(22) Generally, Hitachi has been more independent. Its reliance on JECC has been only marginal. (For example, in 1978 Hitachi used JECC for only 5 percent of its DP sales.)

(23) The Cabinet resolution thus continued the government's restrictive procurement policies. See Appendix 1.

(24) See The Japan Economic Journal, Tuesday, July 25, 1978, p. 12. Also The Economist, April 5, 1980, p. 74.

(25) See EDP Japan Report, vol. 6, Sept. 20, 1979. Also JIPDEC Report, Winter 1979.

(26) A copy of the law appears in Appendix 2. The best analysis of this law is the assessment published by MITI, "Kijöhö no Kaisetsu" (1979) and MITI's, "Jūten Shisetsu" (1980).

(27) The Japanese Government also later established several new divisions within MITI's Machinery and Information Industries Bureau in order to promote the new information industries. These included the Electronics Policy Division and the Data-Processing Promotion Division. The former is responsible for designing comprehensive policies for the industry, including elevating its technical sophistication and diffusing new technologies. The latter is responsible for the development, distribution, and improvement of data processing services.

(28) Attached to each of MITI's specialized divisions is an expert's advisory body. The Electronic's Machinery Industry Council and the Data Processing Promotion Council act at the request of the Minister and consider technical and policy questions relative to their respective jurisdictions.

(29) MITI's Electro-Technical Laboratory and NTT's three Electrical Communications Laboratories are examples of special governmental labs established to promote research and development.

(30) In addition to the formal administrative divisions within MITI and its official advisory bodies, the Japanese Government has also fostered the establishment of many specialized governmental, quasi-governmental and private agencies, centers, and associations. These include:

- a. The Information Technology Promotion Agency
- b. The Japan Institute of Information Technology
- c. The Japan Computer Usage Development Institute
- d. The Japan Information Processing Center Association
- e. The Communications Industry Association of Japan
- f. The Japan Information Processing Development Center
- g. The Japan Software Industry Association
- h. The Kansai Institute of Information Systems
- i. The Living-Visual Information Systems Development Association
- j. The VLSI Technology Research Association

The activities of these bodies differ according to their mandates. The Information Technology Promotion Agency develops by consignment advanced versatile programs that are beyond the technical and financial means of the private sector. It buys, sells, and leases programs, and it guarantees the liabilities of deserving firms in the information processing and software.

Other organizations like the Japan Information Processing Development Center (JIPDEC) conduct market surveys and research, disseminate information, consult on data processing, promote the international exchange of information, and generally facilitate cooperation between government, academic, and financial circles. Still other bodies such as the VLSI Association are organized for more specific technical purposes.

(31) For example, in 1977 ¥52 million was allocated to educating data processing engineers and ¥4 million to training data processing "leaders."

(32) Appendix 1 indicates the share of domestic computers in use at governmental and related offices, local public organizations, and other institutions as of September 30, 1975.

(33) See generally, Eisuke Sakakibara and Yukio Noguchi, "Dissecting the Finance Ministry-Bank of Japan Dynasty," Japan Echo, vol. IV, No. 4, 1977.

(34) Special facilities used in the production of newly developed technologies may depreciate one-third (off the top) of initial book value in the first year in addition to accelerated depreciation under normal tax schedules. Thus approximately 60 percent of book value may be depreciated in the first year.

(35) Purchasers are permitted 20 percent depreciation of initial book value (off the top) in the first year in addition to depreciation at normal rates. Effective depreciation in the first year for tax purposes is 52 percent (applied to computers with at least a 1 million bit memory capacity). A standard local tax of 1.4 percent of taxable real assets is collected every year from the industry. This provision effectively reduces the computer's asset book value by 20 percent, thus lowering the user's tax base.

(36) Tax credits for R. & D.—this provision, which dates from 1957, now applies to all industries. The credit is 20 percent of the increment in expenses up to a limit of 10 percent of taxable income.

(37) A significant feature of JECC is the trade-in loss reserve. As noted the manufacturers must repurchase computers returned to JECC by the end-year at a value determined by the JECC. In order to mitigate losses incurred upon repurchases, the manufacturer may reserve 20 percent of its sales to JECC against taxable income. After 5 years, the reserve is treated as income.

(38) Private companies may defer 50 percent of the company's software profits for 4 years. 25 percent of a software firm's total program sales may be set aside in reserve.

(39) Twenty percent of the increment in expenses borne by software companies and hardware makers is credited against taxes, up to a limit of 10 percent of taxable income.

(40) As of April 1979, a special first-year depreciation is provided to users of online complex equipment where computers are connected with "intelligent" terminals. A special rate of depreciation of up to 20 percent in the first year is applicable to the whole system, including both hardware and software. See generally, "U.S.-Japan Trade: Issues and Problems." A report by the Comptroller General of the United States, Sept. 21, 1979.

(41) See Table 2.

(42) Until liberalization in 1975, imports of foreign semiconductors, computers, and telecommunications equipment were subject to quotas and onerous registration requirements. These requirements both imposed additional costs on foreign importers and encouraged users to look to alternative Japanese sources. Since liberalization foreign semiconductor and other related imports are subject to automatic approval and the registration requirements have been released.

(43) Until recently Japanese law has prohibited foreign acquisitions of domestic semiconductor and other high technology firms and has controlled the percentage of foreign ownership in those firms. Today these controls have been revised. A proposed merger or acquisition, however, must still be approved by a unanimous vote of the board of directors of a targeted company, and comply with other requirements of Japan's Antimonopoly Law.

(44) To date NTT has consistently maintained a "Buy Japan" policy that excludes foreign purchases. Foreign sales to NTT have been mostly limited to peripheral equipment (e.g., telephone poles) of nominal value. Some of the issues arising from NTT's procurement practices can be subdivided as follows:

- i. restriction to "designated" suppliers; reluctance to permit U.S. firms to become qualified suppliers; refusal to establish clear criteria and procedures for qualification;
- ii. use of "design" versus performance standards;
- iii. uncertain procedures on inspection and approval;
- iv. uncertain policy on production of foreign-designed equipment in Japan;
- v. reluctance to employ competitive bidding procedures or to establish a substantial percentage quota for procurement by open tender;
- vi. refusal to supply technical data needed by foreign suppliers in order to meet NTT specifications;
- vii. refusal to approve U.S. manufactured components or to authorize their incorporation into other products;
- viii. refusal to permit free "plug-in" of compatible services or to publish clear compatibility standards;
- ix. refusal to adopt policies consistent with CCITT recommendations and other internationally accepted practices.

NTT, of course, is only one example of the approximately 7,000 public corporations in Japan that are increasingly coming to depend on computers and have adopted buy-Japan policies.

Recently NTT's practices have led to intense controversy as the two following cases suggest.

(1) The General Datacomm "modem" case: In 1978 NTT revised its monthly rate for private leased telephones lines and thereby substantially reduced Japanese imports of U.S.-made modems. (A modem is used to connect business machines via telephone lines.) NTT's rate change eliminated the user's economic incentive to purchase modems on the private market, effectively making NTT the sole supplier of modems. General Datacom, a foreign supplier of modem equipment, referred the case to the Trade Facilitation Committee where it is still being discussed. Since the rate change is fait accompli, it may be difficult for NTT to reverse its action.

(2) The CDC message switching and the Time Sharing, Inc. cases: In three related cases NTT and KDD have used their monopoly position to exclude private suppliers from computer services. Here the principal concern of American suppliers is not that Japanese domestic firms are being favored; NTT also excludes these companies. (Time sharing is currently supplied by NTT's wholly-owned subsidiary NTD.) The principal concern of some American businessmen is that Japan's time sharing market is closed, whereas Japanese companies theoretically can participate in the U.S. time sharing market. (Japan's International Telephone & Telegraph (Kokusai Denshin Denwa) has requested the U.S. FCC to approve the sale of computer lease time in the United States. As of mid-1979 the FCC had not acted on this request.)

(45) There have been several reports of MITI's efforts to control prices in the computer industry. For example, one report notes that in 1979 MITI requested a major American firm to raise its prices by 1.2 to 1.6 percent on a new computer model. On June 5, 1979, Japanese newspapers reported that MITI has warned both Japanese and foreign computer manufacturers against fierce price cutting. A MITI official was quoted as saying: "the present state of competition is far from normal, and it is not desirable for Japanese computer builders to cut prices for equipment developed with heavy government subsidies." On June 12, 1979, Japanese newspapers noted that the JFTC was studying whether price cutting by computer companies violated Japan's Antimonopoly Law. Both MITI and the FTC's actions have significant trade implications because IBM's (and other foreign firms) low prices (and high quality) constitute their principal attraction to the Japanese computer. The MITI and FTC action could substantially reduce or eliminate foreign firms' competitive price advantage in the Japanese market.

(46) As illustrated by the case of Texas Instrument's initial efforts to establish a wholly-owned manufacturing operation in Japan, the Japanese Government in the early years conditioned such approvals on a foreign firm's assent to license critical patents to all its Japanese competitors and to charge a uniform license fee. MITI's action at the time facilitated the diffusion of important technology. In general administrative guidance, particularly of the largest American companies, have over the years interdicted aggressive expansion of marketshare.

(47) See "Jōhō Sangyō no Gendai" (The Present State of the Information Industry) MITI, September (1979).

(48) This period is often referred to as the "priority production system" period. See Toshihiko Tanabe, "Japanese Industrial Structure—Policies and Problems" (unpublished and undated).

(49) For example in 1955 steel production was 9.4 million tons; by 1970 it was approximately 92.4 million tons; cf. Tanabe, f.n. 49.

(50) See generally, Julian Gresser, Koichiro Fujikawa, Akio Morishima, "Environmental Law in Japan" (MIT Press, 1980).

(51) In May, 1971 the Industrial Structural Council, the principal advisory body to MITI on industrial policy, issued an interim report, "Trade and Industrial Policy for the 1970s," wherein it recommended that knowledge intensification of the industrial structure would help equip the nation in dealing with these problems.

(52) The first such vision was the Industrial Structural Council's May 1971 report. Thereafter in 1975, MITI released "Japan's Industrial Structure: A Long Range Vision," which has been updated annually. Japanese planners are already beginning to peer into the 21st Century. See Keizai, Doyūkai, "21 Seki e no Sangyō Kōzō bishion wo motomete" (A Vision of the 21st Century—The Quest for Industrial Restructuring) 1979.

(53) The Japanese Government is also strengthening the international competitiveness of Japanese industry by establishing computerized data retrieval systems on international trade and patents. For example, the JFY budget for the patent retrieval system was ¥22 million; for foreign trade in JFY, ¥42 million.

(54) In FY 1976 the budget for the medical data retrieval system was ¥440 million and in 1976 ¥461 million.

(55) Another class of programs will systematize government operators by promoting data retrieval: (1) in government agencies; (2) integrating the system throughout the government; (3) strengthening measures to protect proprietary information and other sensitive data. See JIPDEC Report, Summer 1979.

(56) The Council has almost 20 committees which include: a general coordination committee, committees on International Trade, Investment and Finance, Pollution and Industrial Location, Distribution, Consumer Policy; and sector by sector committees for steel, chemical, machinery, textiles, etc. MITI's policy is checked and refined through the discussion in these committees. Many industrial problems are considered sometimes by sectors and sometimes by issues. For example, the Investment and Finance Committee annually prepares short-term demand and supply estimates for main industries which were originally drafted in the various sector by sector committees. These committees break down the long-term vision of the industrial structure composed by the general coordination committee. Based upon their estimates, the committee prepares an investment plan for the year, which becomes the basis of MITI's administrative guidance for investment adjustment. See Tanabe f.n. 9.

(57) Currently the automobile industry poses major problems of how fairly and efficiently to terminate assistance.

Part II: The Problem

Introduction

Should the United States be concerned that it might lose its present position of leadership in semiconductors, computers, and telecommunications? After all American consumers are benefited from the influx of high quality, competitively priced Japanese and other country's goods. And in the past foreign goods have swept our markets without disastrous consequence. In Part II, I will argue first that our present piecemeal, uncoordinated approach will not meet the challenge presented by foreign competition in high technology, particularly semiconductors, computers, and telecommunications. Second although, in my opinion, there is no evidence that a foreign "takeover" is imminent, current trends in trade and investment bear watching. And third, a new perspective is required.

A. A CRITIQUE OF THE LAISSEZ-FAIRE MODEL

1. THE PROBLEM OF INFRASTRUCTURE

History suggests that in the past a single firm's or cartel's control over the development of a core technology has permitted these entities (and their governments) to influence critically the design, price, quantity, and time of introduction of other products; and ultimately what new industries, dependent on the core technology, would emerge.

The German dyestuffs industry well illustrates the process. In the late 1860's the industry was small, dispersed, essentially imitative (1). Scarcely a decade later, Germany held half the world market. By the turn of the century the German industry's share was around 90 percent. Dyestuffs displayed a pattern common to other industries in the late 19th century. Efficiency promoted efficiency. Size and integration facilitated greater capital intensity; capital intensity encouraged a more rational organization of work, a simplification of product mix, an elimination of waste. Superior technology went hand in hand with German hegemony between 1890-1914.

The semiconductor, computer, and telecommunications industries may have an even greater influence on our world than the German chemical industry did in the 19th century (2). In 1964 IBM introduced its 360 family of computer systems. Because of its standardized interfaces for peripheral products, IBM's decision at a single stroke created the plug-in compatible peripheral business. Japan's leaders well understood the awesome power IBM could wield, not only in the computer industry, but also over the nation's technological development. Japan's industrial policies were designed precisely to counteract the hazard of such pernicious foreign control.

See references at p. 40.

2. FORWARD PRICING AND SECOND SOURCING

It has been conclusively shown that a general (and very steep) reduction in price occurs in the production of semiconductors. This pattern results principally from three effects. First, experience with different production techniques and processes helps reduce costs (the learning curve effect). Second, increases in the size and scale of operations multiplies output (economics of scale) due to automation, specialization of function, and other causes. Economies of scale reduce per unit production costs. Third, the number of electronic functions enclosed in a single chip has nearly doubled every 2 years since the introduction of integrated circuits in the mid-1960's (the density effect) (3). These effects have permitted the price of integrated circuits to fall from \$50 per function in the mid-1960's to less than one-twentieth of 1 cent per function for the 16K RAM, currently one of the most advanced integrated circuits (4).

The fierce competition in the semiconductor industry and the economics of production at times interact to deny innovators the full benefit of their efforts. One problem is forward pricing. Ordinarily, when a firm begins producing an innovative device, it can expect a grace period without serious competition. At first, profits should increase and costs should be reduced. By cutting price, the innovator can shrink the profits of competitors. Because of sharply declining cost curves, however, many firms base today's prices on the anticipated costs of tomorrow's products. Although this policy has significantly benefited users of semiconductors, it has squeezed profits and forced firms to abandon devices only a few years in production. The innovator's edge in developing the next generation of technology may be lost.

A second problem is second sourcing. In order to influence standardization and to secure a "comparative advantage" on a product's declining cost curve, many semiconductor firms sell their product's architecture to their competitors. Although this has also benefited end users, it has meant the sacrifice in some cases of a significant portion of the benefits of an innovation.

If the U.S. industry did not need to compete internationally, forward pricing and second sourcing might not be problems. But these practices place U.S. firms at a distinct competitive disadvantage when Japan and other countries offset their innovator's losses by subsidies, tax incentives, credit allocation, and other means.

3. MILITARY APPLICATIONS

Semiconductors, computers, and telecommunications have significant military applications. For example, they are important to avionics, radar, missile guidance and encipherment; they are used to design and develop military gear; they are deployed in command and control systems.

For U.S. policymakers two issues are important. First, the commercial technology in some cases represents the state of the art. IBM's Winchester disk drive, for example, preceded the military version of this product. The company's recently marketed disks may also influence later military applications. It is therefore plausible that Japan or another country, by virtue of its leadership in the commercial

sector, could come to control the development of some state of the art military hardware. Perhaps this in itself should not arouse concern. But it represents a significant change and will require the United States to adjust.

Second, one can easily imagine that Japan or our European allies will at some time deny us access to strategic industrial and military technology (5). Although there is little historic evidence that this has happened, the U.S. Government regularly imposes controls on exports to Japan and Europe under the international trade arms regulations. Why should we expect our friends to cherish greater trust than we have accorded them (6)?

MITI's position on the VLSI program's patents suggests that such events are already afoot. Until 1978 foreign companies (including wholly-owned Japanese subsidiaries like IBM Japan) were excluded from licensing VLSI patents developed by the VLSI program. In 1979 MITI indicated that the VLSI Association would license the patents developed by researchers on loan from the five companies participating in the VLSI Technological Research Association to foreign firms.

Yet MITI's position left many issues unanswered. Would rights established by cross licensing agreements between Japanese and foreign firms be honored when these patents derived from the joint research of Japanese industry and government participants? Would a member company first need to obtain MITI's approval before licensing such a patent? Would government-owned patents resulting from the work of researchers transferred from the Agency for Industrial Science and Technology also be open? Would all foreign firms, or only those firms holding cross-licensing agreements, qualify? The VLSI case may foreshadow a new generation of similar controversies.

B. TRENDS IN INTERNATIONAL TRADE AND INVESTMENT

Statistics on international trade and investment in semiconductors, computers and telecommunications suggest that Japanese and other foreign firms are gradually penetrating the U.S. market, while U.S. firms are losing market share in the international, particularly the Japanese market. Table 4 estimates the size of the Japanese market, which most analysts agree is second only to the U.S. market. Tables 5-11 provide a current estimate of recent trends in semiconductor trade. The tables show a pattern of declining U.S. market share. ITC officials suggest that by 1988 Japan's world market share in integrated circuits may equal the U.S. share, if the present rate of growth in the industry remains the same, and if the trade in integrated circuits repeats the same pattern as discrete semiconductors.

TABLE 5.—SEMICONDUCTOR SHIPMENTS OR PRODUCTION DATA, 1976-78

[Dollar amounts in millions]

	Japan production ¹			United States shipments ²		
	Total	Discrete devices	Integrated circuits	Total	Discrete devices	Integrated circuits
1976.....	\$1,528	\$865	\$663	\$4,078	\$1,532	\$2,546
1977.....	³ 1,772	³ 1,015	³ 757	4,832	1,823	3,009
1978.....	2,568	1,228	1,340	5,311	1,946	3,365

¹ Japanese semiconductor production data was taken from the "Yearbook of Machinery Statistics," published by MITI.

² U.S. semiconductor shipments data for 1976 and 1977 were taken from the Annual Survey of Manufacturers. The 1978 data, the latest available, is from the current Industrial Report MA36.

³ 1977 data was estimated by using January-September 1977 production information. Arrival 1977 data was not available.

TABLE 6.—SEMICONDUCTOR TRADE DATA, 1976-78

[Dollar amounts in millions]

	Japanese semiconductor trade with the United States ¹		U.S. semiconductor trade with Japan ²	
	Imports from United States	Exports to United States	Imports from Japan	Exports to Japan
1976.....		\$161	\$56	\$87
1977.....		158	83	76
1978.....		207	134	105

¹ Japanese trade data taken from "Japan Exports and Imports" published by Japan Tariff Association.

² U.S. trade data supplied by the Bureau of the Census. This is the same data found in the FT 135 (monthly imports) and FT 410 (monthly exports).

TABLE 7.—UNITED STATES AND JAPANESE WORLD SEMICONDUCTOR TRADE, 1976-78

[Dollar amounts in millions]

	United States ¹		Japan ²	
	Total exports	Total imports	Total exports	Total imports
1976.....	\$1,400	\$1,107	\$392	\$312
1977.....	1,503	1,352	435	294
1978.....	1,923	1,768	636	361

¹ U.S. trade data supplied by the Bureau of the Census. This is the same data found in the FT 135 (monthly imports) and FT 410 (monthly exports).

² Japanese trade data taken from "Japan Exports and Imports", published by Japan Tariff Association.

TABLE 8.—UNITED STATES AND JAPANESE SEMICONDUCTOR MARKETS

[In millions of dollars]

	United States			Apparent consumption =	Japan			Apparent consumption =
	Shipments	+ Imports	- Exports		Production	+ Imports	- Exports	
1976.....	\$4,078	\$1,107	\$1,400	\$3,785	\$1,528	\$312	\$392	\$1,448
1977.....	4,832	1,352	1,503	4,681	1,772	294	435	1,631
1978.....	5,311	1,768	1,923	5,156	2,568	361	636	2,293

TABLE 9.—UNITED STATES SHARE OF JAPANESE SEMICONDUCTOR MARKET

	United States data			Japanese data		
	Imports from United States	Japanese HC	Percent	Imports from United States	Japanese AC ¹	Percent
1976.....	\$87	\$1,448	6.0	\$161	\$1,448	11.1
1977.....	76	1,631	5.7	158	1,631	9.7
1978.....	105	2,293	4.6	207	2,293	9.0

¹ Apparent consumptions.

TABLE 10.—JAPANESE SHARE OF UNITED STATES SEMICONDUCTOR MARKET

	United States data			Japanese data		
	Imports from Japan	United States HC	Percent	Imports from Japan	United States AC ¹	Percent
1976.....	\$56	\$3,785	1.5	\$80	\$3,785	2.1
1977.....	83	4,681	1.8	98	4,681	2.0
1978.....	134	5,156	2.6	152	5,156	2.9

¹ Apparent consumption.

TABLE 11.—JAPANESE COMPUTER MARKET

	1976	1977	1978
Apparent consumption (billion yen).....	687	766	917
U.S. imports (as percent of apparent consumption).....	11.6	12.0	8.4

Source: U.S. Embassy reports and issues of "Japan Economic Journal."

Table 12 shows imports of U.S. origin as a percentage of apparent consumption in the Japanese computer market. Although there appears to be a pattern of decline, Table 13 does not reflect the market share of firms like IBM derived from local production and sales in Japan.

Table 13 indicates that U.S. firms held less than 50 percent of the Japanese installed base of computers as of mid-1977. This percentage is estimated to have declined after 1977 (7). Table 14 indicates that although U.S. imports of Japanese origin are growing, these imports represented only 1 percent of apparent consumption in the U.S. computer market as of 1977 (8). Together Tables 5-14 suggest that although the U.S. share of Japan's computer market is substantially higher than Japan's share of the U.S. home market, Japanese firms appear gradually to be reducing foreign penetration, while expanding their position in the United States.

Tables 15-16 record some important recent foreign purchases and financial arrangements to acquire U.S. technology. Tables 15-16 suggest that the increasing Japanese presence is only one part of the larger trend of foreign control of the U.S. semiconductor market.

The recent pattern of trade and investment should be construed beside several additional factors. The first is the sharply increasing costs of production equipment (9). The second is the present financial difficulties of many smaller American semiconductor firms. The third is the difficulty that many American firms are experiencing in recruit-

ing able and experienced electrical engineers. The fourth is the financial leverage Japanese firms enjoy from low investment loans, subsidies, guarantees, favorable tax treatment, and general institutional support.

The sixth is the aftermath of U.S. companies' loss of market share in Japan and elsewhere (10). With the erosion of U.S. market position, Japanese and other foreign manufacturers will capture economies of scale. Economies of scale will enable these firms to reduce costs and cut prices. Price competitiveness will help these companies over time secure a larger share of their own, United States, and world markets.

The seventh is vertical integration. Vertical integration can help Japanese firms establish powerful enclaves in the U.S. and world markets. For example, if NEC increases its share of the U.S. telecommunications market, it simultaneously expands its market share in computers and semiconductors, because it can supply most of its own requirements (and so forth up and down the industrial pyramid). Vertical integration would also expand the opportunities for internal financing.

Finally the U.S. semiconductor industry has apparently been unable to meet the demand for some state of the art products. In 1979 Japanese firms were able to fill a breach in supply by acquiring approximately 42 percent of the 16K dynamic random access memory (16K RAM) market (11). The event is significant because the 16K RAM is one of the industry's most profitable products, and critical to the development of the next generation of memory devices.

TABLE 12.—U.S. COMPUTER MARKET

	1976	1977	1978
Apparent consumption (millions) (without parts in imports).....	\$7,781	\$10,387	\$13,360
Japanese imports (without parts as percent of apparent consumption)...	0.5	0.6	0.8
Apparent consumption (millions) (with parts in imports).....			\$13,727
Japanese imports (with parts as percent of apparent consumption).....			1.4

Source: 1976, 1977, Bureau of the Census; 1978, estimated by BIE.

TABLE 13.—*Japan*

Installed computers share of value (as of June 30, 1977):	Percent
United States.....	45
Japanese.....	54
Other.....	1

Source: "Computopia," vol. 12, No. 136, Computer Age Company, Tokyo, as cited in "Country Market Survey, Japan, Computers and Peripheral Equipment," March 1979, U.S. Department of Commerce.

TABLE 14

Installed computer share of value (as of 1978):	Percent
United States.....	98
Japanese.....	>1
Other.....	>1

Source: BIE estimate.

TABLE 15.—FOREIGN ACQUISITION OF U.S. TECHNOLOGY THROUGH FINANCIAL TIES AND SUBSIDIARIES

Type arrangement: Purchaser, lender, or investor	U.S. seller or debtor	Date	Financial gain to U.S. firm	Price paid (millions)	Technology gain to foreign firm
EQUITY PURCHASE					
Partial interest: Fujitsu	Amdahl	1976	Investment capital.		Design technology for special computer IC's.
Controlling interest:					
Mitsubishi	Artex Industries	1973-74	do		MOS/LED technology.
Eiko Business Machines	Frontier, Inc.	1975	do		Digital watch technology.
Nippon Electric (Japan)	Electronic Arrays	1978	Outright purchase.	\$9	MOS technology.
U.S. Philips Trust (Netherlands)	Signetics	1975		49	
Commodore International	MOS Technology	1976		1	
Siemens (West Germany)	Litronix	1977		16	
Siemens	Advanced Micro Devices.	1977		27	
VDO (West Germany)	Solid State Scientific	1977		5	
Northern Telecom (Canada)	Intersil	1977		11	
Honeywell	Spectronics	1978		3	
Honeywell	Synertek	1978		24	
Bosch (West Germany)	American Microsystems.	1978		14	
United Technologies	Mostek	1979		349	
Siemens	Microwave Semiconductor.	1979		25	
Schlumberger (France)	Fairchild Camera	1979		397	
Schlumberger	Unitrode	1979		10	
LOANS					
Seiko	Micro-Display Systems	1973	Working capital		Liquid crystal technology.
Mitsubishi	Optel Corp.	1974	do		LED technology.
SUBSIDIARIES					
Toyo Electronics	EXAR Systems, Inc.	1971			Linear epitaxial technology.
Nagai	Nagai Semiconductors	1974			MOS technology.
Suncru Laboratories	Suncru, Inc.	1974			Digital watch technology.
Murman	Murman Integrated Circuits.	1975			MOS memories.
Tateisi	Omron Corp.	1975			Digital watch technology.
Matsushita	Microelectronics	1977			IC research and development.

TABLE 16.—U.S. semiconductor industry acquisitions and mergers with foreign participation, 1975 to present

Siemens Capital Corporation, a wholly-owned subsidiary of Siemens (Germany) purchased 500,000 new shares of AMD stock for \$45 each in October 1977, for an initial 17% ownership of AMD. The agreement further allowed that Siemens could increase holdings up to 20% through open market purchases. As of March 26, 1978, Capital owned 609,000 shares and a further 75,000 shares subject to a warrant held by W. J. Sanders. The 184,000 shares were purchased on the open market for \$4,223,087, or \$22.95 each. Total investment to date: \$26,723,087. *Siemens (Germany)* purchased 9.7M shares of newly issued Litronix stock, for \$0.77 each in November, 1977. The money was used to pay Litronix bank debt (\$4.2M) and unsecured creditors (\$3.3M) at 35¢/dollar of indebtedness. After this original acquisition of 80% of Litronix stock, in September 1978, Siemens announced plans to offer \$3,625 for each of the remaining 2.4M shares, bringing Siemens total investment to \$16.2M. Offer officially rendered 12/20/78 to run through 1/22/79.

- NEC America*, a subsidiary of NEC Japan, purchased all 1.78M shares of Electronic Arrays stock for \$5.00 per share, subject to approval of shareholders. It was approved 11/29, effective 12/6/78. Total investment, \$8.905M.
- Robert Bosch GmbH (Germany)* purchased 749,000 shares of authorized, but previously unissued, shares of AMI stock for \$19 each in June 1977. Proceeds were used to pay bank debt and establish cash excess. The total investment was \$14.23M, or 25% ownership. Borg-Warner later acquired half of Bosch's shares.
- Commodore International Ltd. (Bahamas)* acquired 86% of MOS Technology in a stock exchange. November 1976. The traded 64,462 shares of Commodore stock plus \$143,000 in notes in November 1976. In 1977, MOS Technology purchased the balance of the stock from shareholders for \$66,000. Presently, MOS Technology is a subsidiary of Commodore Business Machines, Inc. (U.S. firm) which, in turn, is a subsidiary of Commodore International Ltd. (Bahamas).
- Sign Development Corp.*, a subsidiary of N.V. Philips Corporation through the U.S. Philips Corp., merged with Signetics. Each Signetics shareholder received \$8.00 per share, or a total of \$43.85M for 5.48M shares outstanding. Merger occurred June 1975.
- Ferranti Ltd. (Great Britain)* purchased all shares of Interdesign for about \$3.5M, or greater than \$4.66 per share in November 1977.
- Commodore International, Ltd. (Bahamas)* paid approximately \$10M for Frontier, Inc. a Costa Mesa, CA, MOS manufacturer, shareholders and creditors, in September 1977.
- Northern Telecom, Inc.* Subsidiary of Northern Telecom, Ltd. (Canada) purchased 605,940 shares of Intersil for \$3,973,770 from RCA (400K shares), Hales Bros. (76K shares), and approximately 130K on the open market. To this they added 20K shares of preferred stock, Series B, each convertible to 20 shares of common stock, and 30K shares at \$120 each of private issue, Preferred Stock Series D, each of which was convertible to 10 shares of common stock. Total investment to date: \$10,865,629 for 1,314,493 common share equivalents, or 24% of voting shares.
- N. V. Philips (Netherlands)* is sole owner of Amperex, Inc.
- Maruman.* Mansei Kogyo Kabushiki Kaishi (Japan), single investor, 1975. Total investment to date, estimated at \$2.7M with eventual dilution to about 60% of ownership.
- Micropower.* Daima Seikosha (Japan), otherwise known as Seiko: \$3,135,000, plus loan guarantees, plus and unknown amount of about \$250,000; for 1,947,000 shares, or 77% ownership; July 1, 1971, initial investment (\$2.1M converted to stock in 1976).
- Supertex.* Major holdings, percent unknown, are by Hong Kong interests. Founded in May 1976.
- EXAR.* 53 percent owned by Toyo Electronics (Japan). Formed in 1972. Initial Toyo investment was in loans, loan guarantees and stock with approximately \$1,073,000.
- Solid State Scientific.* VDO (Germany), purchased in (1977) 264,200 shares at \$8.50 and \$2,301,800, 7 years, 7½, convertibles (at \$8.50). (Total \$4.5M and 25% ownership.)
- Siliconix.* Lucas (GB) purchased 465,898 shares (24%) for an estimated \$13 share, or \$6.1M.
- Monolithic Memories.* Founded 1969 with Northern Telecom owning 12.4% interest. Investment believed to be about \$285,000.
- Amdahl.* Fujitsu owns 29.4%, plus manufacturing agreements, joint ownership, plus short-term loans, maintenance guarantees, etc. 1,768,750 totals:
 1972—10,000 shares, at \$0.06/share, or \$600.00 total.
 1972—Convertibles, \$5,000,000 at \$16.67.
 1972—310,000 shares, \$6,200,000.
 1974—\$77,100,000 loans.
 1975—\$11,487,500, 9 percent convertibles.
 1976—1,448,750 shares at \$27.50; or \$39,840,625.
- Niedorf (Germany)* also purchased 300,000 shares (1972) for \$6,000,000; this currently constitutes about 5% of total shares outstanding.

Source: Dataquest, Inc., January, 1979.

TABLE 16A.—FOREIGN ACQUISITIONS IN AND MERGERS WITH U.S. SEMICONDUCTOR MANUFACTURERS, 1975 TO PRESENT

Year	U.S. company	Foreign company/country	Foreign ownership
1969	Monolithic Memories	Northern Telecom Ltd/Canada	12.4 percent.
1971	Micropower	Daima Seikosna (Seiko)/Japan	77 percent.
1972	Exar	Toyo Electronics/Japan	53 percent.
1975	Maruman	Mansei Kogyo Kabushiki Kaishi/Japan	100 percent (since reduced to 60 percent).
1976	Signetics	N. V. Philips/Netherlands	Merger.
	Supertex	Hong Kong interests	Not available.
	MOS Technology	Commodore International Ltd./Bahamas	85 percent (since increased to 100 percent).
1977	Frontier	Commodore International/Bahamas	100 percent.
	Intersil	Northern Telecom Ltd./Canada	7.5 percent (since increased to 24 percent).
1978	Interdesign	Ferranti Ltd./United Kingdom	100 percent.
	American Microsystems, Inc.	Bosch/Germany	25 percent (half of interest since acquired by Borg-Warner).
	Litronix	Siemens/Germany	80 percent (since offered to acquire remaining 20 percent).
	Advanced Micro Devices	Siemens/Germany	20 percent.
(ND)	Solid State Scientific	VDO/Germany	25 percent.
	Siliconix	Lucas/United Kingdom	24 percent.
	Electronic Arrays	NEC/Japan	100 percent.
(ND)	Amperex	N. V. Philips/Netherlands	100 percent.

Source: Dataquest, Inc.

C. INADEQUACY OF LEGAL RELIEF

Many executives in the American semiconductor, computer, and telecommunication industry argue that part of their present difficulties arises from foreign government's restrictions on market access and unfair competition. As noted, access and market penetration in the United States are linked through economies of scale. By restricting U.S. firms' access, other governments grant their nationals economies of scale; economies of scale enable foreign firms to reduce costs, cut prices, and market their products more aggressively. This section suggests that the existing remedies for foreign trade barriers and unfair competition, under international, Japanese, and U.S. law are inadequate, although the U.S. industry may not have fully exploited its existing legal options.

1. REMEDIES UNDER INTERNATIONAL AND JAPANESE LAW

This writer's interviews (12) in Japan suggested that the principal remaining problems of market access are tariff staging, customs and procurement practices, Japanese governmental subsidy policies, and American access to governmental research and development programs.

a. Tariffs

Japan's tariffs impose a 12 percent additional cost on American semiconductor imports. Given the intensity of competition in the Japanese market the additional cost can have significant competitive consequences. Under the Multinational Trade Codes (MTC) of 1979 tariffs of the signatories will be staged to parity within eight years. The agreement makes it politically difficult to ask Japan to accelerate staging, although such a request would certainly be permissible under international law.

b. Customs

Foreign importers in Japan charged that Japan's customs practices and procedures imposed particularly high costs. The principal problems are:

i. *CIF versus FOB valuation.*—Japan unlike the United States follows the practice of many other countries by assessing tariffs on a CIF rather than an FOB basis. Because the costs of insurance and freight are not insubstantial, Japan's tariffs burden American exports to Japan more than American tariffs burden Japanese exports to the United States

ii. *Drawback.*—Japan's short statute of limitations often denies rebates on rejected semiconductor chips and other products.

iii. *Drop shipment.*—At times Japanese customs officials assess American products manufactured offshore and repatriated to the United States in bond at the higher rate applied to U.S. exports, and not at the lower rate applicable to goods from the country of origin.

iv. *Uplift.*—It is alleged that Japanese customs officials in some cases arbitrarily assign a higher than stated value to American semiconductor, computer, and other products.

v. *Nonuniformity.*—Customs procedures and practices until recently have been uncertain and not uniform.

Articles 1-8 of the MTN Customs Code establish procedures to determine the fair value of imported goods, and Article 11 requires the signatories to accord a basic right of appeal. These provisions may mitigate arbitrary uplift, which has been an important American grievance in Japan.

This writer does not have sufficient information to judge whether Japan's uplift practices violate Article 1-8. Under Article 19 an aggrieved party can request consultations and Article 20 empowers the Committee on Customs Valuation to investigate the complaint. After the investigation is completed, an aggrieved party may withdraw concessions with consent of the committee.

Although the Customs Code does not explicitly address drawback and drop shipment, these practices could be construed "to nullify or impair" (Article 19) Japan's obligations under the code, and therefore to entitle the United States to the above relief (13).

c. Procurement

Japan's market in government procurement constitutes a significant economic opportunity for American computer and telecommunications firms. If Japanese companies are given exclusive access to this large market, they will capture economies of scale and learning that will enhance their competitive positions. The United States obviously should continue to press Japan to sign the Procurement Code and ensure that the NTT family and the other public corporations (*kōdan*) that purchase electronics equipment are included under its provisions.

The Procurement Code, however, may have only a limited effect on the Japanese Government's procurement policies and practices. Much of Japan's procurement is decentralized, making discovery of violations difficult. Moreover, Japan has widely employed single source

tenders, which are permitted under the code. Finally, remedies even for confirmed violations are uncertain.

d. Access to government research and development programs

As discussed, American firms including those domiciled in Japan as well as United States-Japanese joint ventures have until recently been excluded from participating in Japan's VLSI and other advanced research and development programs. They have thereby been denied the patents and know-how generated by these programs (14).

One could argue that Japan's flat prohibition on access violates Article V.1 of the 1953 Treaty of Friendship and Commerce, which states:

Article V

1. Neither Party shall take unreasonable or discriminatory measures that would impair the legally acquired rights or interests within its territories of nationals and companies of the other Party in the enterprises which they have established, in their capital, or in the skills, arts or technology which they have supplied; nor shall either Party unreasonably impede nationals and companies of the other Party from obtaining on equitable terms the capital, skills, arts and technology it needs for its economic development.

2. The parties undertake to cooperate in furthering the interchange and use of scientific and technical knowledge, particularly in the interests of increasing productivity and improving standards of living within their respective territories.

It is not clear that MITI's position "discriminates" against foreign firms since some Japanese companies are also excluded, although all the major Japanese manufacturers participate. Also unclear is whether the technology in issue is "needed" for economic development.

Since Japan has implemented the Treaty, an aggrieved foreign firm can request relief for violations of Article V in the Japanese courts. Under Japanese law a claim under the treaty would be considered superior to conflicting domestic law or practice.

The U.S. industry has a basis for other private relief. The Japanese Government cannot constitutionally impair the value of existing contracts; moreover MITI's prohibition seems to violate foreign firms' existing property rights (*seisanken*). Foreign firms also have contractual rights under their cross licensing agreements with Japanese firms. These cannot be violated without compensation. MITI's position on the VLSI patents most likely will not shield the Japanese licensees from liability for breach of contract under Japanese law.

2. REMEDIES UNDER U.S. LAW FOR DUMPING AND PREDATORY PRICING

a. Private relief

Officials of the U.S. semiconductor industry charge that Japanese firms have supported their drive for the 16K RAM market by two tier pricing. It is alleged that to capture the 16K RAM market Japanese firms cut their U.S. prices 25 to 50 percent below the prevailing Japanese market price, and that this strategem cost these firms \$500,000 in 1979 on five contracts.

Dumping or predatory pricing are illegal under the Trade Act of 1974, the Trade Agreements Act of 1979, and the antitrust laws (15). These statutes provide remedies designed precisely to address the industry's concerns. The remedy for dumping is a charge in the amount of the dumping margin. A private party may be awarded treble damages for injuries suffered from predatory pricing.

Yet such litigation takes time and the burden of proof can be onerous. Time is of the essence because in some segments (e.g., computer main frames, microprocessors) market share once lost is rarely regained; dead firms are seldom revived. Although the new trade laws are intended to permit import relief for dumping before actual material injury occurs and where a threat of injury is real, the burden of proof is often very great (16). The burden of proving predatory pricing can be even greater.

Despite those impediments relief has been granted under both theories. As of this writing, it is apparent that the U.S. industry has not vigorously exercised its rights under these statutes.

b. Traditional U.S. Government options

Under existing law the United States can take a variety of actions to protect its markets from unfair or overly aggressive foreign competition. These measures include voluntary restraint agreements, orderly market arrangements, trigger pricing, quotas, surcharges, and other remedies implicit in sections 301 and 337 of the Trade Act of 1974. Often these options have not proved satisfactory; more significant is the fact that trade in semiconductors, computers, and telecommunications poses special problems for their use.

The most usual means of handling analogous trade problems has been the orderly marketing arrangement, or its less formal equivalent, the voluntary restraint agreement. These measures are designed to arrest a trade problem at the border and they have in the past afforded some interim relief. The central problems with these arrangements, however, are that they misallocate resources, and often are easily avoided and politically difficult to revoke. An orderly marketing arrangement is even more difficult to police in semiconductors, because of the dispersion of the industry offshore and the small volume and weight of semiconductors that permit their being sent air freight.

Semiconductors present particular difficulties for strategems like trigger pricing, which depend on determining a fixed price. Essentially the trigger price was an administrative ploy to accelerate the remedies under the antidumping laws; some observers note that it has proved of questionable effectiveness and efficiency in managing foreign imports of steel. A trigger price will be of limited value in coping with Japanese competition in semiconductors. First, it will be extremely difficult to identify an appropriate price, because of the uncertainty of the data, the industry's propensity to forward price, and the sharply declining cost curves of most firms. Second, the rapid technological change in the semiconductor industry will require continuous review and updating of the trigger price. Proposals for a surcharge on foreign semiconductor imports, calculated either by unit or ad valorem, will also need to address these concerns.

Part II has suggested that perhaps the most important question presented by foreign competition in semiconductors, computers, and telecommunications is whether over time the United States could lose its influence over the development of this vital technology. Existing legal options will not correct this trend. Of course, if foreigners refuse to supply state of the art technology, the United States could pass legislation to compel companies within U.S. jurisdiction

to register and, if necessary, license all patents. Moreover, any unfair advantage secured by vertical integration could at least be checked by requiring open bidding on telecommunications and computers sales. Yet these remedies will not correct the more fundamental problem of the demise of U.S. technological leadership.

In sum, although the U.S. Government possesses a range of traditional options such as orderly marketing arrangements and trigger pricing, these measures will only temporarily harass foreign competition; they will not provide a cure. The problem demands a new perspective.

REFERENCES

- (1) See David S. Landes, *The Unbound Prometheus*, (1969).
- (2) This is the conclusion the French government has recently reached. See Simon Nora and Alain Minc, "Report on the Computerization of Society" to the Board of Financial Examiners (translation) 1976; also Daniel Bell, "The Coming of the Post Industrial Society" (1973, 1976).
- (3) A fourth effect is industrial synergism. The decline in price of a silicon chip is closely associated with a corresponding decline in computing costs. Many commentators attribute the computer industry's spectacular growth to the essential attributes of silicon technology: increasing speed and reliability, and decreasing costs and size. Conversely the expansion of the American integrated circuit industry, particularly in the case of FET memories, has depended on the presence of a large, innovative, and "local" computer market eager to deploy its semiconductor capabilities.
- (4) To some extent the cost-reducing effect of learning curves, economies of scale, density, and industrial synergism, are offset by the increasing costs of energy and some types of productive equipment and labor. For example, crystal growing consumes electric energy; the costs of productive equipment needed to grow crystals, to manufacture "masks," or to fabricate wafers are also rapidly rising. Electron beam equipment used for masks today costs approximately \$1.5 million; the next generation of "fast direct-write" electron beam devices is estimated at \$2 million each. The industry's cost of production will continue to rise as more expensive automated equipment is used in manufacturing.
- (5) Of course such action would invite retaliation and might somewhat be thwarted by mandatory registration, cross licensing, or by other legal means. In the future the line between industrial and military large scale integrated circuits may become increasingly blurred.
- (6) A final argument against "letting the market decide" begins with the observation that we do not operate within a free market. As Part I has described, the market for semiconductors, computers, telecommunicators in Japan has been subjected since the early 1950s to many barriers (as indeed it has in Europe and the United States.) "Letting the market decide" is more an apology for the inefficiencies of the status quo than it is a defense of neoclassical economic theory.
- (7) U.S. Department of Commerce estimate.
- (8) This estimate does not include import figures. Since 1978 the Bureau of the Census has computed these statistics separately. With parts included, the share of the U.S. consumption attributable to Japanese imports exceeded 1 percent in 1978. However, the reader should note that a high percentage of the value of these imports during the same period originated in U.S. subsidiaries in Japan. Thus only a fraction of these imports can be attributed to indigenous Japanese computer firms. This is reflected in the Japanese share of the U.S. installed base, which is estimated in Table 14. Table 14 suggests that the Japanese share was in fact less than 1 percent in 1978.
- (9) At the same time output per equipment is increasing rapidly, which should to some extent offset rising costs.
- (10) But see explanation in reference 8 on differences in United States and Japanese trade statistics and accounting practices.
- (11) Science Magazine reports that IBM took more than 10 percent of all 16K devices manufactured in 1979. See, "Perilous Times for U.S. Microunit Makers" (vol. 208, May 9, 1980, p. 586). Some commentators note that the failure of the U.S. semiconductor industry to make needed investments in the 1974-75 recession demonstrates how an effective industrial policy might have made an important difference.

(12) In mid-August 1979 I spent 2 weeks in Japan interviewing the president or chief executive officer of 15 American semiconductor, computer, and telecommunications firms operating in Japan; I also interviewed officials of several Japanese high technology companies.

(13) Article 19 states:

"1. If any party considers that any benefit accruing to it, directly or indirectly, under this Agreement is being nullified or impaired or that the achievement of any objective of this Agreement is being impeded, as a result of the actions of another party or parties, it may, with a view to reaching a mutually satisfactory solution of the matter, request consultations with the party or parties in question. Each party shall afford sympathetic consideration to any request from another party for consultations.

"2. The parties concerned shall initiate requested consultations promptly.

"3. Parties engaged in consultations on a particular matter affecting the operation of this Agreement shall attempt to conclude such consultations within a reasonably short period of time. The Technical Committee shall provide, upon request, advice and assistance to parties engaged in consultations."

(14) As noted, the Japanese Government recently appears to have liberalized its earlier position on foreign access to the VLSI patents. Yet the larger issue of foreign access to all such programs remains unsettled. The reader must also recognize that given the pace of technological change, MITI's delay may have accorded a substantial benefit to Japanese firms. Another emerging problem will be the extent of copyright protection for semiconductor "masks."

(15) See generally, P. Areeda and D. Turner, "Predatory Pricing and Related Practices Under Section 2 of the Sherman Act," 88 Harv. L. Rev. 697 (1975); P. Joskow and A. Klevorick, "A Framework for Analyzing Predatory Pricing Policy" 89 Yale L.J. 213 (1979).

(16) For a critique of the new trade codes see, L. Jacobs and R. Hove, "Remedies for Unfair Import Competition in the United States," 12 Cornell International L.J. 1 (1980). Jacobs and Hove argue that despite the acclaim accorded them, the practical effect of new codes is minimal.

Part III: A Strategy for U.S. Policymakers

A. A NEW PERSPECTIVE

The United States can best respond to the problems identified in Part II by constructing a new approach to American industry. The strategy should include:

1. A program to enhance the productivity and international competitiveness of high technology industries. In the beginning it might make sense to focus on semiconductors, computers, and telecommunications and then expand the program to other industries where the United States has, or is expected to have, a competitive advantage.

2. The preparation of a set of projections of alternative futures for the U.S. economy. The projections could serve as a framework to place existing fragmented policies on international trade, domestic productivity, energy, environment, labor relations and other fields within a larger national perspective.

3. The establishment of appropriate domestic supporting institutions.

4. A new bilateral and multilateral initiative to meet the promotion of high technology industries in Japan and Europe.

Many will argue first that this strategy heralds a new wave of governmental interference in the market, at a time when less, not more, intrusion is required; and second, that there is no economic justification for targeting high technology industries. I wish to meet these criticisms before turning to the specifics of my proposal.

1. WE NEED AN EFFECTIVE INDUSTRIAL POLICY FOR THE SAME REASONS THAT THE JAPANESE AND EUROPEANS DO

Our careless attitude toward economic security during the post-war period surely is out of step with the rest of the world. As noted, to most Japanese, economic security is as important and palpable a concern as military (national) security is to most Americans. The 1979 amendments to the Export Administration Act evidence the beginning of the Congress' recognition of the need for realignment.

We need an effective industrial policy for the same reasons that the Japanese and Europeans do: to assure a continuing supply of strategic resources; to accelerate positive market trends; to reduce waste; to promote efficiency; to anticipate shortfalls in supply and injurious perturbations; to create a climate of certainty, reliability, stability; to facilitate structural adjustment.

2. WE ALREADY HAVE AN INDUSTRIAL POLICY—IT IS JUST AN INEFFECTIVE ONE

We deceive ourselves in believing that our present approach to industry relies on the market. In many sectors we already have an industrial policy. It is just a bad one. In style it is ad hoc. Decisions are happenings, they are not the product of reasoned analysis; political

See references at p. 60.

exigency frequently dictates an outcome—witness the recent congressional bailout of the Chrysler Corp. or the 1979 energy plan. Often our industrial policies are internally inconsistent. Consider the administration's decontrol of gasoline prices and the simultaneous maintenance of quotas (1). Existing regulations are also replete with special dispensation—such as the oil depletion allowance or special financial incentives for the housing industry. Such measures are historical artifacts; there is no overarching purpose.

3. EARLY EXAMPLES OF A U.S. INDUSTRIAL POLICY

Many observers believe that the current debate on industrial policy is something new. This view ignores history (2). The United States has had a series of industrial policies at least since the subsidized construction of the canals and railroads in the 19th century (3).

The 20th century has witnessed one experiment with industrial policy after another. Recall the transformation of the Federal Trade Commission between 1914 and 1929 under Warren G. Harding's campaign slogan, "less government in business and more business in government" (4); the War Industries Board of 1918 and national reconstruction in 1919 under the short-lived Industrial Board in the Department of Commerce (5); the promotion of the bituminous coal industry in the 1920's and President Hoover's comprehensive vision of an "Associative State" (1921-28) (6); the Cotton-Textile Institute of the 1930's (7); and national economic planning under the National Industrial Recovery Act of 1933 (8).

Our interest in an industrial policy has developed episodically, usually in a time of crisis. These early efforts generally did not prove effective. Often they became prey to powerful special interests. But history need not always repeat itself. Today we can try to avoid the pitfalls of past experience and attain the benefits these early efforts sought.

4. AT TIMES U.S. INDUSTRIAL POLICY HAS PROVED SUCCESSFUL

Agriculture appears to be one field where some government policies have by comparison been successful (9). Prior to 1929 the principal government aid came through public land policy and through subsidized research to the State land grant colleges. After 1929, especially under the New Deal, a new era of direct aid to farmers began.

There have been five principal categories of governmental assistance to agriculture: (1) transfer payments to needy farmers (e.g., the negative income tax, social security retirement payments); (2) governmental programs designed to increase the demand for farm products or their real cost of production; (3) crop limitation programs (such as acreage allotments or crop quotas) that reduce supply and raise price; (4) purchase-loan storage programs to support farm prices; (5) purchase-and-resale differential subsidy plans (10); (6) the cooperative program wherein the government actively works with producers to market their products overseas.

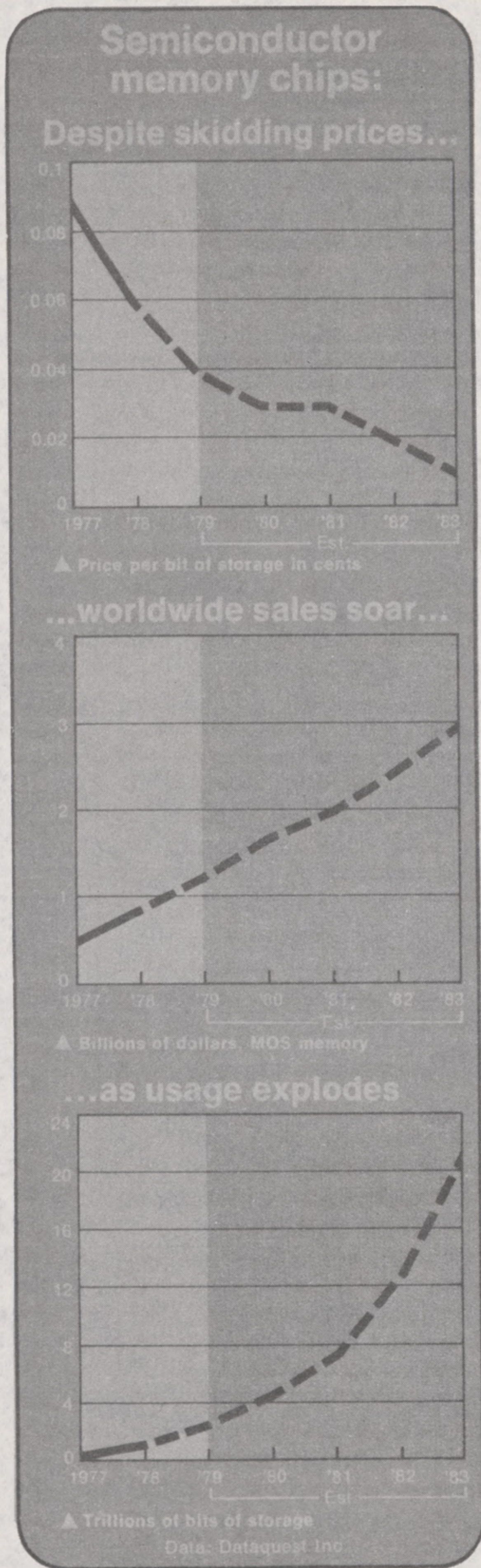
The relationship between the industry and government in general has been less adversarial than in other sectors. A case in point is the cooperation of the industry and government through trade associations such as the wheat or soybean growers association or the poultry and egg institute in the export of surplus farm production (11).

5. THE UNITED STATES IS STILL A WORLD LEADER IN SEMICONDUCTORS, COMPUTERS, TELECOMMUNICATIONS AND OTHER HIGH TECHNOLOGY PRODUCTS

Semiconductors combine high growth, profitability, and a versatility perhaps unknown to any other industry in recent years (12). For example, Chart 5 indicates how world-wide sales of semiconductor memory chips are rising sharply as their usage in automobiles, color TV sets, and many other products multiplies. Table 17 suggests that the U.S. industry will maintain its high rate of growth through 1981.

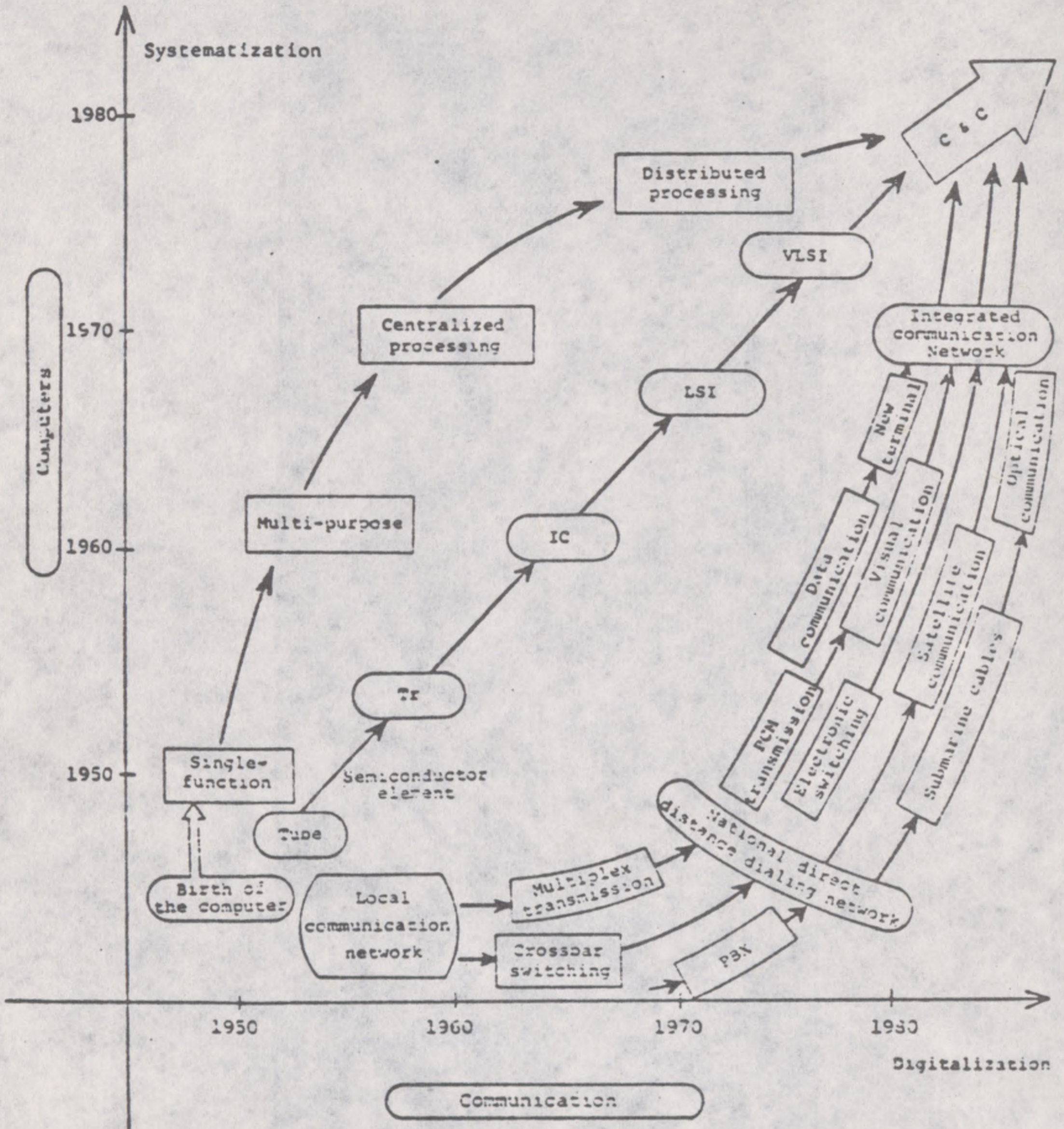
Is it not wiser to invest more governmental attention in high technology industries, where the potential social return is great, and to devote less national resources to other industries that already are in decline (13)? To put the argument differently: granted that loss of world market share may be inevitable (and in some cases even beneficial to U.S. consumers), why should the United States permit foreign firms to dictate the pace of development of all state of the art technology—irrespective of whether these firms (or their governments) decide to deploy this advantage to our detriment? So important an event at least cannot be allowed to “happen” without broad public debate and scrutiny.

CHART 5



Source: Business Week, Sept. 3, 1979.

CHART 6.—The development of semiconductor, computer, and telecommunications technology in Japan



Source : Koji Kobayashi, reference 3, part I.

TABLE 17.—SEMICONDUCTOR FORECAST, 1979-81
[Dollar amounts in millions, annual growth in percent]

	1978	Annual growth	1979	Annual growth	1980	Annual growth	1981
United States.....	\$3,123	15.0	\$3,590	10.1	\$3,951	16.7	\$4,610
Europe.....	259	23.6	320	11.9	358	15.1	412
Japan.....	1,179	15.3	1,359	10.7	1,504	13.2	1,703
Other.....	289	12.1	324	10.8	359	14.8	412
Total.....	4,850	15.3	5,593	10.4	6,172	15.6	7,137

Source: Forecast prepared by the Semiconductor Industry Association, April 1979.

6. AN EFFECTIVE INDUSTRIAL POLICY MIGHT ACTUALLY REDUCE GOVERNMENT INTRUSION IN THE MARKET

It is popularly thought that an industrial policy will further bloat the Federal bureaucracy, and license even greater governmental bungling and intrusion into the market. In fact as Part III B and C will detail, it is possible that a sensible industrial policy might actually reduce intervention.

B. A SECTORAL POLICY FOR SEMICONDUCTORS, COMPUTERS, TELECOMMUNICATIONS, AND OTHER HIGH TECHNOLOGY INDUSTRIES

The reader should be aware of four considerations at the outset. First, specific measures for high technology industries are better developed in the context of a larger national effort to integrate existing fragmented policies on international trade, domestic productivity, energy, environment, labor relations, and other fields. Second, the measures to be discussed constitute some of the elements of a plausible sectoral industrial policy. This approach may not be the "best" way to proceed, but it seems sensible. Third, we should distinguish measures that are specific to the targeted industries from other measures, designed to stimulate overall productivity, which may entail incidental benefits to the targeted industries. Fourth, I am not convinced that the American semiconductor, computer, and telecommunications industries need to be subsidized further, whether by the tax laws, Federal guarantees, or by other means. This subject certainly will require intense public debate. In my opinion the ultimate decision would be improved by the perspective of the projections described in III C. For this reason the question of financial incentives is discussed on a theoretical level. I will offer more concrete suggestions on how existing impediments to productivity and international competitiveness can be removed.

1. FINANCIAL INCENTIVES AND THE PROBLEM OF CAPITAL FORMATION

Representatives of the U.S. semiconductor and computer industries repeatedly have testified that access to capital presents their paramount dilemma (14); that if the "gap" between the U.S. firms and their Japanese (and to a lesser extent European) competitors were eliminated, the continuing international competitiveness of the industry would be assured. Assuming that additional financial incentives is at some point deemed necessary, how might this assistance be best designed?

Three general approaches, a capital gains "rollover", tax credits (or other tax incentives), and Federal guarantees or reinsurance, have received greatest current attention. A rollover essentially defers the payment of tax; in this context it would apply to sales of stock when the proceeds of the sale are reinvested within a set time period. The idea is to stimulate the security markets; a more active market, it is thought, will bring venture capital to high technology and other industries.

There are several proposals before the Congress on the second option, tax credits. One proposal, S. 1065, offers an income tax credit to corporations for basic research; another, S. 1435, establishes a system of capital recovery for investment in plant and equipment; a third, S. 700, extends the investment credit to certain research and development expenditures.

A final approach is Federal loan guarantees or Federal reinsurance. Some industry analysts urge that the ceiling on Federal loans be calculated precisely to offset the high debt-equity ratios enjoyed by Japanese or European firms. Another variant, H.R. 2640, establishes a national corporation to finance loan guarantees for high risk ventures seeking to develop new technologies.

It is useful to assess these and related proposals under three criteria: (1) effectiveness; (2) efficiency; and (3) fairness. More specifically: (1) How closely related is the measure to its purpose? How likely is it to achieve its purpose? To what extent is governmental interference minimized? Is the measure consistent with other policies? (2) Are there less costly means available to yield the same benefits, or more beneficial means available at equal cost? (3) Does the measure distribute its burdens and benefits equitably, or is its impact borne disproportionately by the poor?

Of the three options, Federal guarantees may be the most effective. First, they are more closely linked to the desired activity than the rollover. Although the rollover has the blessing of administrative simplicity, there is no guarantee that many firms might not prefer short term, more speculative, higher yield investments. Hence there is no assurance that the measure would attain its end. On the other hand, tailoring the rollover to specific industries greatly increases its administrative complexity.

Second, Federal guarantees would seem more easily monitored than either the rollover or the tax credit and also more easily liquidated. Conversely, in the case of the tax credit, experience indicates that many firms will reclassify prior expenditures to qualify for the credit. In such cases the credit may not induce greater investment in research and development.

Third, there is some evidence that Federal guarantees have been beneficial in some cases. One apparent success was rural electrification, which was financed by the Rural Electrification Bank; another was the activities of the Reconstruction Finance Corporation (15).

It is not clear to this writer which of these three options is the most efficient. The tax credit and rollover could cost the public billions; yet these measures are administratively simpler than Federal guarantees. Although guarantees are administratively more complex, they may be cheaper. The real cost of guarantees is their administrative costs and the costs in defaults and in opportunities foregone. It is unlikely that the cost of defaults would be excessive, particularly if the private bank screened applicants carefully.

If we view the use of tax funds as regressive—as many theorists do—Federal guarantees seem the most equitable, for the same reason: there is the least risk to the Government coffers, because the Government can control the extent of its exposure. In sum, Federal loan guarantees appear intuitively to be the most effective; they may also be the most efficient and least regressive. But these are only

tentative thoughts on this complex subject. A separate, thorough study is obviously required.

2. DIRECT FEDERAL SUPPORT FOR RESEARCH AND DEVELOPMENT

Part II has suggested that if present trends in international trade and investment continue, foreign firms could come to control the development of state of the art semiconductor, computer, and telecommunications technology; and that these firms and their governments would then be in a position to influence significantly the overall pace and direction of U.S. industry. If policymakers decide that the United States must not relinquish control in certain state of the art technology, one option is direct Federal support for research and development.

To some extent the Department of Defense's Very-High-Speed Integrated Circuit (VHSIC) program already addresses this problem (16). The program will last 6 years, involves nine teams of semiconductor manufacturers (17), and will cost \$210 million. The major objective of the project is to develop technologies for which there is no present commercial and industrial need. The program will stress new architectural concepts that will minimize design customization and permit higher chip complexity.

The VHSI program has invoked mixed reviews. Some industry executives foresee significant commercial spinoffs from the program in the realm of signal processing for video, radar, and voice. For some smaller firms, the VHSI also represents an opportunity to reach a common goal by pooling resources where costs to the single firm would be prohibitive. Other companies like RCA, however, have withdrawn from the competition, believing that it will divert their best talent from more needed commercial applications.

There is a growing literature on the benefits of limited federal support to small business for research and development. According to a recent Senate report, small business and industrial inventors account for more than half of U.S. inventions and innovations (18). In real growth, high-technology industries expanded at a 6.7 percent compound rate from 1950 to 1974, while low-technology industries grew by only 2.3 percent (19). Output per employee in the former increases 4.0 percent, but only 2.0 percent in the latter; high-technology industries recorded 0.5 percent annual inflation versus 3.0 percent in low-technology firms. The rapidly modernizing industries expanded employment opportunities by 2.6 percent compared with 0.3 percent in the low-technology sector.

A sensible way for the Federal Government to support research and development in semiconductors might be to use existing trade associations such as the Semiconductor Industry Association (SIA), the Computer Business Equipment Manufacturers Association (CBEMA), the Electronics Industry Association and other industrial groups, as a sounding board to identify the new frontiers of generic semiconductor technologies. Examples of generic technologies that represented the state of the art in the late 1970's are bubble memories, e-beam lithography and other items covered in Japan's VLSI program. The Government would contract on an individual basis or with a team of firms (20) to research and develop the targeted technology (21). Upon its development, the Government would retain the patent, but grant an

exclusive license on reasonable terms, for a defined period to the contracting firm (or firms) (22).

The proceeds of royalty payments paid by the contracting researchers would be placed in a revolving High Technology Trust Fund. During the first years of its operation the fund would be allocated to research in semiconductors, but soon after it could be deployed for research in computers, telecommunications, aerospace, robotics, biological engineering and the host of other new high growth industries. Future allocations of the fund would be guided by the long term projections described in section III D. The High Technology Trust Fund would be subject to annual review by the Congress (23).

Essentially this proposal seeks to balance the need to reward innovation in order to create an adequate incentive with the objective of minimizing the burden to the taxpayer. Under the scheme the subsidy would be reduced to the extent that the Government retains the patent and recoups a royalty. The entrepreneur is rewarded by an exclusive license, economies derived from experience, a right to sublicense, and the opportunity for standardization of the product (24).

3. INTERNATIONAL TRADE AND INVESTMENT POLICY

a. Reexamining export policy in high technology

Regulatory and administrative controls entail the same economic consequences as barriers to market access (25). They impose institutional costs and make American goods internationally less competitive. By ceding market share to lower priced foreign goods, U.S. export policies grant foreigners economies of scale. As we have seen, economies of scale permit foreign firms to lower prices, increase market share and earnings, expand research and development efforts, and move ahead in the production of state of the art technology. There is an extensive literature in the United States on regulatory disincentives to exports and on how Americans traditionally have failed to exploit business opportunities abroad.

High technology poses particular difficulties for export policy that have not been adequately assessed. For example, the commercial and military applications of semiconductors, computers, and telecommunications products and productive equipment are becoming increasingly entwined. This would suggest an even greater need for surveillance and safeguards. Yet equally important is how perceptions in the United States and the rest of the industrialized world diverge over the relative importance of military versus economic security. As noted Japan (and to a lesser extent the major European powers) places greater importance on economic security than does the United States, and this perception has motivated Japan's policy of decoupling export controls from political considerations. Japan, France, and Germany have been able to capture a major share of the market for high technology products in communist countries. U.S. military safeguards further compound the difficulties for American exporters, because today, unlike the 1950's and 1960's, commercial, not military, technology defines the state of the art.

According to a recently released report by the Office of Technology Assessment, American exporters of high technology products face four principal sets of problems (26). The first is the comparative restrictiveness of U.S. export controls. Because of differing national

interpretations of COCOM rules, U.S. export controls often bar American businessmen from exporting products, which their Japanese and European competitors are permitted to supply. The report notes that although the impact of U.S. export controls on the international competitiveness of American companies has not been estimated, the regulations are "by no means a predominate factor" in lost business opportunities.

A more important cause is the comparative difficulty Americans experience in obtaining Government credits, guarantees and insurance. The report points out that since the selection of turnkey plant suppliers is highly dependent on financing, U.S. exporters have been disadvantaged in these transactions.

The report cites two other serious impediments, delays and inadequate administrative guidance on policy. It states that U.S. exporters have been virtually unanimous in their condemnation of delays, and that such cases, although few in number, are increasing. The report also suggests that too much discretion is allowed mid-level administrators, and that technical and political experts should be permitted a greater voice in licensing determinations.

These problems can be usefully addressed in two ways. First, it is imperative that the objectives of the 1979 amendments to the Export Administration Act be accurately reflected in the preparation of new regulations and in their implementation. The new amendments are sensitive to the need for realigning economic and military priorities and to some extent would remedy the problems of cumbersome export controls, delays, and policy guidance.

Second, the Department of Commerce, the Office of Technology Assessment, or some other appropriate body, should commission a study of the impact of high technology on the nation's economic and military security. The study would assess the possibility and consequences of diversion in light of changing strategic relationships; it would also evaluate the economic impact of present regulatory disincentives, focusing not only on semiconductors, computers, and telecommunications, but also on the range of new industries, targeted by Japanese and European industrial policies.

In addition to removing existing disincentives as described above, should the U.S. Government also affirmatively promote exports of high technology and other products? After all, increasing exports will reduce the U.S. deficit in the balance of payments, strengthen the dollar, create jobs in the export sector, and curtail foreign firms' expansion of market share and production base.

At present there is a discrepancy between U.S. and foreign practice. A recent report (27) notes that in comparison to other major industrialized nations, the United States has failed to provide advice or assistance to firms doing business abroad. U.S. exporters may purchase only governmental insurance against political and commercial risks. Our major trading partners provide optional inflation, exchange rate, and performance bond insurance. Foreign governments offer a variety of specific tax incentives such as special exemptions, deferrals, and deductions for exports. The only specific tax incentive the United States offers is DISC.

The Treasury Department, the Department of Commerce, or some other appropriate Government agency, should review the influence that foreign export incentives have on the international competi-

tiveness of the American semiconductor, computer, telecommunications and other vanguard industries. This study would help us design export promotion measures that will serve, rather than undermine, an evolving national industrial policy.

b. Encouraging direct foreign investment

The progress of countries like Japan in high technology raises the question of whether the U.S. Government in general, and the Treasury Department in particular, should actively encourage a reverse flow of technology. The present policy of neutrality should be reconsidered where direct foreign investment will: (1) lead to the transfer of state of the art technology to American firms; (2) enhance domestic employment opportunities; and (3) contribute to other important national objectives.

The principal objection in the past to such proposals has been that other countries will retaliate. But most other industrialized countries for years have made the acquisition of key foreign technology a national priority. A second objection derives from existing concerns about favoring one sector over another. This argument has already been discussed in III A.

If Federal guarantees are extended to domestic high technology firms, it might make equal sense to extend Federal loan guarantees to joint ventures established in the United States by foreign and U.S. firms. Consider the case of such a venture organized for the purpose of research on new integrated circuit technology. The entity might qualify if the applicant demonstrated: that future inventions and other work product would devolve to the American partner, new jobs would be created, and other important criteria satisfied.

Even a cautious change in Federal policy probably would invigorate present State efforts to attract foreign investment. New York, for example, has recently launched an ambitious program to encourage domestic and foreign firms in targeted (high technology) industries to relocate in the State. In addition to existing tax and other incentives, New York has adopted an analytic marketing approach which provides prospective investors with the costs and benefits of locating in various sites in the State and other information. According to State officials, a change in Federal policy would strengthen the State's efforts to create a business environment attractive to high technology firms.

C. PROJECTING THE FUTURE OF THE U.S. ECONOMY

We have suggested that foreign competition in semiconductors, computers, and telecommunications could have a profound infrastructural impact on the United States; that the costs and benefits of sharing world leadership in these industries with the Japanese and Europeans are yet to be assessed; and that we know little about the thresholds at which foreign competition could begin to affect out national interests adversely. Because we ill understand what part of our present problems in these industries is due to differences in industrial structure, and what part is a classical trade conflict, we are unsure what remedies will be most appropriate and effective. Our confusion arises from a deeper problem, the absence of a framework to make such decisions. And this deficiency grows from our failure to define a national purpose.

It would therefore be useful to construct alternative long term projections of the future of the U.S. economy (28). These projections could serve as a basic frame of reference for congressional and executive decisionmaking. The projections would identify under different assumptions which industries are mature and productive, which are growing rapidly or likely to become internationally competitive, and which are declining or stagnant. These indicators would then be considered beside a statement of national economic and social needs. The assessment would address constraints in energy, environment, labor, land and capital, and could detect how external factors (domestic and international) hamper the formation of "optimum" industrial structure(s). It would also identify ways in which the international competitiveness of U.S. industry might be enhanced, particularly through the creative development of technology. The assessment would be revised and submitted each year to the Congress and the President.

Essentially the assessment would assess the classic questions posed by Abraham Lincoln in his famous "House Divided" speech: "If we could first know *where* we are, and *whither* we are tending, we could then better judge *what* to do and *how* to do it."

Specifically it would help:

- promote understanding of national priorities and identify areas deserving national investment;
- identify ways in which industrial, energy, and environmental policies can be mutually reinforcing (29);
- detect waste, inefficiency, and inequity in existing fiscal, monetary, and regulatory policies and thereby provide a basis for their improvement;
- improve coordination between the Executive and the Congress;
- facilitate positive adjustments where the market is too static to stimulate such adjustments;
- refine statistical data and promote compatibility of data banks;
- anticipate trade conflicts in high technology and other industries and analyze their structural causes;
- assess the effectiveness of domestic and international remedies; and
- create opportunities for more productive bilateral and international collaboration.

There are, of course, serious objections to the preparation of these projections. A principal objection is that an assessment would be tantamount to national economic planning. The debate on national economic planning recurs periodically and each side has its distinguished proponents (30). But the debate is not pertinent here. The projection would be merely a vision of future trends, a tool to provide an explicit rationale for Government interventions in the market, interventions that too often are made on an ad hoc basis. The vision would not require the creation of a new complex administrative apparatus such as the national economic planning commissions proposed by the Balanced National Growth and Development Act of 1973 (31). Nor would it mandate any new wave of governmental regulation.

Others will criticize the choice of identifying high growth industrial sectors that "are or will be internationally competitive." "Why is this choice not better made by the market?" some will ask. The answer is the assessment does not replace the market, it supplements it.

If these projections fail to mandate action, why should anyone pay attention to them? Some will point to the earlier experience under the National Environmental Policy Act (NEPA) where few administrative agencies chose to heed the findings of an environmental impact statement, despite the soundness in some cases of their own analysis. Yet at least with NEPA the courts could step in to compel action, but in the instant case judicial review would not be available.

Although the impact of the assessment cannot easily be predicted, this proposal can be distinguished from the approach of NEPA. Unlike NEPA, the projection would not advance a specific (environmental) interest, nor would they seek to force agencies to subordinate allegiances to new competing concerns; they merely established a reference point.

The initial success of the document will depend on how seriously the Congress and the President regard it. Ultimately, however, the skill and wisdom that it reflected would be its only guarantee of long term acceptance.

A final major objection to the idea of long term projections is that by creating a standard, these projections will discourage excellent, innovative firms from surpassing the indicated targets. Other countries have addressed this problem with some success. The beginning of a solution is to create incentives adequate to reward the most innovative companies.

Who should prepare these projections? In my opinion a definitive answer to this question should be deferred at present, although one can offer certain guidelines. The government will need to be involved, but government officials need not, as in Japan, be responsible for preparing the document. The economists' perspective, although important, should not be permitted to dominate. Scientists, experts on energy, labor, environment, law and other disciplines will also play a part. Those responsible for formulating this vision must have access to the key decisionmakers to be effective, but their independence must be preserved. It might even be sensible for more than one private entity to prepare the projections because competition might improve the quality of the final product and provide some check on the process' vulnerability to co-optation.

D. INSTITUTIONAL CONSIDERATIONS

An effective industrial policy draws its vitality from its supporting institutions. Japan recognized this principle in the early 1960's by establishing special institutions (a new division within MITI, special advisory bodies, governmental laboratories, and other governmental, quasi-governmental and private agencies, centers, and associations) to supplement the keiretsu and federations like Keidanren. These new bodies did not assure the success of the Japanese Government's policies. But they certainly reduced the risk of major errors.

The design of an effective industrial policy in the United States will demand a partial restructuring of U.S. governmental institutions. Two important issues in this connection are: (1) how to improve and expedite decisions within Government; and (2) how to bridge the existing gaps in understanding between the policymakers and the technical experts; and the executors of policy (the deputy assistant secretaries and office chiefs) and their counterparts in industry.

The following ideas are introductory suggestions on a complex subject that requires separate in-depth consideration.

At the highest level of Government there is at present a need for a body in the Office of the President that would coordinate industrial policy throughout the Government, that would work closely with the Congress, and that would perform a vital clearance function. One option would be a new office, like the Office of Balanced Growth and Development, proposed by Senators Humphrey and Javits in 1973. That Office was to include the Attorney General, the Secretaries of Housing and Urban Development, Agriculture, Interior, Commerce, Defense, Labor, Transportation, and Treasury; the Chairman of the Board of Governors of the Federal Reserve System; the Director of the Foundation of the American Future; the Chairman of the National Citizens Council on the American Future; the Chairman of the Domestic Council; the Director of the Office of Management and Budget; the Director of the Office of Emergency Planning; the Chairmen of the Environmental Quality Council, the Interstate Commerce Commission, the Federal Power Commission, the Federal Communications Commission, the Civil Aeronautics Board, and the Atomic Energy Commission; and the Director and Deputy Director of the Office. The director and deputy director of the Office would be appointed by the President, with the advice and consent of the Senate. The Office would have assessed national industrial needs, goals and priorities; evaluated the effects of present and proposed Federal tax incentives; and performed a wide range of other functions related to national industrial policy (32).

A less ambitious, but perhaps ultimately more effective and feasible, alternative would be simply to augment the existing functions of the Council of Economic Advisers and/or the Economic Policy Group in the White House. This option would avoid the time, expense, and controversy necessitated in creating a new administrative appendage.

There is also a need for a broadly based citizen advisory group, which would perform similar functions to Japan's Industrial Structure Council. The U.S. counterpart would include Government officials at the assistant secretary level, the chairmen of the board of the major corporations (33), prominent scientists, economists, lawyers, sociologists, and representatives of labor unions, small business associations, consumer, environmental and other groups. Unlike Japan, the U.S. Industrial Policy Council would also include the chairmen of the pertinent congressional committees and subcommittees in order to forge a vital missing link between the Executive and the Congress.

The Industrial Policy Council would have various industrial sectoral subcommittees, which would include assistant or deputy assistant secretaries, the senior policymakers of the respective industries, and their counterparts in the Congress. A final tier of technical experts within Government and the industry would serve as advisors to the subcommittees. It seems sensible in this connection to review the contribution of the industrial sector advisory committees (ISAC's). The ISAC's were created for the Kennedy round of the Multilateral Trade Negotiations where they provided valuable expertise on technical questions. Consideration should be given to revitalizing the ISAC's linking them to the subcommittees of the Industrial Policy Council, and giving them a greater voice in policy formulation.

In the past the creation of new agencies to mobilize industry has meant more bungling, inefficient, less responsive government. The history of the co-optation and politicization of the Federal Trade Commission after 1925 is only one of many examples. In my opinion the Federal and multistate regional planning commissions contemplated by the Balanced National Growth and Development Act of 1973 would have proved complex and cumbersome and ultimately would have been ineffective. An Industrial Policy Council, however, could avoid the waste and other pitfalls of a ponderous new bureaucracy, while fostering greater cooperation between the Executive, the Congress, industry, and the general public.

E. THE BILATERAL AND MULTILATERAL DIMENSIONS OF A U.S. INDUSTRIAL POLICY

The implementation of a U.S. industrial policy will have important consequences on our trade relations with Japan, Europe, and other countries. This section focuses on the problem of market access in Japan, particularly in semiconductors, computers, and telecommunications. It offers concrete suggestions on how access might be promoted and what institutions would facilitate this adjustment. Finally, it proposes the creation of a new working group on industrial policy and high technology within the Organization for Economic Cooperation and Development (OECD).

1. JAPAN

a. Introductory considerations

At the outset the case of Japan should be distinguished from the problems posed for the United States by the Europeans and some developing countries.

First, the Japanese market for semiconductors, computers, and telecommunications is the second largest in the world.

Second, although barriers to market access in Japan are surpassed in some instances by those of some developing countries, Japanese trade barriers have been more onerous than those in Europe (34).

Third, Japan has substantially increased its market share at the expense of U.S. industry.

Fourth, the United States has a growing negative balance in trade with Japan (and not with Europe) in telecommunications and integrated circuits.

Fifth, Japan has until recently been reluctant to make technology developed under its VLSI program available to American firms despite the possible coverage of some items under existing cross licensing agreements.

Sixth, the International Trade Commission reports that Japan has spent more than any other country in acquiring foreign semiconductors, computers, and telecommunications equipment, but at the same time has invested only marginally by comparison with other countries in U.S. semiconductor, computer, and telecommunication firms. (According to the ITC report only 3.1 percent of direct foreign investment in this industry has been from Japanese sources.) Japan's contribution to employment in this industry has thus been minimal.

Seventh, although most European countries are developing their own industrial policies, Japan's long range plans most directly conflict with industries of strategic importance to the United States.

Eighth, Japanese companies enjoy access to credit, government guarantees, special tax incentives, loans, and subsidies in the service of the nation's industrial policies, which give these firms an advantage over their American and European competitors.

These considerations suggest that U.S. policymakers should pay particular attention to Japan within the framework of a broader multilateral response.

b. Market access in Japan

i. A caveat

Part II has listed the principal remaining problems of access to Japan's market in semiconductors, computers, and telecommunications. These include tariffs, various customs practices and procedures, government procurement policies, and denial of access to the fruits of government research and development programs (35). As noted, access is important first because the Japanese market constitutes a significant economic opportunity for American firms, and second because denial of access permits Japanese firms to capture economies of scale and learning that enhance their competitive position.

Although significant barriers remain, this writer's interviews in Japan in August 1979 produced results that appear inconsistent with how the "access problem" is generally perceived in the United States. Most respondents felt that the home office's perceptions of current difficulties have been distorted; virtually all executives interviewed emphasized that their operations were growing and extremely profitable. Moreover, respondents in Japan did not view certain issues as serious constraints to their businesses. For example, there are frequent complaints in the United States that Japanese firms have an unfair advantage because of intragroup sales relationships. It is also alleged that the major Japanese computer companies can sell chips in the open market in Japan at prices substantially below the prices these firms charge their own subsidiaries. Virtually no one interviewed in Japan considered the disguised subsidy to pose a serious restraint on trade.

American industry officials assert that direct regulatory controls and "administrative guidance" frustrate the establishment of manufacturing operations in Japan, restrain production, and chill aggressive price competition. According to virtually all respondents, administrative guidance simply does not constitute a serious impediment to doing business in Japan. Moreover, almost all respondents emphasized that the Japanese distribution system does not pose particular difficulties to the import of semiconductors, computers, and telecommunications equipment. Most respondents suggested that the charges that the Japanese Government harasses foreign firms and fails to protect proprietary information are either exaggerated or simply unfounded.

How may we explain the discrepancy between the reports in the United States and Japan? Some of the industry's allegations in the United States may be exaggerated; or possibly a few American companies in the past have encountered each of these problems, and their experience has been exaggerated to the point that it is now seen as a general problem. A third explanation offered by many people is that most perceptions in the United States about the present difficulties of access are based on the experiences of American firms in Japan

before the computer industry was liberalized in 1976. Many of these practices have since been discontinued. Finally, it is possible that many American executives living in Japan have resigned themselves to Japan's barriers to access. What their home office consider to be "unacceptable interferences," these executives may now accept as a fact of business life.

U.S. policymakers must also recognize that institutional and cultural factors may now exert a more powerful influence on the U.S. market position in Japan than residual restraints on trade. These factors include the extent to which Japanese firms invest in the training of their employees, the dedication and esprit of these employees, the company's commitment to lifetime employment, the skill of many electronics and other companies in subcontracting, thereby in deploying other people's assets to further their own corporate objectives; the interlocking banking and industrial affiliations that assure easy access to loans, guarantees, and credit; the cultural preference of most Japanese companies to prefer Japanese products (36).

These aspects of the Japanese business environment only underscore how essential it is for Americans wishing to succeed in Japan to bind themselves as closely as possible to the existing power structure. The most successful electronics and other firms in Japan have appointed Japanese nationals as presidents of the Japanese subsidiaries, and have placed former high ranking MITI officials on their boards of directors. They have retained wise corporate counsel and have formed strong partnerships with the major banks and retail networks.

Yet even the most successful executives cautioned that the United States may never regain market share in Japan, no matter how forcefully the U.S. Government presses the industry's claims with the Japanese Government, no matter how sensitive Americans become to the peculiarities of doing business in Japan. Foreign market share once lost, they noted, is rarely ever regained, especially where, as in Japan, the industry is vertically integrated. In their view "natural" competitive forces will henceforth check foreign penetration.

ii. Specific recommendations on market access: A coordinated U.S. Government strategy

The U.S. Government should continue to discuss its concerns over global trends in semiconductors, computers, telecommunications and other high technology industries with Japanese Government and industry officials. A coordinated, sustained, articulate high level U.S. Government interest may prove more productive than developing lists of specific NTB's and corporate complaints. At the same time specific major issues of access remain and these problems require the U.S. Government to devise an interagency strategy. These issues include tariff staging, Government procurement, customs valuation, and access to the fruits of Japanese Government sponsored research and development programs.

Staging.—This year the Diet approved the MTN package. By agreement Japan is permitted an 8-year period to conform its tariff schedules with those of other countries. Given the intense competition in the Japanese market, Japan's 12 percent tariff imposes a significant burden on American semiconductor firms seeking access to the Japa-

nese market. Since the Japanese industry is already mature, the tariff no longer seems necessary. The U.S. Government should signal its interest to Japan in reopening the issue of staging. Alternatively, it may be more sensible to approach this issue multilaterally and to assault the 17 percent duty of the European Community at the same time.

Government procurement.—Although Japan's procurement practices can be approached in the current NTT negotiations, the issue should be addressed more broadly. This is because Japan's policies to promote telecommunications are predicated on more generalized restrictions on procurement in hardware, software, and services. The policy should be challenged on a generic and sectoral basis.

Customs valuation.—These issues should be handled through the new MTN customs valuation code. Since customs officials are accorded broad administrative discretion, it is counterproductive for the U.S. industry to seek to undermine the authority of the Japanese Customs Bureau. U.S. exporters must deal with customs issues patiently, establish relationships of mutual trust with customs officials, and enlist the support of the Embassy more than they have in the past.

Access to Government-sponsored research and development.—This is an area where some progress is reported. For example, in January 1980 the Japanese Government announced that it would open all patents to items developed in its VLSI program. The Embassy should continue to monitor this issue to assure that existing government programs and future programs are also opened to foreign participation.

c. Bilateral working group(s) on industrial policy

The current problems of high technology and industrial policy will require continuous review, consultation, and negotiation because these issues will remain of highest importance to the United States and Japan. The tasks of study and consultation should be the responsibility of new bilateral working groups.

Existing institutions, the Trade Facilitation Committee (TFC) and the Trade Study Group (TSG) are unable to play this role. First, although the TFC and TSG undisputedly have served a useful function by investigating and mediating current complaints, the energy of both groups is too diffusedly employed. Industrial policy demands the focused attention of a higher body. Second, the TFC is understaffed and underfinanced. It does not possess in-house expertise on these issues; it is subject to political influence; it is too low level for either the U.S. or the Japanese Government to allow it to influence the issues at stake.

The simplest and most direct way to handle these issues would be for the sectoral industrial subcommittees of the two nation's Industrial Policy Councils (or working groups organized under the subcommittees) to meet annually, or perhaps biannually. These bilateral working groups would help: identify deficiencies and gaps in existing data; air current grievances; educate the participants; facilitate structural adaptations to diminish pressure for protectionist action; and regularly review and assess government policies and practices to assure their compliance with the GATT and other international agreements.

2. A NEW SUBCOMMITTEE ON INDUSTRIAL POLICY AND HIGH TECHNOLOGY WITHIN THE ORGANIZATION FOR ECONOMIC COOPERATION AND DEVELOPMENT (OECD)

Japan is not the only country whose industrial policies pose problems for the United States. Indeed all the major European powers are actively pursuing their own industrial policies and in some cases these countries have erected trade barriers against American semiconductor and other high technology products that equal those of Japan. For these reasons a new working group should be established within the OECD, preferably within the existing Industrial Policy or Science and Technology Committees. The group might be organized along the lines of the bilateral committees and could perform many similar functions.

REFERENCES

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(2) See, for example, Alfred Chandler, *The Visible Hand* (1977).

(3) See, Schreiber, *The Ohio Canal Era* (1965).

(4) G. Davis, "The Transformation of the Federal Trade Commission, 1914-1929," 49 *The Mississippi Valley Historical Review*, 437 (1962).

(5) R. Himmelberg, "Business, Antitrust Policy, and the Industrial Board of the Department of Commerce, 1919," 44 *Business History Review* 1 (1968); also R. Himmelberg, "The War Industries Board and the Antitrust Question in November 1918," 52 *The Journal of American History* 59 (1965).

(6) Ellis W. Hawley, "Secretary Hoover and the Bituminous Coal Problem, 1921-1928," 42 *Business History Review* 247, (1968).

(7) L. Galambos, "The Cotton-Textile Institute and the Government: A Case Study in Interacting Value Systems," 38 *Business History Review*, 202 (1964).

(8) E. Hawley, *The New Deal and the Problem of Monopoly* (1966). E. Hawley, Herbert Hoover, "The Commerce Secretariat, and the Vision of an Associative State, 1921-1928," 61 *The Journal of American History*, 116 (1974).

(9) I have not been able to locate any studies of the effects on productivity and the distributive consequences of a completely laissez-faire policy in agriculture.

(10) P. Samuelson, *Economics* (1976), p. 413.

(11) See generally, W. Cochrane, *American Farm Policy 1948-1973* (1976).

(12) Sales of some companies such as Intel have increased more than a hundred-fold in the last decade. *Business Week*, April 14, 1980, p. 92.

(13) See "The U.S. Semiconductor Industry," A Report by the U.S. Department of Commerce, September 1979; also, "Innovation, Competition, and Government Policy in the Semiconductor Industry," Charles River Associates, Inc., March, 1980. I do not intend to suggest that in some narrowly defined areas adjustment assistance and other relief may not be necessary for limited periods of time, particularly to alleviate the hardship of unemployment.

(14) This is the same conclusion reached by a recent study conducted by the Financial Policy Division of Chase Manhattan Bank, "U.S. and Japanese Semiconductor Industries: A Financial Comparison," June 9, 1980.

(15) The Reconstruction Finance Corporation played some role in mitigating the impact of the depression and was instrumental in switching industries from peacetime to wartime production. It also succeeded in creating new industries (synthetic rubber) and markedly expanding others (aluminum).

(16) Leonard R. Weisberg, "The New DOD Program on Very High Spot Integrated Circuits (VHSI)" (undated); also "Defense Department Fires Up High-Speed Integrated Circuit Push," from *R. & D., Military/Aerospace*, editor John Miklosz (undated).

(17) Systems/Semiconductor Manufacturing Teams in Phase 0 of VHSIC (amounts in millions):

GE/Intersil, Stanford University, Analog Devices, Tektronix, \$0.51;

Hughes/Signetics, Research Triangle Institute, Burroughs, Stanford University, Cornell, University of Southern California, \$1.52;

Rockwell/Sanders Associates, Perkin Elmer, \$1.57;

TRW/Motorola, Sperry-Univac, GCA, \$1.36;

Westinghouse/National, CDC, Carnegie Mellon, \$1.21;
 IBM, \$1.02;
 Texas Instruments, \$1.27;
 Raytheon, Fairchild, Varian-Extrion, \$1.02;
 Honeywell/3M, \$0.81.

Source: Miklosz, reference 16.

(18) Some important contributions of independent inventors and small organizations in the 20th century:

Xerography: Chester Carlson.	Jet engine: Frank Whittle/Hans Von Ohain.
DDT: J. R. Geigy & Co.	Frequency modulation radio: Edwin Armstrong.
Insulin: Frederick Banting.	Selfwinding wristwatch: John Harwood.
Vacuum tube: Lee De Forest.	Continuous hot-strip rolling of steel: John B. Tytus.
Rockets: Robert Goddard.	Helicopter: Juan De La Cierva/Heinrich Focke/Igor Sikorsky.
Streptomycin: Selman Waksman.	Mercury dry cell: Samuel Reuben.
Penicillin: Alexander Fleming.	Power steering: Francis Davis.
Titanium: W. J. Kroll.	Kodachrome: L. Mannes & L. Godowsky Jr.
Shell molding: Johannes Croning.	Air conditioning: Willis Carrier.
Cyclotron: Ernest O. Lawrence.	Polaroid camera: Edwin Land.
Cotton picker: John & Mack Rust.	Heterodyne radio: Reginald Fessenden.
Shrink-proof knitted wear: Richard Walton.	Ball-point pen: Ladislao & Georg Biro.
Dacron polyester fiber "Terylene": J. R. Whinfield/J. T. Dickson.	Cellophane: Jacques Brandenberger.
Catalytic cracking of petroleum: Eugene Houdry.	Tungsten carbide: Karl Schroeter.
Zipper: Whitcomb Judson/Gideon Sundback.	Bakelite: Leo Baekeland.
Automatic transmissions: H.F. Hobbs.	Oxygen steelmaking process: C. V. Schwarz/J. Miles/R. Durrer.
Gyrocompass: A. Kaempfe/E.A. Sperry/S. G. Brown.	

Source: "Technological Innovation: Its Environment and Management," U.S. Department of Commerce, 1967, Chart 13, p. 18.

(19) See "Small Business and Innovation," Report of the Select Committee on Small Business, U.S. Senate October 15, 1978; also "Small Business and Innovation," Committee on Small Business, House of Representatives, August 1979. See also, Final Report of the Advisory Committee on Industrial Innovation, September 1979.

(20) Unlike Japan, joint research has generally been the exception rather than the rule in the United States. Despite the willingness of the Justice Department to use the affirmative business review letters, many firms are still chary of the antitrust implications of collaboration. For a good analysis of these and related questions, see Douglas H. Ginsburg, "Antitrust, Uncertainty and Technological Innovation," 24 *Journal of American and Foreign Antitrust and Trade Regulation* 635 (1978).

(21) Targeting, of course, raises difficult problems of definition and equity. For example, should software firms be included along with hardware manufacturers in defining the computer industry? In difficult cases the better policy would err on the side of inclusion.

(22) However, for a critique of the effectiveness of patent protection in stimulating innovation, see Eric von Hippel, "Appropriability of Innovation Benefit as a Predictor of the Functional Locus of Innovation," working paper, Sloan School, MIT, June 1979.

(23) This would obviously be necessary given the propensity of such funds to perpetuate themselves.

(24) A related question is whether there is a national need to promote the education of electrical engineers and other experts in high technology. Although I have not adequately researched this issue, the problem of training might well be handled as elsewhere by per capita and facilitation grants.

(25) The issue of access to foreign markets is discussed specifically in III E1b.

(26) A very good recent study is "Technology and East-West Trade," Office of Technology Assessment (1979).

(27) For example, see H. L. Weisberg and Charles Ranch, "A Comparative Study of Export Incentives in France, the United Kingdom, the United States, Germany, and Japan," December 1979; "Policies and Programs for Expanding U.S. Exports," "Recommendations of the Chamber of Commerce of the United

States, February, 1979; "The Effects of U.S. Corporate Foreign Investment" Business International Public Policy Series, 1970-77. S. 1003 is an example of recently proposed legislation to aid exporters by tax incentives.

(28) For some background on the applications of input-output analysis see, Wassily Leontief, Anne P. Carter, and Peter A. Petri, "The Future of the World Economy" (1978); W. Leontief, "An Information System for Policy Decisions in a Modern Economy" in *Business Disclosure: Government's Need to Know*, ed. Harvey J. Goldschmidt (1979). The U.S. Government already makes certain projections but on a limited basis. See, for example, the Labor Department's Career Survey and the Commerce Department's Industrial outlook. The private sector also regularly conducts such surveys, e.g., Business Week's outlook for the 1980's, etc.

(29) See, for example, the synergism between industrial policy, energy, and the environment resulting from advances in photovoltaic cells and related technology. See, generally, Joseph Merrigan, *Sunlight to Electricity* (MIT Press, 1980).

(30) See W. Leontief, "What an Economic Planning Board Should Do" in *Challenge*, July-August 1974. But see also, Bruce R. Scott, "How Practical is National Economic Planning?" *Harvard Business Review*, March-April 1978.

(31) See also the Full Employment and Balanced Growth Act of 1978, 15 USC 3101.

(32) A proposal submitted to the Subcommittee on Economic Progress of the Joint Committee describes the functions of the office as follows:

"Section 222—Functions of the Office

"This section would direct the Office to provide for and effectuate the policy direction and coordination of all federal and federally assisted programs for planning and land use development, to improve human resources, to allocate resources and to develop energy resources within the departments and agencies designated by the President. The Office would also be required to prepare an Annual Report on Balanced National Growth and Development; provide such additional studies and analyses of such reports as the President and the Congress might require; assess national needs, goals, and priorities; evaluate effects of present and proposed Federal tax incentives and State and local government tax policies upon the private industrial mix and location in the context of balanced national growth; evaluate all present and proposed Federal credit programs; and evaluate the effects of fiscal and monetary policies and other economic stabilization tools that may be adopted upon changes in income and the composition of economic production.

"With respect to ongoing and proposed programs within departments and agencies, the Office would have to evaluate the programs from a cost-benefit viewpoint; assign goals, plans, and programs to departments and agencies generally; and in coordination with the Office of Management and Budget, provide for the development of three-, five-, and ten-year program projections.

"Other functions of the Office would include the evaluation of regional and human resources in relation to projected development; the analysis of tradeoffs in adoption of alternative national growth policies; establishment of multi-state regional offices of the Office, to obtain regional and State implementation and input with regard to national goals and policies; the establishment, for purpose of coordinated planning and development, of representative multi-State regional bodies, and encouragement of the formation of multijurisdictions within States; the establishment of cooperative mechanisms, including tax policies and grants to obtain maximum participation of private industry in achieving the purposes of the Act; and the establishment of national growth policies, approved by the President, which would require the Office to participate in the review of agency and departmental budgets after they are submitted to the President or the Office of Management and Budget, but before submission to the Congress.

"In addition, in order to establish a nationally coordinated comprehensive planning process, the Office would have to engage in various activities, including: (A) supervision and coordination of activities of Federal Co-Chairmen of Regional Planning and Development Commissions provided for in the Act; (B) facilitating the use of common information and data bases for regional, State, and local comprehensive and functional planning; (C) provision of channels to facilitate exchange and consideration of planning information among planning agencies at all levels of government, to help achieve mutually consistent and realistic, growth policies; (D) monitoring the growth and development of regions, States and localities to compare planned and realized development, and make necessary adjustments in growth policies; (E) review of proposals for federally aided programs and projects for consistency with stated growth policies, in accordance with provisions of section 204 of the Demonstration Cities and Metropolitan Develop-

ment Act of 1966 and section 401(a) of the Intergovernment Cooperation Act of 1968 and of this Act; (F) review of planning requirements of all existing and proposed Federal programs for compatibility with the unified comprehensive planning system; and (G) periodically summarizing current and foreseeable needs for various types of Federal assistance as indicated by the comprehensive planning system.

"The Office would also be required to prepare evaluations of the yearly funding of the Office and of the Foundation on the American Future to be established under title X.

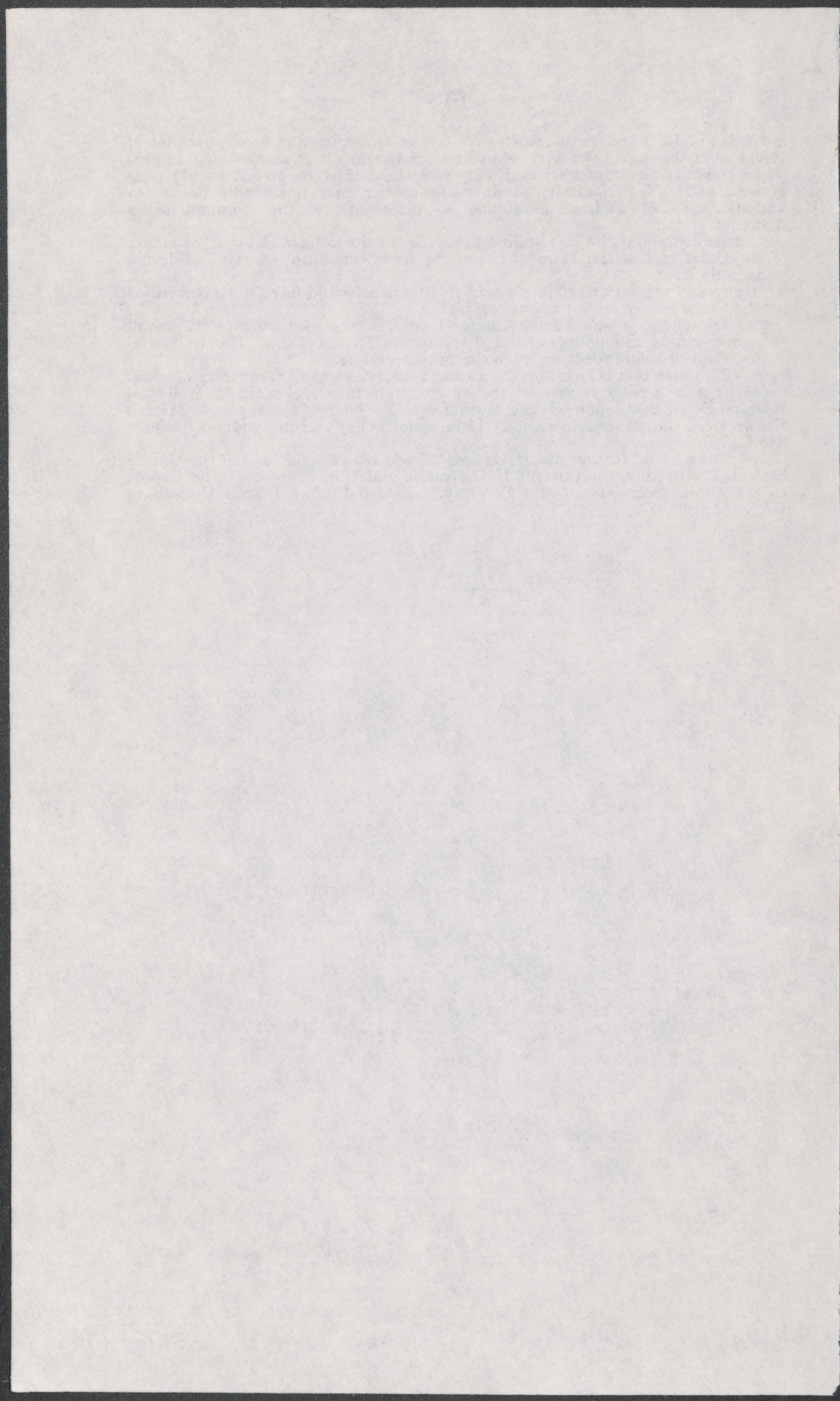
"Rules and regulations to implement its functions would have to be prescribed by the Office as soon as is practicable."

(33) Of course, to some extent there already is general discussion on overall economic trends and policy within the Business Round Table. The Industrial Policy Council would focus on more specific sectoral issues.

(34) This assertion is based on the author's interviews of U.S. industry officials.

(35) For a general review of the access problem see, Frank A. Weil and Norman D. Glick, "Japan—Is the Market Open? A View of the Japanese Market Drawn from Corporate Experience," 11 *Law and Policy in International Business* 845 (1979).

(36) For a useful further discussion see, "Trade Between Japan and the United States: The Setting, the Current U.S. Position and U.S. Prospects," the Report to the Under Secretary of the Treasury, prepared by the Boston Consulting Group, April 1978.



APPENDIXES

APPENDIX I

1. Cabinet Decision on Promotion of Use of Domestic Products

CABINET DECISION

SEPTEMBER 20, 1963.

In order for the Japanese economy, a part of the increasingly competitive international economy, to maintain its growth at the speed that the Government expects, it is required of the Government to carry out measures in various areas of the economy, keeping a balance in international payment, on the basis of voluntary cooperations of industrial and financial businesses.

Japanese people traditionally tend to esteem foreign products too highly. There are many instances that foreign products are used even when Japanese products of competitive quality, functions, design and price are available. This is especially true in the case of machineries where public faith, which is an important element of the competitiveness, in the Japanese products are extremely low since the years of experience on the part of both manufacturers and users are short. Even worse, as liberalization progresses from now on, this general tendency may get intensified.

SOURCE : MITI Gazette, Sept. 23, 1963.

2. Request for Cooperation for the Promotion of use of National Products

MINISTER OF MITI, HAJIME FUKUDA

SEPTEMBER 1963.

Following the Cabinet Decision for the promotion of use of National Products, the Government has decided to amend "the Special Budgetary and Accounting Measures" and to take new measures for promoting use of National Products in the Government and Quasi-Government agencies.

MITI has already had measures taken for the promotion of use of National Products, such as promotional campaigns through the center for the Proliferation and Promotion of National Products, loans for purchase of Machine Tools and Heavy Electrical equipments, and surveys and announcement of the performance of such machineries, domestic and foreign, as electronic computers, automobiles, etc.

The Government intends not only to try to enhance these promotional measures, but also to study on new measures to help further promotion of use of National products. Under the circumstances, we request your special cooperation in the promotion of the use of National products, in such ways as to get all of your member companies to thoroughly understand the Cabinet decision as well as the Government measures referred to above.

Based on the stated judgement, the Government and Quasi-Government agencies will take measures to encourage use of national products aiming at establishment of just public esteem of national products including machineries, prevention of foreign currencies from flowing out as a result of unnecessary importation and promotion of the domestic industries.

Cooperation in this Government's effort by prefectural and municipal Governments and also by financial and industrial businesses is hereby requested.

SOURCE : MITI Gazette, Sept. 23, 1963.

3. On the Discontinuance of the Cabinet Decision on Promotion of the Use of the National Products

CABINET DECISION

SEPTEMBER 1972.

Discontinue the Cabinet Decision of September 20, 1963 "Promotion of the Use of the National Products for Effective Utilization of Foreign Currencies, etc."

The electronic computers (including peripheral and other related equipment), however, remain to be treated the same as before.

(Official Cabinet Summary, published by the Cabinet Secretariat, 1972 volume, p. 143.)

4. On the Liberalization of Import of the Electronic Computers

DECISION OF THE CABINET MEETING

DECEMBER 19, 1975.

The measures have been carried out for some time until now to develop and strengthen the electronic computer industry, since it will become more and more important to the economy, society and life of the people of our country in the future.

At the import liberalization that will become effective on December 24 of this year, looking forward to self-reliance and future growth of the electronic computer industry of our country, the Government has decided to keep watching the trend of the electronic computer market so that the liberalization may not affect the national manufacturers adversely and the electronic computer market of our country may not be thrown into confusion.

The Government has also decided to ask a wide range of people in local as well as central governments, industries and financial businesses to understand and acquire proper knowledge of the national computers.

SOURCE: *Monthly Report of the Electronics Industry* (published by the Japan Electronic Industry Development Association), vol. 18, No. 1, January 1976.

5. On Liberalization of Import of the Electronic Computers

DANWA (INFORMAL TALK) BY THE MINISTER OF INTERNATIONAL TRADE AND INDUSTRIES

DECEMBER 19, 1975.

Our country has been actively promoting import liberalization in order to internationalize the economy. As a part of the same efforts, we have decided that the main frames of electronic computers and others are liberalized completely for importation as of December 24 of this year. This reduces the number of items of the list of residual quantitative restriction of import of our country by two to 27 items.

This import liberalization of the electronic computers is based on the judgment that, partly because of number of measures by the Government in the past, it is possible to let the electronic computer industry of our country stand by itself with feet fixed on the ground even after the import liberalization.

The electronic computer industry is a typical of the intelligence-intensive industry. It will increase the importance to the economy, society and people's life of our country in the future, and is expected to develop into a major export industry. It is upon this understanding that I request the industry to consolidate to do the best under internationalized environment on occasion of the import liberalization.

At the same time, the cabinet meeting has decided today the countermeasures to be carried out in the future as follows:

The Government should watch the trend of the electronic computer market, expecting self-reliance and future growth of the electronic computer industry of our country after the liberalization, so that the liberalization may not affect the national manufacturers adversely and the electronic computer industry of our country may not be thrown into confusion. It has been decided to ask local governments, industrial and financial businesses, not to speak of the Government agencies, to understand and acquire proper knowledge of the national electronic computers.

The Ministry of International Trade and Industries recognizes that it is essential for the self-reliance and development of the electronic computer industry of our country that the national computers get the reasonable share of the market

in our country. The Ministry has made it known that it will watch the trends of importation and installation of the electronic computer in the market of our country, and powerfully deploy various promotional measures such as promoting development of super LSI for the next generation of the electronic computers and securing rental fund for the national computers.

It is even more important after the liberalization that the national electronic computers receive proper understanding and get utilized. I would like to ask everybody concerned for sufficient cooperation in this regard.

SOURCE: *Monthly Report of the Electronics Industry* (published by the Japan Electronic Industry Development Association), vol. 18, No. 1, January 1976.

6. Facing the Liberalization of Import of Electronic Computers

RECOMMENDATIONS (SUBCOMMITTEE ON THE INFORMATION INDUSTRY OF THE INDUSTRIAL STRUCTURE COUNCIL)

DECEMBER 12, 1975.

1. The computerization in our country has been steadily developed, with the rapid technological innovation in the background, in not only industries but also every field of Japanese economy. As the needs of the nation for the computerization get even diversified under the restricted supplies of raw materials and energy resources, it has become an acute necessity to advance the computerization further.

The electronic computer industry is to become the core of the industry's structure of our country, as it is an intelligence-intensive, resource and energy-saving and pollution-free industry itself, and as it is vital to the computerization.

2. Because of such importance of the industry, various measures by the Government have been carried out to strengthen the competitiveness of the manufacturers of the national computers (JCM). This, together with manufacturers' own efforts, has made it a reality that the national computers get over half of the national market. However, as the liberalization of the capital investment in the electronic computer industry has recently become effective and importation will be liberalized soon, it is essential for continued healthy development of the electronic computer industry of our country that all the concerned brace up themselves, become one solid entity and face the problems.

3. The Government is requested to enrich promotional measures that have been in effect for some time, and to become active in developing such newly necessitated measures as helping development of super LSI for next generation of the electronic computers.

A keener competition is anticipated after the liberalization. As a result, healthy development of the electronic computer industry of our country can be hampered. It is necessary to consolidate the statistics systems to properly keep hold of trends of importation and installation on electronic computers after liberalization, so that proper countermeasures can be taken when significant harms to the national industries, such as rapid decrease of the market share of the national computers, are anticipated.

4. Enterprises of electronic computer industry of our country are requested in order to grow steadily in the harsh environment after the liberalization, to realize the needs for stepped-up management efforts, to concentrate in improving business health, to promote further cooperation among businesses and to establish single system of the industry for R. & D. as it becomes necessary.

5. It is necessary to reconfirm the continued preferential use of the national computers after the liberalization by the Government agencies in line with the cabinet decision of September 11, 1972. Positive cooperations of the agencies are requested. It is also necessary to study such measures, to insure actual effects of preferential use of the national computers as practiced by European nations.

It is requested that local government agencies, industrial and financial businesses also acquire deeper understanding of the national computers and cooperate in buying them.

6. The information processing industry is requested to promote with full strength, as the liberalization of capital investment comes in effect at the end of the year, improvement of technological capability and health of the business. In addition to enrichment of the present measures, it is requested to develop and promote actively the new measures to radically modernize and rationalize the software production.

7. MITI Minister Sends "Buy Japanese Computers" Request Letters to Public Sector, Utilities, and Banks

On March 10, 1976, MITI disclosed that it had sent letters signed by MITI Minister, Mr. Komoto, to local public organizations, financial organs, power industries, and educational institutions. In this letter, the MITI Minister asked the addressees to "promote the introduction of domestic computers to foster the domestic computer industry and to expand its share. The Minister asked them to use domestic computers to protect the Japanese computer industry from any sudden decrease in share due to full liberalization of computer imports, and, moreover, recently announced Japanese models have become comparable to foreign models in performance. This letter is one of MITI's efforts to protect the Japanese computer makers by securing new customers, along with subsidizing development of new computer models.

The full liberalization of computers became effective on December 24, 1975. Prior to liberalization, the Industrial Structure Council's Data Processing Industry Committee had made the following proposals.

(1) If the share of domestic computers falls quickly, some adequate measures must be taken.

(2) The industry must make all the efforts to strengthen the computer enterprise structure, to promote mutual cooperation, and to establish a good research and development system.

(3) Governmental and other public sector offices must give priority to domestic computers.

In response to these proposals, MITI said that some urgent measures (customs duties, safeguards) must be taken if the domestic manufacturers' share falls by 10% within a short period.

The share of domestic computers was 56.2% of as September 30, 1975. The share has been rising quickly. The share was 55.2% as of March 31, 1975. The share grew as much as 1% within only half a year. Recently, the share increase is especially obvious in the field of large models, although this has been a weak point in the Japanese computer industry.

However, foreign computers are used by many governmental, semi-governmental and public offices. Minister Komoto issued this letter in consideration that the domestic computer industry must be fostered and developed by giving a fair evaluation of its technological standards. That is, if a Japanese model is on an equal level as a foreign model, the Japanese model should be selected. The letter was sent to various organizations, educational institutions, banking organs and local public organizations. It asks to make a fair evaluation of the performance of domestic computers and to promote their installation.

The share of domestic computers in use at governmental and government-related offices, local public organizations, and various other organizations as of September 30, 1975 is given below.

	Installed units	Value in million yen	Value in million dollars	Share percent
Governmental offices.....	339	72,075	240.3	92.6
Government-related offices.....	562	170,310	567.7	95.6
Local public organizations.....	601	45,185	150.6	87.8
Cooperative societies and miscellaneous organizations.....	1,763	53,700	179.0	67.8
Universities.....	563	42,560	141.9	89.7
Financial institutions.....	3,882	382,938	1,276.5	24.5
Electricity, gas, and water utility services.....				23.4

Note: US\$1 = ¥300.

Source: Denki, Mar. 11, 1976.

APPENDIX II

The Law for Extraordinary Measure for Specific Machinery and Information Industries

Article 1 (Purpose)

The purpose of this Law is to promote specific machinery and information industries through the improvement of their production techniques, thereby contributing to the sound development of the national economy and facilitating the betterment of the people's living.

Article 2 (Definitions)

1. The term "electronic apparatus" shall mean in this Law the machines and equipment which draw upon the peculiar characteristic of electron movement by the use of electronic tubes, semi-conductor elements, and other similar components, as well as the components, parts, and materials which are chiefly used in such machines and equipment.

2. The term "machinery" shall mean in this Law machines and equipment (other than electronic apparatus), as well as (finished or half-finished) parts and components which are chiefly used in such machines and equipment.

3. The term "program" shall mean in this Law the programs which are referred to in Article 2, Paragraph 2, of the Law Concerning the Data Processing Promotion Association, Etc. (Law No. 90 of 1970, as amended).

Article 3 (Intensification Program)

1. The competent Minister shall establish a program for the intensification (hereinafter referred to as "the intensification program") of the businesses listed below (hereinafter referred to as "the specific machinery and information industries"):

- (1) The business of electronic apparatus manufacturing, but limited to:
 - a. The manufacturing of electronic apparatus whose production techniques have not yet been fully established in Japan and the acceleration of research and experiments (including prototype development; hereinafter the same except in Item (4) of the next Paragraph) on whose production techniques is of a particular necessity and, further, which are so designated by the Government Order;
 - b. The manufacturing of electronic apparatus whose industrial production is non-existent or is extremely low in terms of volume in Japan and the acceleration of the commencement of or increase in the volume of whose industrial production is of a particular necessity and, further, which are so designated by the Government Order; and
 - c. The manufacturing of electronic apparatus the acceleration of the improvement of whose performance and/or quality, of the reduction of whose production cost, or of the rationalization otherwise of whose production is of a particular necessity and which are so designated by the Government Order.
- (2) The business of machinery manufacturing, but limited to:
 - a. The manufacturing of machines the acceleration of research and experiments on whose production techniques is of a particular necessity in order to facilitate the prevention of hazards, the preservation of living environment, the rationalization of resources utilization, or the enhancement of machinery manufacturing business infrastructure (hereinafter referred to as "hazard prevention, etc.") and which are so designated by the Government Order;
 - b. The manufacturing of machines (limited to machines—but not parts and components—which are combined with a computer or other electronic apparatus and whose performance is substantially improved by being so combined) the acceleration of the commencement of or increase in the volume of whose industrial production is of a particular necessity in order to facilitate hazards prevention, etc. and which are so designated by the Government Order; and

c. The manufacturing of machines the acceleration of whose performance and/or quality improvement, of whose production cost reduction, or of the rationalization otherwise of whose production is of a particular necessity in order to facilitate hazards prevention, etc. and which are so designated by the Government Order.

(3) Software business (which is that of formulating programs in response to others' requests, but not that of chiefly formulating programs for processing data in a single specific field of business; hereinafter the same).

2. The intensification program shall set forth in it:

(1) With regard to the business of Item (1) a. and Item (2) a. of the preceding Paragraph, the matters of a. below and, when needed, the matters of b. and/or c. below which provide bases for the acceleration of relevant production techniques establishment:

a. The substance of research and experiments to be conducted and a target fiscal year for completion,

b. Matters concerning funds required for the research and experiments, and

c. Other important matters for the acceleration of the research and experiments.

(2) With regard to the business of Item (1) b. and Item (2) b. of the preceding Paragraph, the matters of a. below and, when needed, the matters of b. through d. below which provide bases for the acceleration of the commencement of or increase in the volume of said industrial production:

a. A target fiscal year for the commencement of said industrial production or the volume of production to be attained in a target fiscal year;

b. The kind and quantity of facilities to be newly installed;

c. Matters concerning funds required for the commencement of or increase in the volume of said industrial production; and

d. Other important matters for the commencement of or increase in the volume of said industrial production.

(3) With regard to the business of Item (1) c. and Item (2) c. of the preceding Paragraph, the matters of a. below and, when needed, the matters of b. through e. below which provide bases for the acceleration of production rationalization:

a. The level of performance and/or quality, production cost, and other rationalization targets to be attained in a target fiscal year;

b. The kind and quantity of facilities to be newly installed;

c. Matters concerning an optimum production scale, business collaboration, and/or specialization in product variety for production;

d. Matters concerning funds required for the rationalization; and

e. Other important matters concerning the rationalization.

(4) With regard to the business of Item (3) of the preceding Paragraph, the matters of a. and b. below and, when needed, the matters of c. through e. below (excluding those which pertain to the acceleration of formulation of only the *programs* for processing data chiefly in a single specific field of business) which provide bases for the acceleration of the improvement and rationalization of techniques for *program* formulation:

a. An objective of research and experiments on *program* formulation and other techniques improvement targets to be attained in a target fiscal year;

b. A *program* formulation cost and other rationalization targets to be attained in the target fiscal year;

c. Matters concerning business collaboration;

d. Matters concerning funds required for the acceleration of said technology improvement or rationalization; and

e. Other important matters for the acceleration of said technology improvement or rationalization.

3. The competent Minister shall, in establishing an intensification program, bear in mind inter-industrial mutual relationships among specific machinery and information industries and give necessary consideration so as to facilitate the effective promotion of such industries which are covered by or deeply related to the intensification program.

4. The competent Minister shall, when he has established an intensification program under the provision of Paragraph 1 above, announce the program without delay.

Article 4 (Program Modification)

1. The competent Minister, when he deems it particularly necessary to do so due to a substantial advancement in the technology of specific machinery and information industries or to a substantial fluctuation in the conditions of production or in economic circumstances, shall modify the intensification program accordingly.

2. The provisions of Paragraphs 3 and 4 of the preceding Article shall apply *mutatis mutandis* to the case of the preceding Paragraph.

Article 5 (Securing of Funds)

The Government shall use endeavors for the securing of funds to be designated by the intensification program as being required.

Article 6 (Instructions for Collaboration)

1. The competent Minister may, when he deems it particularly necessary for the attainment of rationalization targets set forth for such business by the intensification program, instruct those who are engaged in the business of Article 3, Paragraph 1 Item (1) c. or Item (2) c. (hereinafter referred to as "the to-be-rationalized business") to exercise the act of collaboration in terms of limitations pertaining to product specifications and/or technology.

2. The competent Minister may, when he deems it inevitably necessary for the attainment of the rationalization targets set forth for such business by the intensification program, instruct those who are engaged in the to-be-rationalized business failure to accelerate the rationalization of whose production is feared to cause serious hindrance to the sound development of the national economy to exercise the act of collaboration in terms of limitations pertaining to product variety (but not to product specifications) or in terms of the use of production facilities.

3. The competent Minister may, when he deems it particularly necessary because to his opinion it is d_____ for the act of collaboration in terms of limitations pertaining to product specifications provided for by Paragraph 1 above to accomplish such limitations with regard to electronic apparatus designated by the Government Order under the provision of Article 3, Paragraph 1 Item (1) c., or to machines designated by the Government Order under the provision of Item (2) c. of said Paragraph (these apparatus and machines shall hereinafter be referred to as "the to-be-rationalized apparatus"), instruct those who are engaged in the business (other than the to-be-rationalized business) of manufacturing electronic apparatus or machines using the to-be-rationalized apparatus as materials, parts, and/or components thereof to exercise the act of collaboration in terms of limitations pertaining to the product specifications of the to-be-rationalized apparatus which they use. However, the same shall not apply when to do so is not believed to facilitate the rationalization of the business of manufacturing electronic apparatus or machines using the to-be-rationalized apparatus as materials parts, and/or components thereof.

4. Instructions under the provisions of the three preceding Paragraphs shall be given in the form of announcement, indicating the period of time during which said act of collaboration is to be exercised and the substance of collaboration.

Article 7 (Substance of Collaboration)

The substance of collaboration provided for by Paragraphs 1 through 3 of the preceding Article shall conform to the following:

- (1) That it does not exceed the degree and extent essential to the attainment of the rationalization targets set forth by the intensification program,
- (2) That there is no fear of such collaboration unduly harming the interests of consumers at large, as well as of affected business enterprises, and
- (3) That it is not unreasonably discriminative.

Article 8 (Instructions Modification, Etc.)

1. The competent Minister shall, when he considers that the substance of instructions given under the provisions of Article 6, Paragraphs 1 through 3, no longer conforms to the Item of the preceding Article, modify or withdraw the instructions.

2. The provisions of Article 6, Paragraph 4, shall apply *mutatis mutandis* to the case of the preceding Paragraph.

Article 9 (Collaboration Report)

Those who have received the instructions provided for by Article 6, Paragraphs 1 through 3, shall, when they have put into practice the act of collaboration in compliance with such instructions (or, when modified under the provision of

Paragraph 1 of the preceding Article, instructions as modified), report the matters stipulated by the competent Ministry's Order to the competent Minister without delay. The same shall apply when they have changed or discontinued the practice.

Article 10 (Production Specifications Limitation Order)

The competent Minister may, when he has under the provision of Article 6, Paragraph 1, instructed those who are engaged in the to-be-rationalized business to practice the act of collaboration in terms of limitations pertaining to product specifications and when coming under either of the following Items, order them, by the means of his Ministry Order, to limit the production specification of the to-be-rationalized apparatus in accordance with said instructions:

(1) That the value of the to-be-rationalized apparatus which are produced by those who are practicing such act represents an adequate proportion of the total production value of the to-be-rationalized apparatus as a whole;

(2) That the business activities of those who are engaged in the to-be-rationalized business and received said instructions but have not put such act into practice constitute a serious obstacle to the attainment of the rationalization targets set forth for such business by the intensification program;

(3) That the limiting of product specifications of the to-be-rationalized apparatus is impossible or is extremely difficult by the instructions under the provisions of Article 6, Paragraph 3; or

(4) That the persistence of the situation referred to in Item (2) above is feared to have critical ill effect on the improvement of production system of said to-be-rationalized business and to cause a serious hindrance to the sound development of the national economy.

Article 11 (Exception to the "Anti-Monopoly Law")

The provisions of the Law Concerning the Prohibition of Private Monopoly and the Securing of Fair Trade (Law No. 54 of 1947, as amended) shall not be applicable to the act of collaboration exercised in compliance with the instructions given under the provisions of Article 6, Paragraphs 1 through 3. However, this exception shall not be available when an unfair means of transaction is used.

Article 12 (Regarding the Fair Trade Commission)

1. The competent Minister shall confer with the Fair Trade Commission when he is to give instruction under the provision of Article 6, Paragraphs 1 through 3, or orders under the provisions of Article 10.

2. When the competent Minister has received a report under the provision of Article 9, he shall notify the Fair Trade Commission to that effect without delay.

Article 13 (Exhortation)

1. The competent Minister may, when those who are engaged in the to-be-rationalized business or software business are recognized to have put into practice the act of business collaboration (or, in case of the to-be-rationalized business, either business collaboration or specialization in product variety; hereinafter referred to as "business collaboration, etc.") in accordance with the intensification program and the value of to-be-rationalized apparatus or the value of *programs* produced by those who are practicing said act represents an adequate proportion of the total production value of the to-be-rationalized apparatus as a whole or of the total production value of *programs* as a whole, whichever the case may be, and when the Minister fears that the commencement of new such business in a large scale or a large scale expansion of an existing such business by a person other than those practicing said act will have a critical ill effect on the exercise of business collaboration, etc. and to cause a serious hindrance to the sound development of the national economy, exhort such person to joining in the act of collaboration, to changing the date of said commencement or expansion, or to modifying the contemplated scale of the new business.

2. The substance of exhortation under the provision of the preceding Paragraph shall not exceed the degree and extent essential to the attainment of the rationalization targets set forth for such business by the intensification program and shall not unduly harm the interests of consumers at large, as well as of affected business enterprises.

3. The competent Minister shall, when he is to exhort under the provision of Paragraph 1 above a person who is planning such commencement or expansion, provide the person with an opportunity for him to express his views.

Article 14 (Tax Measures)

The State shall use endeavors to take necessary tax measures for the users of the electronic apparatus designated by the Government Order under the provision of Article 3, Paragraph 1 Item (1) b. (limited to electronic apparatus—but not

parts and components—which are combined with a computer or other electronic apparatus and whose performance is substantially improved by being so combined) or the machines designated by the Government Order under the provision of Item (2) b. of said Paragraph the acceleration of whose popular use is of a particular necessity.

Article 15 (Council Advice, Etc.)

1. The competent Minister shall seek the advice of the Aircraft-Machinery Industry Council when:

(1) He is to draft a Government Order under Article 3, Paragraph 1 Item (1) a., b., or c. or under Item (2) a., b., or c. of said Paragraph or when he is to draft an amendment to or the rescision of such Government Order;

(2) When he is to establish an intensification program under the provision of Article 3, Paragraph 1, or to modify the program under the provision of Article 4, Paragraph 1; and

(3) When he is to give instructions under the provision of Article 6, Paragraphs 1 through 3, when he is to give orders under the provision of Article 10, or when he is to effect exhortation under the provision of Article 13, Paragraph 1.

2. When the intensification program in the instance of Item (2) of the preceding Paragraph is that which pertains to software business, the Competent Minister shall consult with the heads of interested executive organs in the matter.

Article 16 (Collection of Reports)

The competent Minister may, to the degree and extent necessary for the enforcement of this Law, have those who are engaged in specific machinery and information industries or those who are engaged in the manufacturing of electronic apparatus and/or machines using the to-be-rationalized apparatus as materials, parts, and/or components thereof submit reports on their business or financial conditions following the provisions of the Government Order.

Article 17 (Competent Minister)

The competent Minister shall in this Law be the Minister of International Trade and Industry with regard to the business of manufacturing electronic apparatus designated by the Government Order under Article 3, Paragraph 1 Item (1) a., b., or c. and to software business, and, with regard to the business of manufacturing machines designated by the Government Order under Item (3) a., b., or c. of said Paragraph, the Minister having jurisdiction over the production of the particular machine.

Article 18 (Penal Provision)

Any person who disobeyed the orders given under the provision of Article 10 shall be punished by fine in amount not in excess of five hundred thousand yen.

Article 19 (Penal Provision, Continued)

The following shall be punished with fine in an amount not in excess of one hundred thousand yen:

(1) Any person who failed to make the report provided for by Article 9 or who submitted a false report; and

(2) Any person who failed to make the report provided for by Article 16 or who submitted a false report.

Article 20 (Penal Provision, Continued)

In case a representative of a corporation or an agent, employee, or other worker hired by a corporation or an individual has committed either of the acts of violation referred to in the preceding two Articles in connection with the business of the corporation or the individual, the penalty of said Articles shall apply to the corporation or the individual in addition to the punishment of the actual offender.

SUPPLEMENTARY PROVISIONS

1. (Enforcement Date) This Law shall be enforced as from the date of its promulgation.

2. (Invalidation) This Law shall become invalid as of the day on which a period of seven years counting from the enforcement date of this Law has elapsed. However, with regard to the application of penalties for acts committed before that day, this Law shall remain in force even after that day.



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