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ABSTRACT

A series of meetings was held to assess future problems in United States high technology, particularly in the fields of robotics, computers, semiconductors, and telecommunications. This report, which focuses on the computer industry, includes a profile of this industry and the papers presented by industry speakers during the meetings. The profile (prepared by Robert Eckelmann) assesses the industry's international competitive position, identifies important competitive issues, and presents options to address these issues. Issues focus on the systems concept, the skills shortage, research and development (R&D), software capabilities, and foreign targeting practices. Industry papers are: (1) "The Computer Industry: Restrictions and Performance Requirements" (Edson de Castro); (2) "U.S. Response to Industry Targeting Practices" (Stephen G. Jerritts); and (3) "U.S. Controls on International Trade" (John W. Lacey). Introductory material includes a list of 11 general issues which emerged from the meetings followed by a summary of issues related to the computer industry. Two issues noted are that the industry requires both the domestic and international markets to sustain its characteristically high level of investment in R&D and that the competitive problem needs to be addressed through domestic policies that improve the efficiency of the U.S. free market system. (JN)

High Technology Industries: Profiles and Outlooks

THE COMPUTER INDUSTRY

U.S. DEPARTMENT OF COMMERCE
International Trade Administration

High Technology Industries:
Profiles and Outlooks

THE COMPUTER INDUSTRY

U.S. Department of Commerce
International Trade Administration
April 1983

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INTRODUCTION

The High Technology Meetings

In the past two decades, economic development in the United States has increasingly depended upon high technology industries. The "high tech" sector has contributed significantly to economic expansion, employment opportunities, and national productivity. It has also become increasingly important to the competitiveness of other sectors. All indications are that its importance will continue and grow in the future.

The same trends are clear in other industrialized countries. Each in turn has recognized that its high technology capabilities may critically influence its long-term economic success. Out of this has grown an atmosphere of intensifying international competition in most high technology fields, and a keener awareness of the role that public policy plays in shaping and directing this competition.

In order to assess future problems in U.S. high technology competitiveness, the Secretary of Commerce held a series of meetings in January and February of 1983 attended by leading executives of four high technology growth industries and high-level Administration representatives. The four industries chosen were robotics, computers, semiconductors, and telecommunications. These four industries were selected because they are key sources of future growth and productivity for the U.S. economy. In addition, these industries all face significant problems associated with the "targeting" practices of foreign governments.

In his opening remarks, the Secretary stated that the meetings were designed "to explore the problems and challenges you face as an industry and to exchange views with you as to what the U.S. Government should -- or should not -- do in response to those challenges. We want to know what you see ahead and how you plan to respond as an industry. We also want to know if there are appropriate ways the government can facilitate your competitiveness."

The Department of Commerce found these meetings very useful. Important issues were discussed frankly. The Department regards the meetings as the beginning of a widened and improved process of communication between government and industry. The Department expects to arrange similar meetings with other industries.

This paper is one of a series of four publications containing statements and discussions of the problems these four industries face, as they emerged from the meetings. We believe these issues deserve continued wide discussion by an informed and interested readership. Each paper is devoted to one of the four industries and contains two major sections: an overview of the industry, and a second presenting the papers given by the industry speakers during the meetings.

Industry Profiles

The industry profiles present a brief assessment of the competitive situation faced by each of the four industries. Each profile is designed to:

1. assess the industry's international competitive position;

2. identify important competitive issues; and

3. present for discussion options to address these issues.

Presentations Made by Industry Speakers

The issues raised by the various industry speakers fell into two categories: first, issues common to more than one of the four industries and second, issues specific to the industry in question. A list of the general issues raised in the meetings as a group appears below, followed by an outline of the issues specific to the computer industry. The industry presentations discuss the specific issues in greater detail.

General Issues Developed from the High Technology Meetings

A total of eleven generic issues emerged from the four meetings. Each industry tended to rank the importance of the issues differently. The list below enumerates the issues raised during all the meetings in no order of priority:

- Access to foreign markets.
- Better U.S. Government response to foreign governments' targeting practices.
- Use of fiscal and tax policy to provide incentives for high technology R&D and applications.
- Dampening effect of present antitrust regulations.
- Export controls and licensing.
- Government support of research and development.
- Formulation of a U.S. industrial strategy covering both the domestic and international markets.
- Need for better technical-scientific education to ensure supply of qualified personnel.
- More assertive U.S. role in multilateral and bilateral trade negotiations
- Better support for Eximbank.
- Better export promotion.

Specific Issues Raised by the Computer Industry

Each industry's speakers focused on the issues of principal concern to their own industry. Thus, not all of the eleven issues listed above were raised in each meeting. Summarizing the issues particular to the computer industry:

- The industry requires both the domestic and international markets in order to sustain its characteristically high level of investment in R&D.

- Investment restrictions and performance requirements increasingly imposed by developing countries are serious protectionist barriers which could cause long-term injury to the computer industry. There should be a well-enunciated U.S. policy against investment restrictions and performance requirements.

- Foreign industry targeting policies have an adverse effect on U.S. commercial interests. The industry does not believe that the U.S. should adopt the industry targeting methods used by other countries. Rather, we need to address the competitive problem through domestic policies that improve the efficiency of the U.S. free market system, including the following:

  - Further removal of foreign trade barriers through bilateral and multilateral negotiations and stronger GATT enforcement mechanisms.

  - Strengthening tax provisions that affect research and development and U.S. exports, including permanent R&D credits, deletion of IRS Reg. 861-8, and a DISC substitute.

  - Development of long-term U.S. policy towards non-defense research to promote technological innovation in the commercial marketplace. The defense market is too small to provide adequate stimulus to widespread technological advance.

  - Removal of outdated restrictions on inter-corporate cooperation in R&D.

- Stronger multilateral mechanisms for denying militarily significant products and technologies to the USSR and other designated adversary countries are needed, while reducing product and technology controls on trade with countries agreeing to support similar controls on trade with adversaries.

- The U.S. should resist the temptation to apply export controls for reasons of foreign policy since history shows that such controls do not work when applied only by the U.S.

A Study of the Competitive Position of the U.S. Computer Industry

Prepared by:
Robert Eckelmann
Office of International Sector Policy
International Trade Administration
Department of Commerce
March 10, 1983

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PURPOSE

This profile is designed to:

1. assess the international competitive position of the U.S. computer industry;

2. pinpoint the major foreign and domestic challenges to American computer manufacturers; and

3. present for discussion possible options in terms of U.S. government policies affecting the sector's international standing.

SUMMARY

The computer industry has become a cornerstone of the American economy. Over the last ten years, every major indicator in this sector—sales, production, and employment—has shown strong and consistent growth. On an international level, U.S. firms have occupied a position of overwhelming superiority, controlling some 75-80% of the world computer market during the 1970s, while watching the nation's annual trade surplus grow from $1.16 to $6.84 billion.

But recent trends indicate that U.S. dominance is being increasingly challenged, with the stiffest competition coming from Japan. While overall U.S. performance remains quite strong, Japanese computer development, accelerated by extensive industrial targeting programs, has progressed beyond simple control of their domestic market to a growing international presence. Though Japanese interests and activity span the full range of computer products, they have enjoyed particular early success in specialized segments of the industry. But other constraints, including more limited Japanese capabilities in software and services, have thus far prevented these inroads from being translated into a pattern of broad penetration. How long this will continue to be the case remains a subject of intense debate.

Last year, the severe global recession interrupted the historically impressive statistical performance of computer markets everywhere, but most analysts expect the lull to be brief and look to the rest of the decade as a pivotal period for American manufacturers. Their annual sales already exceed $65 billion, and forecasts indicate that 1990 could see that figure pass the $200 billion mark. This kind of continued success will require that U.S. firms:

1) meet unprecedented price competition across the entire range of computer products, both at home and in traditional export markets;

2) continue to pioneer new technologies while anticipating and absorbing advances in component industries;

3) maintain their leadership position in terms of the software and services that comprise a growing share of data processing revenues;

4) continue to parlay these advanced capabilities into a progressive systems approach to the broadening range of computer applications; and

5) expand aggressively into new foreign markets, situated primarily in the developing world.

The American computer industry is certainly capable of meeting these challenges, and by all accounts, should retain an impressive overall competitive position for the forseeable future.

But trade has steadily gained importance as a share of U.S. producton, rising from 21.9% to 28.0% of output since 1972; at the same time, overseas subsidiaries remain a critical dimension of a healthy American computer industry. Therefore, as foreign programs more concertedly target computer development, and as a national computer capability evolves abroad into a more serious political, economic, and security concern, it will become imperative for private leaders and U.S. government officials to cooperate in:

1) assessing the magnitude and importance of whatever distortions might be introduced by such promotion;

2) seeking equitable access for American firms to the foreign markets involved; and

3) maintaining a U.S. policy stance that effectively incorporates the commercial interests, at home and abroad, of the American computer industry.

A number of options for possible USG action in response to the competitive challenges faced by the U.S. computer industry have been raised by various sources. These options are concerned with the following issues:

1) the U.S. response to foreign targeting practices that promote overseas competitors in computers;

2) USG policy on R&D, whether through public research, government support for academic and corporate activity, or tax treatment of R&D through the Economic Recovery Tax Act;

3) export controls on computer products;

4) the "skills shortage" - the problem of insufficient and inadequately trained manpower in computer fields.

DEFINITIONS

Due primarily to the rapid change that characterizes most high-technology fields, analysis of the computer sector presents a host of definitional problems. In terms of the area as a whole, the last few years have brought a gradual blurring of traditional distinctions between computers, telecommunications, and other "information industries", complicating even the simplest attempts to section off a discrete subject for study. Within the field, four powerful trends--dramatic improvements in computer capabilities, rapid evolution of their physical characteristics, steady expansion of their application and usage, and constant enhancement of their embodied price/performance ratios--have all necessitated constant modification of the standard labels used in computer product classification. Even then, the terminology always trails the marketplace. For purposes of simplicity and consistency, this analysis will adhere wherever possible to the following groupings:

Hardware ..... { Mainframe....over $100,000
Mini.....$10,000 to $100,000
Micro.....under $10,000
Parts.....full range }

Software (and Services).....full range

The reader will be alerted to occasional situations where limited data and international discrepancies require the use of different categories and descriptions.[1]

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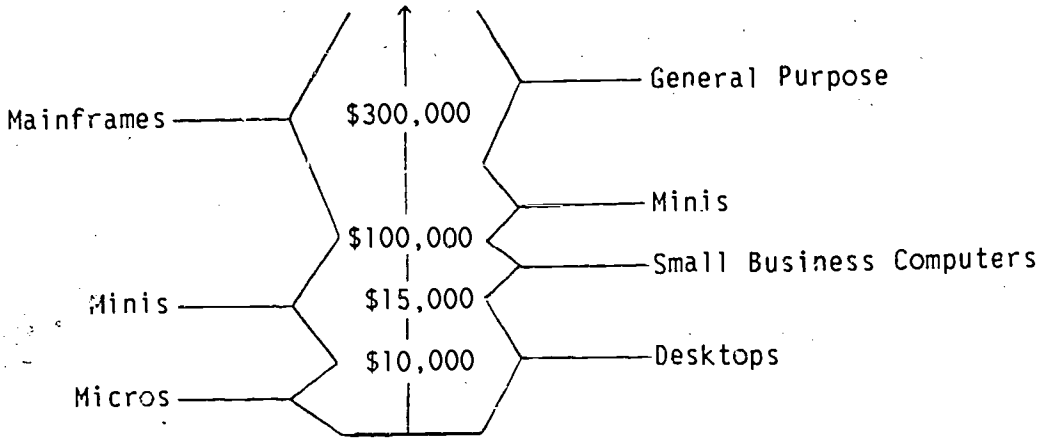
[1]The other prevalent classification system employs a four-part breakdown - General Purpose, Minis, Small Business Computers (SBCs), and Desktops - in addition to Parts and Software and Services. The following diagram portrays the rough correspondence between these two structures and demonstrates the semantic problems inherent in this kind of analysis:



THE U.S. MARKET

Strong, steady growth has characterized the U.S. computer market over most of the last decade. Although not unaffected by the gyrations of the economy as a whole, the U.S. computer industry's fairly sustained performance remains the envy of most sectors. Since 1972, the overall rate of expansion has averaged 18.1% per year (compounded, in current dollars),[2] and despite the slight 1981-1982 decline to roughly 11.3%, most forecasters expect a 15-17% annual pace to resume at least through 1990. Also in 1982, employment growth slowed somewhat from previous norms, increasing only 5% over 1981 figures (versus the 12% achieved during the four previous years); but even this modest increase proved impressive against the general employment environment.[2]

Producers

The table and figure that follow summarize the solid overall record of the U.S. computer industry, as witnessed in years past and as expected in the future. But it indicates as well that aggregate figures disguise diverging trends for the major industry segments. Most striking is the sharp contrast between the large, mature mainframe market and the young, burgeoning microcomputer area--a clear signal that current patterns in technology, price, and usage relatively favor the low end of a still dynamic computer industry.

Table 1
Worldwide Production of U.S. Computer Companies
(in billion $)

	1976	1981	1986
TOTAL	23.4	56.0	108.3
of which			
Mainframes	6.2	17.2	24.8
Minicomputers	2.0	8.8	22.2
Microcomputers	-	1.2	3.5
Peripherals	10.0	13.9	18.7
Software/Services	5.2	14.9	39.1

Sources: Datamation; forecasts from survey of mutiple sources.

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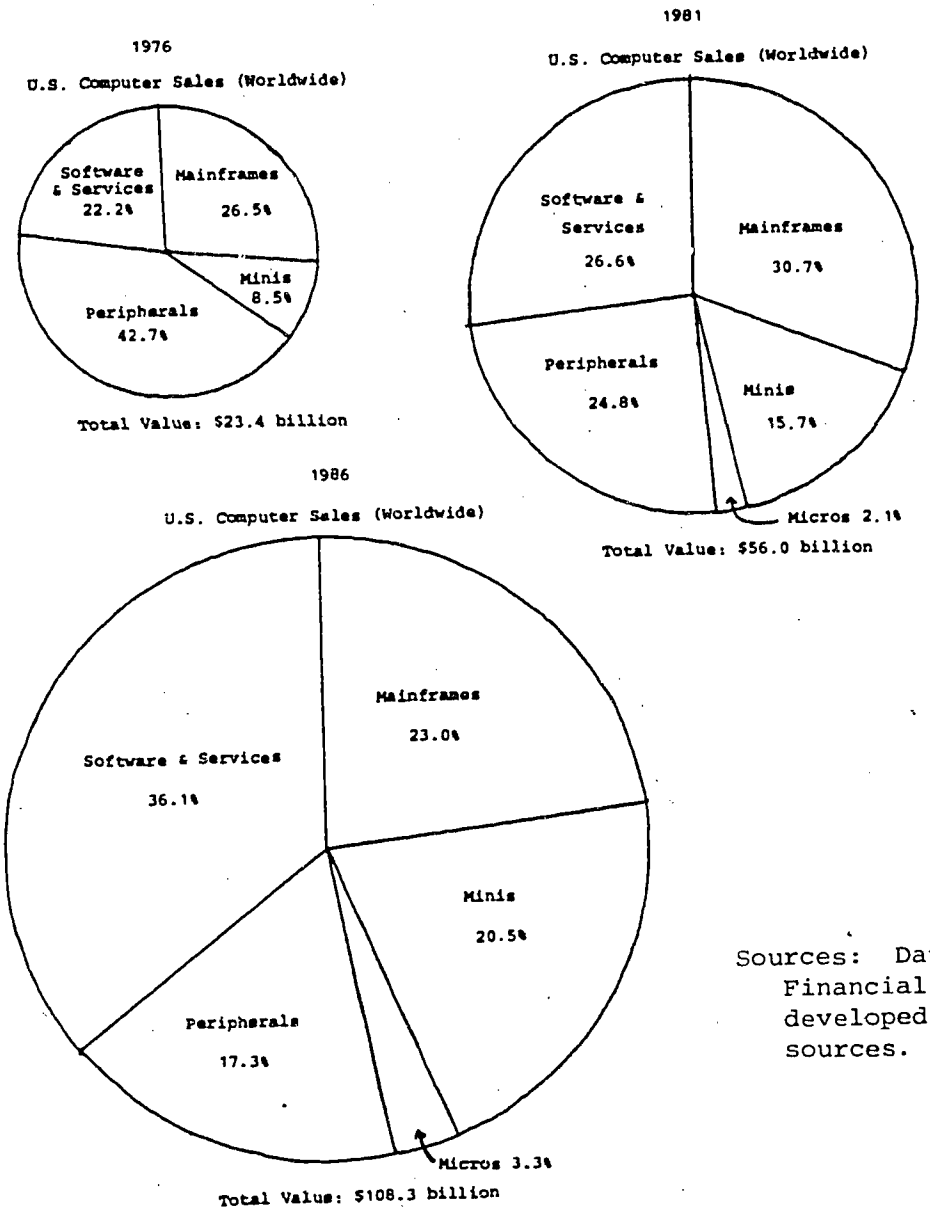
[2]Data refers to SIC 3573 - Computers and Parts - and originates in the U.S. Industrial Outlook, Department of Commerce.

Figure 1

Worldwide Production of
U.S. Computer Companies--1976, 1981, and 1986
(broken down by market segments)



Sources: Datamation, the Financial Times; forecas developed from multiple sources.

Recent strides in improving cost, capabilities, and convenience have both opened up new mass markets for microcomputer products and brought unprecedented performance within full reach of a previously limited, mid-level business clientele. While the user side of the American market features an explosive diversification of demand, the producer side is led by the industry's largest manufacturer, International Business Machines Corporation. Yet its control over some 44% of U.S.-affiliated worldwide production (with an additional 14.6% of the domestic software and services market)[3] has in no way prevented other American firms from participating in the sector's vigorous expansion. Table 2 presents the overall sales figures, market share statistics, and annual growth rates for these leading companies.

Table 2
The Leading U.S. Computer Companies - 1981
(Worldwide Computer Revenues in $ Millions; Shares of U.S.-Affiliated Production; Year-to-Year Increase, 1981 over 1980)

Firms	Revenues	Share	Growth	Firms	Revenues	Share	Growth
IBM	24,480	43.7%	16.6%	Data General	764	1.4%	13.6%
Digital	3,587	6.4%	30.7%	GE	670	1.2%	57.8%
NCR	3,071	5.5%	4.1%	Texas Inst.	667	1.2%	6.7%
Control Data	2,893	5.2%	12.2%	Compu Sci.	625	1.1%	11.4%
Sperry	2,781	5.0%	8.9%	ADP	613	1.1%	20.9%
Burroughs	2,668	4.8%	24.6%	ITT	484	0.9%	33.3%
Honeywell	1,775	3.2%	8.5%	Amdahl	417	0.7%	12.2%
Hewlett-P	1,725	3.1%	18.4%	Tandy	416	0.7%	109.0%
Xerox	967	1.7%	15.7%	Apple	401	0.7%	142.7%
Storage	922	1.6%	52.9%	Wang	373	0.7%	47.9%
TRW	815	1.5%	11.1%				
			Industry Total (estimate)		58,500	100.0%	20.0%

Source: Datamation
Note: This table, which includes overseas revenues but not foreign competitors, does not reflect "market shares".

The mainframers still comprise most of the "first division", but, as indicated in Table 2, firms specializing in mini and micro output are advancing rapidly. This pattern, an obvious corollary to the market trends noted in the previous section, becomes clearer in Table 3 and Diagram 1, which provide a breakdown of the competition within each of the main product areas. And since 1981 (the latest year for which hard data is available), the phenomenal growth and opportunity presented by the "low" end of the market has lured several of the top systems firms into across the board competition, matching their diversified strength against the prodigals of the personal and small business computer fields.

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[3]Source: ICP Software Business Review.

Table 3
Breakdown by Firm of the U.S. Industry's Worldwide Revenues in Each Major Market Segment (1981, Millions of $)

Mainframes

Firm	Revenue	Share(%)
IBM	12,000	68.8
Burroughs	1,255	7.3
NCR	1,027	6.0
Sperry	918	5.3
Control Data	623	3.6
Honeywell	511	3.2
Amdahl	335	2.0
Tandem	213	1.2
Natl.Adv.Sys.	175	1.0
Cray	102	0.6
TOTAL	17,200	(+9.3%)

Minis

Firm	Revenue	Share(%)
IBM	3,000	34.1
Digital	2,224	25.2
Burroughs	575	6.5
Data General	573	6.5
Hewlett-P.	435	4.9
Texas Inst.	320	3.6
Prime	309	3.5
Honeywell	300	3.4
Wang	272	3.1
Man. Assist.	244	2.5
TOTAL	8811	(+30.6)

Micros

Firm	Revenue	Share(%)
Apple	401	28.6
Tandy	293	20.9
Hewlett-P	235	16.8
Gould	140	10.0
Commodore	140	10.0
Cado	68	4.9
Cromenco	59	4.2
Total	1400	(+52.7%)

Peripherals

Firm	Revenue	Share(%)
IBM	5,000	36.1
Control Data	1,116	8.1
Sperry	1,112	8.0
NCR	1,015	7.3
Storage Tech	786	5.7
Xerox	748	5.4
Hewlett-P	510	3.7
Digital	452	3.3
ITT	400	2.9
Textronix	309	2.2
Total	13,850	(+10.8)

Software/Services

Firm	Revenue	Share(%)
IBM	4,480	28.0
Control Data	1,154	7.2
NCR	1,029	6.4
Digital	911	5.7
Burroughs	838	5.2
Honeywell	835	5.2
TRW	725	4.5
Sperry	695	4.3
Comp Sci.	625	3.9
ADP	613	3.8
GE	570	3.6
Hewlett-P	545	3.4
Total	16,000(E)	(+26.0%)

Source: Datamation
Note: Software and Services are more narrowly defined in Datamation's survey than in the ICP Review (see note 3, p.17). Hence the apparent incompatibilities in the numbers presented. Also, firms do not formally break out their revenues according to market segments such as these; therefore, in a strict sense, the above data should be regarded as estimates.

THE WORLD MARKET

Computer Hardware

On a global level, the computer market has had a healthy performance similar to that witnessed in the United States, with annual compound growth in the domestic output of all major producer nations averaging 20.3% over the last four years (1978-1981). The result: total production of computing equipment (SIC 3573) passed the $50 billion mark in 1981, and most forecasters remain bullish about the decade ahead, predicting that figure will exceed $185 billion by 1990. Table 4 denotes the present position of the six leading producer countries, according to output value, individual growth rates, and market shares:

Table 4
World Computer (SIC 3573) Production by Country

	1981 Output Value (billion $)	Growth rate (1978-1981)	World Market Share
United States	29.53	23.2%	57.7%
Japan	6.70	17.5%	13.1%
France	4.88	18.1%	9.5%
West Germany	3.50	13.3%	6.8%
Great Britain	2.33	12.2%	4.6%
Italy	1.19	30.4%	2.3%
Others	3.07	-	6.0%
Total	51.20	20.6%	100.0%

Source: U.S. Industrial Outlook, 1983.

More detailed analysis reveals that the product and sales trends which have come to shape the U.S. market also prevail on the international scene. Again a pronounced trend is the upsurge of the small computer sector. Table 5 lists the fifteen most prominent companies worldwide. Within this group, mini and micro producers managed to raise their share of total data processing revenues by over 40% since 1978.

Table 5
The World's Top Computer Firms
(Ranked by Computer/DP Revenues in billion $)

1979		1981	
IBM	18.34	IBM	24.48
Burroughs	2.43	DEC	3.59
NCR	2.40	NCR	3.07
CDC	2.27	CDC	2.89
Sperry	2.27	Sperry	2.78
DEC	2.03	Burroughs	2.67
Fujitsu (Japan)	1.49	Fujitsu (Japan)	2.03
Honeywell	1.45	Honeywell	1.77
CII-HB (France)	1.22	Hewlett Packard	1.73
ICL (U.K)	1.09	NEC (Japan)	1.51
Hewlett Packard	1.03	ICL (U.K.)	1.44
Hitachi (Japan)	0.98	CII-HB (France)	1.34
Olivetti (Italy)	0.98	Hitachi (Japan)	1.31
NEC (Japan)	0.91	Olivetti (Italy)	1.09
Siemens (FRG)	0.91	Xerox	0.97
Philips (Neth)	0.75	Nixdorf (FRG)	0.89
Nixdorf (FRG)	0.65	Siemens (FRG)	0.84

Sources: Corporate Financial Reports; Datamation; Bureau of Industrial Economics, Department of Commerce; and others.

Software and Services

Through the 1960s and 1970s, software and services came to comprise an ever larger portion of data processing costs. For a typical mainframe system, this fraction now ranges from 1/3 to 1/2, and while the figure has recently shown signs of steadying, the fact remains that this dimension of computer products can decisively influence their technological and commercial success. As a result, international competitiveness in computers has become strongly correlated with a nation's software, as well as hardware, capabilities.

Over the past few years, the U.S. position in this area has seemed particularly strong; but as software has assumed a more central role in determining the performance and marketability of computers, the struggle for software leadership has intensified. Though technological change here does not lend itself to the simple performance summaries that chronicle hardware development, the unprecedented attention that the segment now receives is reflected both in the rapid domestic rise of software and services firms (Tables 2 & 3) and in the growing international competition for

software markets. A summary of S&S activity in Europe and the U.S. (Table 6) reflects the continued expansion of recent years in both places. And the Japanese, supported by government programs that acknowledge software's indispensability, are attempting to improve their position in this field as well.

Software production has proven an essential ingredient of any viable computer industry. Its importance for the future is difficult to overstate. Certain keys have surfaced as essential to software success--high-quality, error-free products, standardization in programs and languages, and custom capabilities (i.e., tailoring to specific applications). And in a field filled not only with independent houses but with systems firms that purvey packaged products, the continued adoption and application of creative new concepts will be required of those who are to emerge as leaders. (For further discussion, see pages 41-42.)

Table 6
Europe and the U.S.: Software and Services

	1981 Market Size (mil $)	Curent Annual Growth Rate(%)
France	1800	19.5
United Kingdom	1450	13.4
West Germany	1180	10.6
Italy	849	17.8
Netherlands	536	14.8
Sweden	444	11.3
Denmark	328	12.0
Belgium	325	14.0
Switzerland	300	11.8
Norway	268	21.2
Spain	241	22.2
Finland	236	15.6
Portugal	23	35.9
Western Europe	8170	15.3
United States	12500	14.8
U.S. firms' worldwide S&S revenues: $22.6 billion (1981)		

Sources: ADAPSO, Financial Times (Computer Services Outlook).

New Markets

The world market has gradually accepted the full range of computer products and activities; but from a geographic point of view, the most dramatic change has been its expansion to include a wider range of customers and users. Industrializing countries (led by Brazil, Mexico, and the East Asian NICs) have already demonstrated enormous potential as a source of future demand, with selected growth rates often exceeding 25% per year. Further discussion of trends and activities in these emerging markets follows on pages 36-38.

WORLD COMPUTER TRADE

World trade in computer products has grown at a faster rate than computer production itself--overseas shipments, for each of the major supplier nations, have comprised a steadily rising share of both total output and consumption. The chart below provides an overview of this trend as it has evolved over the last few years.

Table 7
Trade as a Share of Computer Production/Consumption
(for the major supplier nations)

	1978		1981	
	Export %age	Import %age	Export %age	Import %age
United States	26.5	6.1	28.8	7.3
Japan	11.5	12.1	18.0	14.7
France	32.4	32.6	34.7	39.5
West Germany	51.2	55.4	66.5	69.5
United Kingdom	77.3	81.8	[illegible]	85.3
Italy	57.7	68.1	74.7	[illegible]
TOTALS	30.8	23.4	34.4	25.6

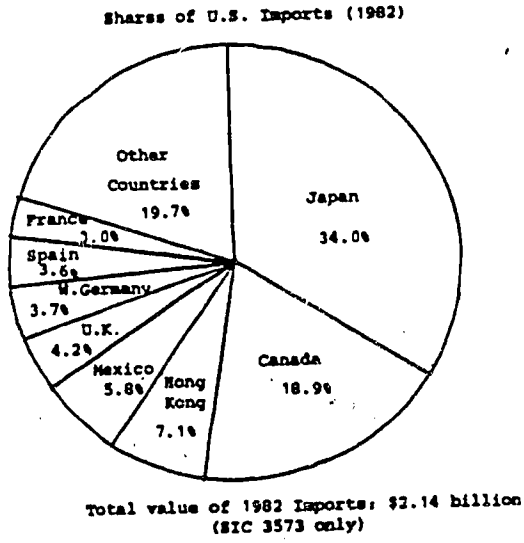
Note: Exports are as a percentage of domestic production; imports are as a percentage of apparent consumption. (SIC 3573 only)
Source: U.S. Industrial Outlook, 1983.

The basic reason for this development is the continuing "internationalization" of the computer market as a whole. In terms of demand, the three main forces at work are its rapid rise in key areas of the developing world, its steady diversification in traditional but unsaturated industrialized markets, and the increasing overseas activities of American subsidiaries. In terms of supply, the primary consideration is the improving competitiveness of non-American sources.* For the U.S. this has meant a rapid rise in imports which, in 1982, reduced the U.S. trade surplus by nearly $105 million. The overall U.S. trade position in computers (1978-1981) is summarized in the following diagram and table, which include a breakdown of the major sources and destinations of these international product flows (SIC 3573 only).

*Of course, one could also consider foreign subsidiary activities as a supply-side force in both their production and re-export roles.

Figure 2

U.S. Computer Trade (SIC 3573 only)
Imports by Source; Exports by Destination



Source: Official U.S. Trade Statistics and Bureau of Industrial Economics estimates.

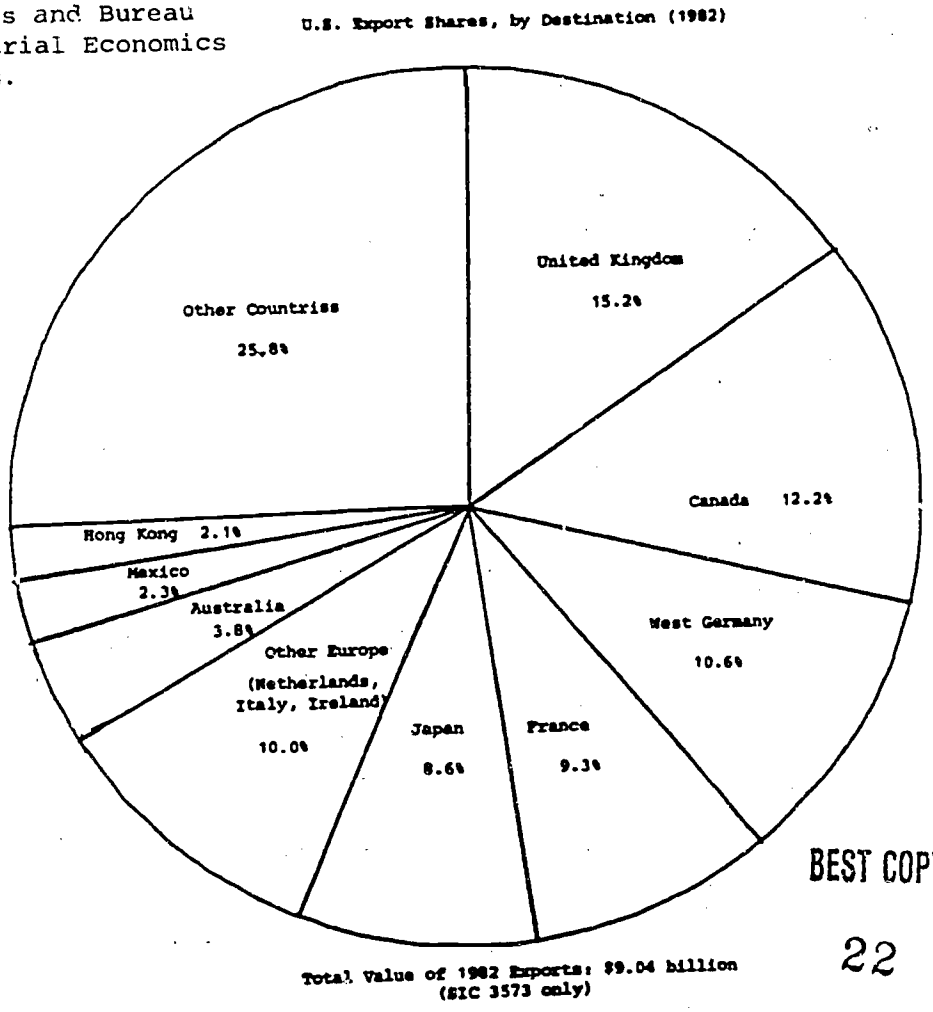


Table 8
U.S. Computer Trade (SIC 3573):
Origins and Destinations, Flow Value,
and Annual Growth (1981-2, % of value)

1982 Imports ($mil)

Total:	2140	(+29.9%)
of which		
Japan	729	(+88.2%)
Canada	404	(+ 0.0%)
Hong Kong	151	(-21.6%)
Mexico	123	(+27.0%)
U.K.	90	(+12.2%)
W.Germany	79	(+12.9%)
Spain	78	(+25.3%)
France	64	(- 2.6%)

United States

	Imports	Exports
1978	755	4194
1981	1647	8652
1982	2140	9040
Growth (78-82)	+29.8%	+21.2%

1982 Exports ($mil)

Total:	9040	(+ 4.5%)
of which		
U.K.	1374	(+15.3%)
Canada	1103	(-11.2%)
W.Germany	958	(- 6.2%)
France	841	(+ 7.0%)
Japan	777	(+ 8.3%)
Netherlands	380	(+14.0%)
Australia	344	(+ 0.0%)
Italy	298	(- 4.1%)

Obviously, the U.S. trade surplus remains quite strong. But its unexpected deterioration in 1982 may imply more than just currency movements and disproportionate softening of overseas demand in the face of global recession. It has also served to underscore the serious concern over foreign targeting of computer development and government intervention in high-technology trade. The country by country analysis which follows will cover each of the primary producer nations (and thereby each of our major trading partners), including assessments of each domestic industry's competitiveness. This analysis constructs the complex network of public and private international challenges that face American manufacturers.

JAPAN

Both the Japanese market and the Japanese industry have performed impressively over the last several years. Recent growth in production has averaged 17.5% annually (compound rates in U.S. dollars), fueled in part by a continuing surge in exports; consumption has expanded at the slightly more modest pace of 15.8% per year. Overall its posted 1981 output of $6.7 billion in computing equipment now places Japan securely in the runner-up spot in this category, and the established group of Japanese manufacturers (Fujitsu, Hitachi, NEC, Toshiba, Mitsubishi, and Oki) seems well-positioned for the 1980s. Their current standing and the details of the Japanese market are provided below (See Tables 9 & 10).

Table 9
Computer Sales of 8 Major Computer Manufacturers in Japan
(Millions of Current Dollars)

	FY 1976	FY 1979	FY 1981	Average Annual Growth Rate 1976-1981 (%)	FY 1982 (Est.)	Chg. 1981-1982 (%)
Fujitsu	1,086.5	1,481.9	2,033.3	13.4	2,426.0	19.3
NEC	516.9	910.1	1,507.7	23.9	1,766.2	17.2
Hitachi	643.9	979.5	1,305.9	15.2	1,496.4	14.6
Oki	219.0	284.8	494.7	17.7	594.0	20.1
Toshiba	268.4	228.5	430.8	9.9	521.5	21.1
Mitsubishi	145.1	240.3	331.0	17.9	399.0	20.5
Major 6 Japanese Firms (1)	2,879.8	4,125.1	6,103.4	16.2	7,203.1	18.0
IBM Japan (2)	1,248.8	1,470.1	1,944.9	9.3	N.A.	N.A.
Nippon Univac (1)	320.1	333.7	412.2	5.2	453.5	10.2
Total 2 U.S. affiliates	1,568.9	1,803.8	2,357.1	8.5	N.A.	N.A.

(1) Fiscal year ending March 31st.
(2) Fiscal year ending December 31st.

Sources: Japan Economic Journal, June 9, 1981 and June 8, 1982, and the Bureau of Industrial Economics. 1981 exchange rate of 220.53 ¥ per $1 used for all years.

Table 10
Japan's Installed Base (1982)

Computer Size	# of Systems Installed	Value of Installed Base	% of Total Value of Instl'd Base	Growth Rate (of Value)
Very Large (over $2 mil)	1,914	$8.73 billion	44.4%	11%
Large ($1-2 mil)	1,586	$2.43 billion	12.4%	10%
Mid ($0.16-1 mil)	11,130	$4.56 billion	23.2%	16%
Small ($41-166 K)	32,565	$2.48 billion	12.6%	22%
V Small (under $41K)	59,149	$1.45 billion	7.4%	20%

Computer Usage in Japan
(installed base, share of value)

Universities/academics	16%	Elec. Machinery	11%
Finance	15%	Transport Machinery	4%
Distribution	15%	Chem/PetroChem	4%
Government	13%	Insurance	3%
		Others	19%

Source: MITI

In 1979, a domestic Japanese manufacturer managed to displace IBM Japan from its top spot in their domestic market.[4] Now, 1981 has produced another milestone--for the first time, Japan posted a surplus in computer trade. Table 11 provides a breakdown of Japanese computer exports by firm.

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[4]Fujitsu's total revenues for JFY1979 exceeded IBM Japan's figure for calendar year 1979.

Table 11
Japanese Computer Exports by Company
(In Millions of Current Dollars)[5]

Company	1981	Change(%) 1980-81	1982(Est)	Change(%) 1981-82
IBM Japan	490	+ 57	N.A.	-
Japanese Firms[6]				
Fujitsu	263	+ 57	363	+38
NEC	172	+124	231	+34
Hitachi	132	+ 85	159	+21
Oki	59	+ 97	91	+61
Toshiba	36	+ 74	54	+44
Mitsubishi	32	+ 40	51	+29
Six-firm Total	694	+ 78	939	+35

5 1981 exchange rate: 220.53¥ = $1
6 Fiscal years ending March 31, 1982 and 1983, respectively.

SOURCE: Compiled by the Bureau of Industrial Economics

It appears that the next objectives of the Japanese industry will be two-fold: to compete vigorously in the European market (where foreign penetration is already high), and to develop a firm footing in the U.S. market. Already, their presence is being felt in certain peripherals areas (such as small printers, disk drives, and auxiliary storage), is expected anytime in the micromarket, and should develop soon in the prestigious supercomputer field (where both Fujitsu and Hitachi have announced certain machine capabilities which they claim are beyond those currently available from their main American competitors, Cray and CDC).

Most forecasters anticipate that a Japanese growth rate near 20% is sustainable through 1985, resulting in a total shipment value by then of over $13 billion, a 10% share of the expected world market. That kind of success will doubtless require significant penetration of the U.S. market over and above full exploitation of their European potential. The precise timing of such developments is always subject to debate, but 1982 brought an 88% rise in computer exports to the U.S. and the first full results of several OEM agreements with European firms (Siemens, ICL, BASF, Olivetti).

The Role of the Japanese Government in Computer Development

Perhaps the greatest future concern surrounds the eventual impact of the Japanese Government's computer promotion efforts. Historically, public policies have provided a broad range of support to ensure the continuing growth and competitiveness of the domestic computer industry. Most recently, these included (1981):

I. Tax Measures

1) Accelerated depreciation of computer purchases—an additional 13% first year write-off is permitted on all "machine types for the provision of industrialization";

2) 20% of total computer purchases can be deducted for purposes of local asset tax valuation;

3) Accelerated depreciation for computer producers - one-third of the initial book value of facilities used in the producton of MITI-approved "newly developed technologies" is permitted as an additional first year write-off;

4) Tax deductions for computer producers:

a) 25% of all year-to-year increases in R&D expenditures (up to 10% of taxable income);

b) 50% of "software income realized" can be set up as a tax-free reserve to cover future software development costs;

c) 20% of all year-to-year increases in training costs for software engineers;

d) up to 2.5% of sales if placed in a reserve fund to protect against losses "caused by return of computers" via JECC, the joint leasing company.

II. Direct funding for major research programs:

1) ¥100 billion over 8 years for 5th generation computer development;

2) ¥25-30 billion over 9 years for super computer development;

4) ¥20.0 billion over 7 years for research into "optical telemetering" technologies.

III. Government loans for leasing organizations (¥46 Billion in FY1981 to the JECC) and joint software programs (¥5 billion via the IPA Trust Fund and Long-Term Credit Banks).

Industrial policy support in Japan is well-managed, highly directed, and efficiently funded. It has contributed to the rise of an internationally competitive computer sector and is now turning its attention to more innovative efforts. Though it is impossible to determine what impact current projects will have, recent history indicates that the Japanese challenge should not be taken lightly, and that distortionary public assistance could affect the U.S. share of world computer markets.

WESTERN EUROPE

Western Europe represents the largest market[7] for computer products outside of the United States, and thus is critically important to the American computer industry. The U.S. sector's fundamental dependence upon tolerant, if not hospitable, treatment in Europe is reflected in its three-pronged involvement in the European marketplace:

1) through direct exports (the 1980 U.S. computer trade surplus with Western Europe was $4.1 billion);

2) through production by American subsidiaries for domestic consumption (in each of the major supplier nations, these firms accounted for over 50% of total output, for an overall estimate of $10-12 billion annually)[8]; and

3) through trade within Europe among those same multinational enterprises (no precise figures are available, but over 1/2 of all European production is traded).

The following overviews of the destinations for exports of the principal competitor nations (Table 12) and the top European computer firms (Table 13) emphasize Europe's central role in the world computer market.

Table 12
1980 Computer Exports of Principal Supplier Nations by Region
(In Millions of Current Dollars)

Destination by Region	Principal Supplier Nations					
	U.S.	West Germany	U.K.	France	Italy	Japan
North America(US/Can)	755	104	168	144	14	271
Latin America	615	29	7	29	2	61
Europe[9]	4,527	2,036	1,625	1,262	518	184
Africa	128	47	72	85	-	4
Asia/S.E. Asia[10]	1,382	32	36	43	4	170
Middle East	117	41	39	56	4	8
Communist Nations[11]	76	51	23	59	10	42
Other	6	7	211	14	318	1
Total	7,606	2,347	2,181	1,692	870	741

Sources: Official trade publications of each nation.
Compiled by Bureau of Industrial Economics, Science and Electronics Div.

Table 13
Europe's Largest Computer Manufacturers (1981)

Company	Parent Company HQ	European DP Revenues (mil$)
IBM	United States	8,846
CII-Honeywell Bull	France	1,311
Siemens	West Germany	1,296
Digital Equipment	United States	1,162
ICL	United Kingdom	1,067
Olivetti	Italy	1,006
Sperry Univac	United States	850
Control Data	United States	765
Phillips	Netherlands	750
Burroughs	United States	742
NCR	United States	728
Nixdorf	West Germany	678
Hewlett-Packard	United States	604
CIT-Alcatel	France	556
Honeywell Inf Systems	United States	497

Note: Data not directly comparable to that elsewhere in this report because it includes some "non-computer" revenues from word processing, data communications services, etc.

Source: Foreign Trade News, 8/31/82.

The basic characteristics of the European producer nations are:

1) the important role therein of U.S. subsidiaries;

2) the high traded fraction of total consumption and production;

3) the concentration of most national production into one or two major firms;

4) the gradual encroachment of Japanese firms (especially Fujitsu and Hitachi) through joint ventures and OEM agreements; and,

5) the persistent attempts, through targeting programs, to promote the rise of a fully competitive national computer industry.

Even on an international level, certain European countries have sought to cooperate with one another in their attempts to challenge the U.S. and Japan in the world computer market. A major recent effort has been the European Economic Community's "Esprit"

project - the European Strategic Programme of Research in Information Technology. A dozen firms from 5 countries will collaborate in both the current two-year pilot phase (begun in July 1982) and the eventual full-scale program, to start in 1984. The topics under consideration for study range from chips to 5th generation computers, and the Community's technologists have estimated that its funding of the program in the late-1980s could surpass $2 billion.[12]

In the future, should European governments (either collectively or individually) voice increasing concern over the American presence in their computer sectors, and should the limited success of current targeting efforts then give rise to unacceptable forms of market interference, an important group of U.S. economic interests could be at stake. The following overview of the French, German, and British situations provides basic information on the current and expected market conditions in each country.

FRANCE

In the 1970s, France established itself as a European leader among computer-producing nations. But while 1981 output figures reached $4.87 billion, an unsettled economic and political atmosphere has limited French growth prospects in the eyes of most analysts, with typical forecasts hovering in the 7%-9% range. The forced rearrangement of CII-Honeywell Bull, the nationalization of Thomson, and apprehension over additional policy changes with the shift in government made for a more sputtering and hesitant year than originally anticipated. Even a generous program of industrial policy support has failed to restore fully the optimism that once prevailed. Several types of assistance are now in place:

1) preferential public procurement from national sources, as epitomized in French manufacturers' 63% share of the civil service's installed base (vs. a private market share near 45%);[13]

2) recent establishment of a "Super-Ministry" for Industry and Research (in imitation of Japan's MITI), with ambitious investment plans for France's electronic industries and with goals involving extensive technological cooperation with other European countries;

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[12]Financial Times, 8/3/82.

[13]The Market Monitor, 1982.

3) the "Farnoux plan", which intends to bring together private, nationalized and public sectors (including scientists, businessmen, users, and union members) in "national projects". By 1990, the proposed program hopes to double the French electronics market and increase total research outlays by 50%. In the meanwhile, it recommends a 3-year manpower effort, which would include the establishment of advanced electronics schools within existing technology-oriented institutes, the training of 2,000 top engineers (with an additional 10,000 technicians), and the gradual joining of the research efforts of Thomson, the PTT, and the French Radio and Television Office. Estimates of the cost of carrying out this segment of the program (including both public and private contributions) have run as high as FF10 billion. The scheme was developed in preparation for the French Government's new 5-year Microelectonics Plan.

4) the minimization of competition between French firms, focusing on cooperation between CII-HB and Thomson (through, for example, the research and development stages of new minicomputer projects).

But although most observers remain skeptical of the benefits to accrue from this comprehensive package, it may presage more serious market intervention that could disrupt U.S. subsidiary activities and/or Franco-American computer trade. Consistent with the trade pattern outlined previously as typical of European nations, much of French output and consumption flows through the foreign sector. A fairly small 1981 deficit of $386 million (hardware only) occurred despite penetration rates of over 42.6% on imports of $2.1 billion; at the same time, exports of $1.69 billion accounted for nearly 35% of total production. Furthermore, the majority of domestic output falls to either IBM's French subsidiary (with a 50-55% estimated market share) or CII-Honeywell Bull (now less than 20% owned by Honeywell Inc., and with a 25-30% market share).

WEST GERMANY

The German computer market is the second largest in Europe, and the domestic industry includes two of the continents most competitive firms--Siemens and Nixdorf. Total national computer production (SIC 3573) in 1981 reached $3.5 billion, with these native non-subsidiaries performing as follows:

	Computer Revenues	% Growth over 1980	Estimated Market Shares
Siemens	841	20%	21.0%
Nixdorf	885	24%	22.0%

Note: Revenue figures for Siemens and Nixdorf, presented in millions

As through much of Europe, the U.S. plays an important role in the German market--through direct exports, shipments from non-German subsidiaries, and the internal production of American firms. But Japanese competition has recently increased through OEM agreements such as those between Fujitsu and Siemens and between Hitachi and BASF. This development should soon manifest itself in Germany's trade figures, where like France, it maintains a persistent deficit (with nearly 1/2 of its imports coming from U.S. subsidiaries in the rest of Europe). Most forecasters also anticipate that currently modest growth figures (8-11%) will continue through most of the decade ahead.

The government's concern over the long-term future of the industry prompted the establishment, in 1977, of a significant network of support programs, which covered twelve financial plans in the three main areas deemed crucial to future computer development:

1) industrial R&D;
2) data processing applications; and,
3) manpower training.

Total disbursements for the effort (1977-80) reached 1.25 billion DM ($625 million at 2DM/$). Since its conclusion, most German government support for computer-related development has taken the form of R&D assistance to firms and universities through the Federal Research Ministry's Technology Center in Berlin. Some 266 million DM ($133 million at 2DM/$) will be provided in 1982 for its two major programs, in microelectronics and optic communications engineering.[14]

All in all, the German industry is perhaps the most competitive in Europe, but its relatively open market has enabled American firms to obtain a market share comparable to that common in more protectionist countries. Accordingly, though demand growth in their domestic market should offer no special promise, German computer manufacturers may provide an occasional challenge in the years ahead on an international level.

UNITED KINGDOM

The U.K. is home to ICL, the largest European computer manufacturer, with 1981 data processing revenues of $1.44 billion. However, expectations as to Britain's long-term growth possibilities and competitive prospects are only mildly optimistic. Its total hardware market passed $2 billion in 1980 and should expand at a 10-12% annual pace during the next several years. Growth in terms of installed base, however, does remain brisk:

Unit Value	% increase in 1981
above £30,000	+25.7%
£15,000 - £30,000	+30.0%
below £15,000	+38.9%

Source: BIS - Pedder Census, 1981.

Apart from ICL, holding a 25-30% share of the home market, the main supply factors will be the American presence in the U.K. (with a 50-60% share, half of which can be traced to IBM) and the arrival of Japanese firms through OEM agreements. These arrangements, because they can include technology transfers (as in the ICL-Fujitsu case), could have long-term implications for the nation's production structure. The traditional British strengths have been software and services, and their tie-ups with Japan could provide complementary coverage of all aspects of computer systems.

In the meanwhile, government promotion of the computer industry has taken a variety of forms—grants, subsidies, loans, and publicly supported research:[15]

1) The Department of Industry has undertaken extensive funding (£80 million over 4 years) of "information technology developments". In a program to be administered through three existing frameworks (the Product and Process Development Scheme, the Electronics and Avionics Requirements Board, and the Software Products Scheme of the National Computing Centre), the government will directly support public research activity while furnishing grants to both firms and users to encourage more extensive computer application and usage.

2) Also proposed to the Industry Department is a joint research program aimed at development of advanced technologies for 5th generation computers. The 5-year, £350 million effort would cover four main topics:

    1) Software engineering;
    2) Intelligent, knowledge-based systems;
    3) Interface between humans and machines;
    4) Very large scale integration of electronic components.

3) Finally, the British government has repeatedly provided emergency financial assistance to ICL during its periods of severe financial strain. Most recently, this meant a £400 million series of loans over the 1981-83 period. The government has also blocked foreign purchase of ICL on several occasions.

In sum, the expected growth of demand in the U.K. market indicates a modest level of activity through the 1980s; but British computer manufacturers, despite increased public backing, should provide only limited competition (restricted largely to the home market) for their foreign counterparts.

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[15]The Financial Times, 5/29/81, 9/6/82.

OTHER MARKETS

Certain developing countries have added some new reasons and techniques to the traditional motives and methods involved in computer promotion. As through much of Europe and Japan, they see the computer industry as an opportunity for extended growth once a domestic production capability can be established. A pattern of strengthening demand has independently materialized, but it can only be met through unencumbered importation or extensive government involvement. And the vast technological gap between nations like Brazil or Mexico and the United States presents those countries with unusually difficult dilemmas. They must weigh the costs of varying levels of economic inefficiency against their

1) fear of being altogether shut out from the high-tech club;
2) concern over dependence upon foreign sources for computer technologies;
3) need to restore immediately whatever measure of external balance industrial policies can provide.

In the case below (as well as in certain of those examined in Annex I), the choice has been promotion through elaborate and restrictive computer development programs. For example, performance requirements, trade restrictions, and fiscal and financial assistance have all become central to the high-technology efforts of both Mexico and Brazil. For several reasons--technical constraints, service/support limitations, and growth expectations—public policy has emphasized micro and mini products, leaving the larger mainframes to foreign producers. But the cost to the national governments and domestic consumers of such extensive attempts to restructure their computer market have already proven burdensome, breeding a widespread skepticism as to any eventual closing of the gap between the professed strategy and economic realities. Nevertheless, U.S. firms must still tolerate onerous systems of public control if they are to share in the computer market growth of these newly industrialized countries.

MEXICO

In a manner typical of several countries in the developing world, Mexico has singled out the computer industry as a target sector. Its objectives--establishing a sizeable domestic production capability, ensuring that research and development efforts are locally based, and developing the industry's full potential as an exporting sector--inspired a single comprehensive promotion package that now serves as the centerpiece of Mexico's computer policy. This "National Computer Plan", consolidated in December 1981, includes sweeping provisions across the full range of industrial targeting tools. Market access is directly controlled by five basic techniques:

1) A quota system.
2) Imposition of tariffs.

3) An import permit requirement.

4) Selective (i.e., national) purchases by the Government of Mexico and public sector entities.

5) A limitation that foreign firms be only minority partners in joint venture agreements involving local production.

Five additional forms of tax incentives further encourage domestic computer development:

1) A tax credit of 20% of investments in new or expanded production capabilities.

2) A tax credit of 20% of new payroll generated among computer manufacturers.

3) A tax credit of 15% of purchased components manufactured in Mexico.

4) A tax credit of 15% of the purchase price of computer equipment bought from manufacturers registered in the National Computer Plan.

5) Unspecified tax incentives for establishing R&D facilities within Mexico.

In addition, the program provides direct financial encouragement through a hodge-podge of preferential inducements:

1) Special prices for energy (up to a 30% discount off established rates) are made available to computer manufacturers participating in the overall program.

2) Subsidized credit for computer industry development via FOMEX, FONEI, and other federal lending institutions.

3) Government-sponsored (and primarily government-funded) research efforts.

Finally, the plans of foreign subsidiaries are directed towards national goals by the imposition of two statutes over and above the minority ownership provision:

1) Preferential quotas for importing are granted to companies registered under the National Computer Plan, and

2) Export performance requirements are imposed upon investors, ensuring that they "earn" certain minimum levels of foreign exchange.

This elaborate network of industrial policies targeting computer development in Mexico can be expected to interfere with past patterns of U.S. exports to that market. Sales of computer equipment and services in Mexico totalled nearly $700 million in 1981, and the recent 25% per annum growth rate indicated great promise for the foreign manufacturers that dominated the picture. American firms alone controlled some 75% of total shipments (by value), but the combination of Mexico's overall economic crisis and its aggressive program to "domesticate" its computer market could seriously limit the near-term growth potential for U.S.-based computer companies. The National Computer Plan was only introduced in December 1981, so few conclusions can be drawn at this stage. Indeed, many of the trends it has precipitated (an increase in U.S. shipments of component parts, for example) should moderate the impact of its rather stark objectives and methods. Nevertheless, the National Computer Plan will, over the immediate future, distort Mexico's trade in computer products and services, an area where the U.S. has traditionally played the dominant role. A more extended experience with this targeting package and more detailed study of its apparent consequences should provide important additional clues as to its eventual effects upon both the American and Mexican computer industries.

KEYS TO THE FUTURE COMPETITIVENESS IN COMPUTERS

The Systems Concept

Perhaps the most striking aspect of future high-technology development will be the continued blending of computers with a broad range of related industries. And as this process advances further, computer manufacturers will find important markets emerging in (and new lessons being learned from) altogether new areas of application. The ability to anticipate and pursue new directions for both hardware and software use will remain a fundamental criterion for corporate success. This wider perspective will necessitate creative appreciation for the potential role of computer technology in systems of a broader nature than simply data processing or information management. The sweeping implications of machine intelligence and advanced automation will influence a full range of economic activities—from farming to high-tech manufacturing itself. And in most of these settings, the effectiveness of particular computer products will depend upon the success with which they have been integrated into the larger systems (whether production, communication, storage, transportation, etc.) at work. The computer company that best adapts its innovation, design, and product to these novel applications will prosper in the marketplace of the future.

Skills

Considerable attention has recently been devoted to the shortage of skills required by the computer industry and related high-technology sectors. Concern has centered around:

1) the declining number of students graduating with an emphasis on engineering, the sciences, and mathematics;
2) the dwindling population of qualified teachers and professors in these critical areas (due largely to disparities in salary between academics and private industry); and,
3) the gradual deterioration of available instruction in these quantitative fields (for reasons of both inadequate staff and aging facilities).

Well-developed human resources have been an important key to American pre-eminence in "knowledge-intensive" industries like the computer field. The importance of a well-trained pool of eventual contributors has led countries as diverse as Singapore, West Germany, and Japan to devote considerable effort to cultivate this resource, for a shortfall of skilled technicians can impose limitations on high-technology development no less serious than financial or production constraints. Several U.S. corporations have

already, in recognition of this problem, provided assistance to various universities for purposes ranging from overall technical education to the modernization of laboratory equipment. In some instances, they have even established their own institutes for instruction in such areas as programming and engineering. The options section discusses certain additional possibilities for USG action on the training and education problem.

Research and Development

As always, research and development activity remains a critical ingredient of a competitive computer industry. The "technological acceleration" that has come to characterize most sophisticated sectors ensures that only the innovative survive, and the computer field—at the center of high-technology development—epitomizes this trend.

Recent activity abroad indicates that commercially-oriented R&D expenditures have become an item of priority concern to public officials. As noted earlier, Japan's Ministry of International Trade and Industry has organized several major research projects that involve all of the leading Japanese computer firms. These efforts are designed to address both current industry weaknesses (such as software) and future areas of promise (optical telemetering, 5th generation technology, and supercomputers). This latter group will receive at least ¥173.5 billion ($867 million at ¥200/$) in direct public funding and ¥23.5 billion ($117.5 million) from private sources before their respective conclusions in the mid to late 1980s.

In Europe, much of the public support furnished to the computer industry comes in the form of R&D assistance, and recent patterns indicate that the larger European firms are now concertedly attempting to marshall their forces in areas of long-term study. Phillips and Siemens, for example, have disclosed plans to cooperate in their investigations of sub-micron technology, general microelectronics, computer-aided design, and electronic speech recognition. In addition, as noted above, there are indications of significant cooperation between European governments as they jointly attempt to accelerate their collective computer development.

Within the U.S., computer R&D responsibilities rest primarily with the private sector, a pattern reinforced by recent budgetary trends and changes in tax policy. In the areas of space and defense, real funding levels for R&D have risen from FY1981 to FY1983, but outside of NASA and DOD, most science and technology budgets were trimmed during that same period. This condensation of public activity coincided with passage of the Economic Recovery Tax Act (1981), which included three measures for encouraging private R&D:

1) tax credits for 25% of any increased in corporate R&D expenditures;

2) a two-year suspension of allocation rules governing tax treatment of research and development outlay; and

3) accelerated depreciation for R&D facilities and equipment.

Specific data on the impact of these provisions is as yet unavailable, but despite some conflicting early reports, it is hoped they will catalyze some increase in research and development activity.

At the same time, broader interpretation of antitrust provisions has enabled the formation of selected private-sector R&D consortia, such as the Microelectronic and Computer Technology Corporation (MCC).[16] Led by Control Data Corporation, this group will attempt to exploit the economies of scale and risk-minimization that collective efforts in basic R&D may provide. If this effort establishes a trend, it could mean more frequent inclusion of smaller U.S. companies in the long-term research activities essential to the continued growth and competitiveness of the U.S. computer industry.

Software Capabilities

As noted in the earlier section on software and services (pp. 20-21), this dynamic aspect of the industry has become an essential component of success in computers. The rising financial and commercial importance of the software field is well-documented. But behind the numbers lies the simple fact that software, often as much as hardware, sells systems. On the one hand, this is an imaginative field where marketable output must not only avoid constraining hardware performance but also open new technological frontiers of its own. On the other hand, it involves more conventional production problems--quality control, standardization, efficiency--that will critically determine the fate of individual firms. Software must continue to embody steady technological improvement while evolving into a mass production commodity. Independent specialists and more diversified packagers will need to move forward on both fronts, and at the same time maintain a creative, far-sighted understanding of future directions in hardware

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[16]The MCC venture will apparently be constrained as follows:

a) it can be a profit making enterprise;
b) no firm will be allowed more than a 10% interest;
c) the Justice Department will also monitor
   i) the overall corporate membership
   ii) the identity of companies participating in particular projects, and
   iii) whether or not the risks involved in MCC's efforts are sufficient to justify joint efforts.

development. On an international level, the growth and prospects in the field have attracted the intense interest of foreign firms and governments alike, a sure clue to the mounting challenge that American manufacturers will certainly face in the years ahead. Traditionally, software has been a particular strength of the U.S. computer industry, contributing directly to the sector's prowess at home and abroad. The essential point for the future, therefore, is that only if the U.S. can maintain some of that software leadership will it be able to maintain its overall computer leadership as well.

Foreign Targeting Practices

The computer sector has probably proven the most popular target for industrial policy programs abroad. Because of its critical position at the center of the high-technology field, foreign governments have repeatedly deemed computer development essential to their nations' long-term growth and continued economic well-being. Dramatic improvements in Japan's competitive position across a broad range of industries drew considerable attention to their targeting techniques, and as other advanced nations have since tried to improve their standing in the high-technology race, they have, in some cases, attempted a similar approach, or at least invoked certain similar methods. International agreements have imposed some constraints upon signatories, but financial support, fiscal incentives, and direct public participation in computer development have become commonplace in many foreign markets. These kinds of policies have posed a difficult challenge to both American computer manufacturers and the U.S. government. First, it must be determined the extent to which such practices may or may not erode U.S. competitiveness; and second, it must be decided what type of response, if any, is appropriate. Both are complex questions, on the one hand involving methodological problems, on the other requiring expert analysis of the potential consequences of each available course of action.

Among the developing countries, computer targeting has generally taken a more elaborate, if not more sophisticated, form than the current promotion practices of industrialized countries. In addition to using methods at work in Europe and Japan, they appeal to "infant industry" arguments as justification for imposing performance requirements and establishing direct import barriers for domestic protection. The investment restrictions include export requirements, technology transfers, ownership limitations, and sales ceilings, to name a few. Trade can be controlled through quotas, tariffs, licensing, and national sourcing regulations. The consequences of such measures for the competitiveness of foreign

OPTIONS: A Discussion of the Pros and Cons of Proposals for USG Action as Recommended by a Variety of Sources.

I. A primary issue of great interest is the level of R&D activity in the United States. Several recent policy changes have acknowledged its importance for the nation's future, especially in high-technology areas, but some concern remains over the long-term implications of inadequate R&D expenditures.

Discussion: The computer industry has always been a leader in terms of its R&D outlays. Revisions in the tax treatment of R&D (embodied in the 1981 Economic Recovery Tax Act) were designed to further stimulate such expenditures. The accelerated depreciation schedules included for R&D equipment should provide significant and secure incentives for corporate investment in this area. The accompanying R&D tax credits, however, may need elaboration to ensure their effectiveness.[17] Insofar as firms' decisions on R&D allocations require long-term planning and more extended lead-times, two years (the applicable period of these current measures) may prove inadequate for generating a broad positive response. A longer-term provision of this type may prove desirable. A second possible shortcoming of the stepwise R&D credit may be its lack of stimulus for the young, fast growing companies that so heavily populate research-intensive sectors, and from which an impressive proportion of technological innovation has emanated. The simple incremental approach embodied in existing legislation may provide the least benefit and incentive to many of those most active in the area of policy concern. Revisions that structure into the formula credits for a baseline, dollar-amount R&D increase (on top of which the 25% schedule would take effect) might somewhat alleviate this problem.

Another set of policy developments in the R&D field involves more open interpretation of anti-trust regulations (see page 41 for discussion). Recognizing that some legitimate economies of scale can be realized through

given qualified approval to the establishment of the joint venture Microelectronic and Computer Technology Corporation (MCC). Many observers feel that this could represent an important first step towards similar cooperative activity, both in other areas of the computer industry and in other high-technology sectors. But it appears that before any field can reap the full rewards of this new understanding, the ground rules will need to be clarified and secured. The lack of detailed and defensible preconditions will likely deter many valid participants from joining a collective undertaking of this type. At this point, considerable discretionary/interpretive power remains with the Justice Department, the courts' position on such ventures has yet to be clarified, and no protection from civil suits has been provided. In the face of such impediments, legislative action may emerge as the only mechanism able to catalyze full use of this collaborative opportunity.

II. A second, long-term problem for both the computer industry and the economy as a whole is the "skills shortage" (see page 39 for a discussion of this issue). Increases in the number of new scientists, mathematicians, and engineers have not kept pace with a growing field's demand for this type of trained personnel. This has in turn led to a depletion of the ranks of qualified instructors remaining in academics. And to complete the cycle, this shrinking number of teachers (in both secondary schools and universities) is less able than ever to educate the larger numbers of trained students needed by high-technology sectors. The following represent selected options considered in response to this issue:

1) Provide a greater network of government support for education and training in the areas of concern; specifically,

   a) increase public funding for discretionary improvement and enlargement by educational institutions of programs aimed at the training of scientists, mathematicians, and engineers; and/or

   b) lend more directed public assistance, in such

d) provide incentives for broader and indirect private sector assistance to educational programs in the maths and sciences (such as the Computer Equipment Contribution Act considered by the Congress in 1982).

Pros: These kinds of measures would both facilitate scientific education and help pique the interest of greater numbers of prospective students in the designated fields. It could also assist in retraining of workers whose skills have become obsolete because of shifts in the U.S. production base.

Cons: Special caution would need to be exercised to avoid intensifying the current competition between industry and academia for skilled people (see, for example, the proposed salary assistance for teachers). Also, increased budget support would be required under any of these programs unless current resources were transferred from the liberal arts to the sciences, a move that could generate considerable opposition from other affected interest groups.

2) Leave the necessary adjustments to the marketplace.

Pros: For some, this may offer a more efficient alternative to the kinds of government involvement implied in the policy options outlined above.

Cons: The adjustments needed to restore equilibrium between the supply and demand of technical skills under a laissez-faire approach may require an inordinate period to complete. The shortage of qualified personnel is an immediate problem which, if not addressed soon, could have adverse long-term consequences for the American economy. In other words, the employment market may function inefficiently in translating sudden changes in demand through educational institutions into shifts in the training and eventual supply of properly equipped graduates.

III. A third area of concern for many involved in the computer industry is the proliferation of foreign government programs aimed at the development of a domestic computer capability. These may affect the competitive position of U.S. manufacturers. The four most commonly cited options for USG action (and a brief listing of the pros and cons in each case):

1) Adopt comparable targeting practices.

Pros: These could be formulated to spur development in any of several areas of the computer industry. They could provide additional demand stimuli, encourage risk-taking among producers, avoid undesirable waste and duplication in certain R&D areas, and presumably, place U.S. manufacturers on an "equal footing" with their foreign counterparts.

Cons: Certain minor types of support (especially basic research in government and university laboratories) and special tax credits for R&D are already in place. More liberal interpretation of anti-trust regulations has also enabled some joint research efforts to be organized between computer companies. More sweeping measures would require a fundamental change in the current philosophy of business-government relations in the U.S. Such revisions could also either a) shift competition in computers from production programs to support programs as other countries in turn attempt to provide the most generous terms for development or b) precipitate the introduction of less palatable trade barriers, such as tariffs, quotas, etc. And again, industry-specific USG policies would invoke demands for equal treatment across a whole range of American sectors that feel similarly victimized.

2) Protecting the U.S. Market

Pros: This could result in an eventual dismantling of selected foreign industrial policy programs if this is accepted as the price for regaining access to the U.S. market.

Cons: The vagueness of many foreign provisions and the inherent competitiveness of the industry

interests. This solution also fails to address the question of third markets--and protective diversion of foreign exports could erode U.S. market share abroad. Finally, such unilateral action raises the spectre of a full trade war, an eventuality that could seriously damage the U.S. economy across a much broader range of products and industries.

3) A vigorous U.S. program to counter targeting programs through strict enforcement of U.S. trade laws.

Pros: Negotiation under Section 301 could produce case-by-case agreements as to how an equitable trading environment could be restored. Historically, this has been a successful process, with only rare invocation of Executive Authority to impose unilaterally reciprocal restrictions. Above all, active enforcement would lend integrity to the legal structure now in place.

Discussion: Most U.S. trade laws only emphasize temporary relief and adjustment assistance where damage is found, offering little to actually discourage targeting practices. The resources required of firms to pursue trade action cases, and the often lengthy period between violation and judgment, may discourage many (particularly smaller companies) from invoking what provisions are available. While several complaints are still in decision at this time, Section 301 (the mechanism relevant for most targeting problems) would also appear not to deal with the question of third markets, and many nations may well decide that the benefits of promotion policies still outweigh the costs of American enforcement. Finally, there remains some question as to the GATT-legality of certain responses of this type.

4) Negotiation through bilateral channels for country by country removal of the most restrictive practices (such as performance requirements and blatantly protectionist trade barriers).

Pros: Such an effort could give rise to a consistent and principled U.S. strategy for dealing with this type of restriction in the context of particular bilateral relationships.

security interests at stake. Because these may vary greatly from case to case, it could prove difficult to develop any set of policy positions on targeting in developing countries that appears coherent and non-arbitrary.

IV. A final concern for industry and government alike has been the effect of export controls (whether COCOM or unilateral restictions) upon computer sales and computer firms.

Discussion: USG policies in this area will clearly be attempts to balance sometimes conflicting objectives, and any effort to dictate a binding solution in this context would prove highly problematic. However, the upcoming renewal of the Export Administration Act does provide an opportunity for debate over the methods and content of export controls. As part of the review, it could be appropriate to

1) re-emphasize the priority of technology transfers over product transfers as a guiding principle for security concerns,

2) underscore the broad damage to commercial interests that results from perpetuating the United States' reputation as an "unreliable supplier".

3) highlight the fact that export markets in high-technology fields also contribute to national security by expanding the U.S. military/industrial base.

4) urge all policy-makers involved to give full attention to the competitive interests of the relevant manufacturers, noting in particular the disproportionate burden that export restrictions can place on smaller computer firms, and

5) formalize this advocacy role by involving Commerce Department industry and trade policy specialists in future discussions of computer trade controls.

"Computer Industry Overview"

Vico E. Henriques
President, CBEMA

Mr. Secretary, my role here this morning is to convey to you in ten minutes the dimensions and dynamics of this remarkable industry which we represent.

I have tried to collect ideas and data that will portray the current state of our industry, both domestically and internationally, and the key facts of life which determine our member companies' international competitiveness.

The computer industry is at the heart of a growing collection of intertwined but separate industries which depend critically upon the use of digital technology. While the inherent advantages of a reprogrammable control unit have caused computers to be at the heart of devices as different as space shuttles and automobiles, the industry we are talking about this morning is that of commercial off-the-shelf computers and business equipment which are found in information systems and networks. This includes computing equipment from the home personal computer to the supercomputers NOAA uses for weather forecasting. It includes the computer software provided with or purchased for use on these computers. It includes all of the supporting products such as terminals, memory and printing equipment. Last but very importantly, it includes the support and maintenance services which keep the equipment and software running.

In the past weeks and in the near future, you will be hearing presentations from other industries such as semiconductors, telecommunications and robotics, with which we have a close and growing connection. Their opportunities and their problems, however, are quite different from ours.

The computer industry began only around 1950, yet today is one of the United States' major industries, and even more critically, is viewed by most industrially-oriented nations as the key industry for their economic future.

I have distributed four tables which give some measure of the amounts of business and the rates of growth being experienced by our industry. Let me summarize these briefly by saying that in 1983, worldwide industry equipment and software revenues, excluding on-line services and user programming investments, will amount to an estimated $92.5 billion dollars.

In addition, we estimate $20 billion dollars in business equipment and business forms revenues, much of which either supports or utilizes the application of computers in making business more effective. The dynamics of the industry are supported by heavy R&D investments. In 1981 our CBEMA members invested $3.855 billion in R&D, a 32% increase over 1980. I don't have the 1982 figures, but I believe the gentlemen here will substantiate that we have not cut back.

International trade is important to our industry. In 1981, the domestic revenues of our member companies were 63 percent of their world-wide revenues -- that means that 37 percent of our member companies' revenues, many of whom are represented here today, come from international operations. In 1982, total computer industry exports from the U.S. were $8.88 billion and imports were $2.14 billion, giving us a favorable trade balance of $6.74 billion In addition to this trade balance, we must add a large flow of revenues from licenses, royalties, dividends and other "invisibles." The amount of this flow is difficult to quantify from the data which we have, but it constitutes approximately 10 percent of international revenues, or about three billion dollars, and is growing. These data point out that this industry is truly multinational. We do not, and cannot because of the kind of business we are in, export solely from the United States. On the other hand, these data point out that almost all computer companies, even the very smallest, quickly engage in international trade, and that international trade remains a significant part of their business.

As a company's activity expands abroad, it soon requires the establishment of a local presence beyond that of a distributor. Frequently, branches and then full-fledged subsidiaries are established. Because of the requirements of the local markets, establishment of manufacturing operations which cater to the standards and requirements of those markets are likely to follow on obtaining a significant amount of business; and ultimately, development and even research operations may be established in major areas.

Development activities are frequently necessary to support local manufacturing activities when the requirements for the marketplace are significantly different from those in the U.S. A good example would be to optimize products for sale within the European economic community. Development and research activities also are established abroad because that is where the expertise may be. Despite the intense concentration on research and development within our industry domestically, no environment would be more productive for research and development into the input and output of non-roman alphabet characters than Japan and China, simply because of the deeply-felt need for continuing to use the ideoform writing, leading to a great deal of attention on developing devices that can handle it. Thus, we see a two-way flow of technology within companies which are established abroad that integrates with the world-wide marketing and manufacturing operations to support the global marketing approach required in the industry.

Many computer products require a market greater in size than the U.S. market, and for some products, only a world-scale approach will support the investment necessary for the product.

The industry's products are non-sectoral in that they are used by practically every business, they are used by governments, and with the advent of personal computers they are now used by the individual.

This is perhaps a unique occurrence in industrial development. The implications have been that the industry has expanded greatly over the last three decades, and continues to expand, even in the current recession, because of the potential for our products to enable others to increase their productivity and reduce their costs. We feel the opportunities for the United States computer industry are excellent.

There are steps which the U.S. government can take, some in traditional trade policies and some in domestic policies which would enhance our international competitiveness in the face of the concerted activities of our trading partners. Rather than detailing them now, I will defer to those who will follow me today.

Perhaps, Mr. Secretary, you or the other attendees would have some questions about the general shape of the industry before we turn to the specific topics we wish to address this morning.

TABLE I

WORLDWIDE
COMPUTER AND BUSINESS EQUIPMENT INDUSTRY REVENUES 1965-82

DESCRIPTION	1982E	1981	1980	1975	1970	1965
Total Revenues	113.300	101.600	90.600	46.200	20.500	4.500
Total DP Equipment Revenues ($Bil)	69.000	61.800	55.100	27.900	10.500	2.400
Application of Software Revenues Excluding Contract Program ($Bil)	23.500	21.000	18.000	6.500	2.500	.200
Total BE Equipment Revenues ($Bil)	16.500	14.700	13.500	9.300	6.000	3.500
Business Form Revenues ($Bil)	4.300	4.100	4.000	2.500	1.500	.900

TABLE 2

CBEMA MEMBERS' GROSS REVENUE DISTRIBUTION

	FOREIGN	DOMESTIC
1981	37%	63%
1980	37%	63%
1975	40%	60%
1970	35%	65%
1965	25%	75%
1960	18%	82%

TABLE 3

CBEMA MEMBERS' R&D EXPENDITURES (BILLIONS OF $)

1982	4.700E
1981	3.855
1980	2.915
1975	1.660
1970	.921
1965	.172
1960	.050

TABLE 4

CBEMA MEMBER COMPANY PROFILE - EMPLOYMENT 1960-1982

DESCRIPTION	1981	1980	1975	1970	1965	1960
Total	1,550,000	1,530,000	1,240,000	1,143,000	630,000	365,000
Industry Employment	1,160,000	1,145,000	1,000,000	900,000	600,000	300,000
Domestic Industry Employment	740,000	720,000	600,000	585,000	450,000	246,000
Foreign Industry Employment	420,000	425,000	400,000	315,000	150,000	54,000

"The Computer Industry:
Restrictions and Performance Requirements"

Mr. Edson de Castro
Data General Corporation

1. The computer industry continues to encounter investment restrictions and performance requirements that deny or impede access to important world markets.

a. Brazil, Mexico, South Korea are the most current examples. Details of these barriers are well known. The trend is rapidly spreading.

1. Mexico - last year introduced an integration plan through which they hoped to establish a domestic computer industry. Details of this plan are now being changed, due to the Mexican economic situation. Regardless, companies like Data General are severely limited in the number and value of import licenses into Mexico. And we are not allowed to establish there unless we agree to surrender controlling interest, transfer technology and build substantial manufacturing facilities.

2. Brazil - Since 1978 Brazil has been trying to establish a visible domestic computer industry through government protection and subsidy. Over the five years since then, market access has been granted to only those who agree to transfer of technology. There have been few takers and import licenses for shipments to Brazil are few and far between. Their effort to build a domestic industry continues to be heavily subsidized by the Brazilian government and is notable for its lack of success. Realizing their inability to produce newer 32-bit computers they are once again, trying to strike bargains with American firms. The deal is more or less the same: Access to the Brazilian market in return for technology transfer.

3. South Korea - This nation's markets have been alternatively closed and opened to us. At present, foreign investment laws are being used to fashion a new computer integration plan that threatens to once again restrict our ability to sell products there.

b. It is an approach to imposing non-tariff trade barriers for the protection of domestic industries that began in the non-industrialized world and now threatens to spread to industrialized nations (Canada is an example). It is particularly appealing during periods of economic decline.

2. Investment restrictions and performance requirements threaten the structure and the future of the U.S. computer industry.

a. U.S. computer companies are reliant on international business and derive a substantial portion of revenues from exports. Because of the rapid pace of technological development, the industry is capital intensive. Growth and development rely heavily on an expanding revenue base. This can only come from full participation in established and developing global markets. Reliance upon domestic markets alone is not enough.

b. Companies need to be close to their customers in order to adapt their products to local/regional appllication needs.

c. The sale of computer equipment requires an ongoing commitment to service and support of products once sold. Companies need access to foreign markets in order to meet these commitments to their customers.

3. There is no well-enunciated U.S. policy on investment restrictions and performance requirements. There is a lack of coordination between government agencies on such matters. There are not adequate resources within the U.S. government to deal with this issue. Our industry needs all of these.

4. There is no multilateral vehicle for addressing investment restrictions and performance requirements.

a. Last fall's GATT ministerial meeting suggests that the GATT is unable, for the time being, to deal with the issue.

b. In the short term, bilateral solutions are the only viable alternative.

5. Possible Solutions:

a. Many of those non-industrialized nations with firmly-established restrictions on foreign investment and performance requirements are experiencing financial crisis. Some teeter on the brink of bankruptcy. They turn to the U.S., the World Bank and the International Monetary Fund for help in the form of new credits and renegotiation of debt repayment. U.S. assistance, either direct or indirect, should be predicated on the relaxation of restriction.

b. The U.S. should adopt a "no nonsense" policy of opposition to such barriers to free and fair trade and to national industrial policies that prevent accordance of national treatment.

c. Based on such a policy, the efforts of all U.S. government agencies should be well-coordinated to reach these objectives.

d. Greater resources should be devoted to bilateral negotiations of national treatment accords, starting first with those nations that represent the most substantial markets.

e. U.S. trade and foreign assistance programs should be used as incentives for other nations to relax restrictions.

"U.S. Response to Industry Targeting Practices"

Stephen G. Jerritts
Senior Vice President
Honeywell, Inc.

I would like to express my appreciation to the Secretary of Commerce for arranging this meeting and for the work which his department and others in this administration are doing to promote international trade. This is a subject of tremendous importance to Honeywell, and one to which we feel an increased need to devote our attention.

What I'm going to say today makes a case against protectionism and for a more competitive America. There can be no denying that some countries have adopted mechanisms to aid their domestic computer industries. And there can be no denying that the American people feel a growing frustration with the economic relations between this country and others, particularly Japan.

Honeywell believes that many of Japan's protectionist barriers have come down, and that more will come down with a continued aggressive negotiating stance by the Administration. But elimination of these barriers alone is not enough to help keep U.S. industry competitive, either here or in foreign markets.

There are four key elements which we would like to talk about today. These are areas in which we believe government support can help the private sector become more competitive. The four areas are: foreign trade barriers; fiscal policy; government supported research and development; and industry cooperation. Export control policy is also a critical element but that will be discussed later in the meeting by Robert Price of Control Data.

I would also like to point out that we do not believe that the U.S. should adopt the industry targeting methods used by other countries. Each country has to develop policies that reflect its own culture, its own history, its own economy. We believe that the U.S.' economic strength is its free market system. We need policies that improve the efficiency and adaptability of that system.

We have four policy areas where we think improvements can be

1. Foreign Trade Barriers

The United States now has on the books a variety of measures to deal with unfair foreign trade practices.

Remedies provided in these laws include import restrictions, countervailing and anti-dumping duties, vigorous enforcement of patents and copyrights, and enforcement of rights under trade agreements including GATT. We are pleased that both the U.S. Trade Representative's Office and the International Trade Commission are showing a willingness to take aggressive action with these existing laws.

Unfortunately, our complex and open legal system may result in the remedy's coming long after the damaging fact. The 1979 Trade Act sought to speed up the fact-finding and ruling process, but much more needs to be done.

Much more also needs to be done within GATT. GATT provisions need to be extended to services and investment, and negotiations must also begin on the treatment of high technology industries. Very little was accomplished in these areas at the recent GATT Ministerial but the U.S. should continue to pursue them.

As proposed in the Senate's Reciprocal Trade and Investment bill last year, the U.S. Trade Representative's Office needs to have its responsibilities extended to include monitoring as well as negotiating. In particular, the Trade Representative's office needs to search out and publicize countries and regulations that treat U.S. and other foreign firms differently from domestic firms.

Congress should also restore the President's authority to negotiate tariff reductions in specific industries.

2. Fiscal Policy

We believe the recent steps to increase cash flow in some industries by speeding depreciation schedules, to stimulate investment in new businesses by reducing capital gains taxes, and to lower income taxes are very positive. Over a period of time these steps will increase the productivity and competitiveness of American industry. It is true that the 1981 and 1982 depreciation changes have had little effect on cash flow in the computer industry. However, we do believe they have had a positive impact

But there are some things which the government could do in the fiscal area that would be of great benefit to the international competitiveness of the computer and other high technology industries:

Research and Development Credit. The 25 percent credit on increases in qualifying R&D expenses needs to be made permanent and to be liberalized. In fact, we believe that it would be a positive step to make all R&D, not just the increment, qualify for the credit. Although the credit has been in place only a short time, and many companies are only now beginning to take it into account when determining their research programs, we believe it is having a positive effect. Unfortunately, the credit is due to expire after 1985. From now until 1985 is not a long enough period of time to expect a wholesale improvement in the R&D plans of American industry. Industry action is also being held back since early termination of the credit seems to be turning up on many lists of possible "revenue enhancers."

Section 861. The present two-year suspension of the Treasury Department's regulations on the allocation of R&D expenses also needs to be made permanent. The Treasury regulations would have limited the deductibility of R&D expenses for companies who sell their products overseas.

DISC. DISC has provided cash-flow benefits for U.S. exporters by deferring some federal income tax on export sales. It has been attacked by other countries as a violation of GATT rules. If DISC must be replaced, an alternative must be found that is consistent with GATT rules and that provides equivalent cash flow benefits.

Federal Deficit. We are not here to discuss the specifics of reducing the federal deficit. But it must be reduced if we are not to have higher interest rates and a resulting early return of inflation.

3. Government-Supported Research

The federal government has played a major role in industrial development, with substantial fall-out from government contracts benefiting related products subsequently sold in the private sector. The computer industry, in fact, grew out of government contracts in the 1940s

At the present time, the Defense Science Board has rated the VHSIC program as the number one DOD technology program. This program, which was initiated to jump the "state of the art" of military integrated circuits, is already having an impact on the integrated circuit industry. It stimulated the industry to accelerate programs in finer-geometry integrated circuits. One criticism of the VHSIC contracts is that they were several years too late.

More federal funding of VHSIC-type programs in basic technologies affecting the future of our electronics industry will be essential to stay ahead in those technologies that are too far ahead of commercial feasibility to attract commercial funding at adequate levels.

Nearly six percent of the federal budget is for research and development, primarily through DOD, NIH, NASA, DOE, and the National Science Foundation. The Administration's proposal to increase funding to universities through the NSF is a good sign, as that budget has seen no real growth over the past four years. There also needs to be some discussion of setting overall goals and strategies for the government's investment in R&D, rather than negotiating it on an annual basis through countless budget line items.

4. Industry Cooperation

Of all the four areas I have mentioned, we believe that this is probably the most important. Individual U.S. corporations face many research and development projects too large and costly for them to handle individually. But they are reluctant to engage in cooperative efforts with other companies because of anti-trust risk. There are some innovative efforts in the cooperative R&D area which minimize these risks.

One example would be the Semiconductor Research Consortium created by the Semiconductor Industries Association. The approximately 30 members of this consortium contribute on the basis of their integrated circuit use and/or sales. The consortium distributes its funds in response to proposals from universities and will initiate new areas of research most need by U.S. industry.

Another example is the Microelectronic and Computer Technology Corporation established under the leadership of Control Data. MCC is similar to a limited partnership for R&D in which companies combine to form a vehicle that performs the R&D at arm's length and

Some reduction of the anti-trust risks in cooperative R&D came with the publication of the Justice Department's liberalized guidelines in 1980 recommending the issuance of "business letters" to specific joint ventures. These letters indicate that the Justice Department has no intention to attack the joint venture on anti-trust grounds. But the letters are no assurance that Justice will not change its mind in the future, nor are they any protection against private anti-trust suits.

The law needs to be modified to grant binding anti-trust exemption, applicable to private as well as government suits, for approved R&D joint ventures. Such exemptions would enable U.S. companies to combine complementary resources and skills to accelerate innovation and avoid duplication of effort.

Cooperative efforts may also be needed in areas other than R&D. The recently enacted Export Trading Company Act, for example, recognizes the need for marketing cooperation in export sales. Another area for consideration might be certain declining U.S. industries. This could be achieved through an official identification of these industries, and the establishment of definite anti-trust exemptions for the appropriate mergers, consolidations, transfers, rationalization and other cooperative action between companies within the industries.

In summary, we need to keep negotiating pressure on Japan and other countries to eliminate the remaining barriers to trade and investment. But other advanced industrial countries will always be formidable competitors for many of the products we make. These steps I have outlined will, we believe, enable us to help ourselves maintain and improve the competitive position of the United States.

"U.S. Controls on International Trade"

John W. Lacey
Executive Vice President
Technology and Planning
Control Data Corporation

Control Data strongly supports the effective administration of the current Export Administration Act for export promotion and its enforcement for national security purposes.

We are very concerned, however, over the West-West export controls which are in place and which are becoming more extensive as a result of the efforts by the U.S. Government to deny or delay the acquisition of products or technologies by our adversary nations.

Our industry has a good record and a deep interest in protecting its proprietary technology. This industry is multi-national in nature. The United States is no longer, if it ever really was, the only source of technology in our industry. There must be free flow, both ways, of research and development results within the corporate structure if we are to remain competitors in the international marketplace.

Control Data also questions those who have suggested that restrictions be placed on the results of basic research which are in a real sense "vital" to the competitiveness of U.S. industry. We believe the free exchange of such research, excluding classified work carried out for national security purposes, benefits the United States and its allies. The exchange of ideas is the basis for much of our industry's development work.

A technological parity exists with our trading partners and with the realization of that fact we must develop policies toward effective controls which will retard the flow of technology to our adversaries, recognizes our industry's multi-national nature and does not further, but removes, the causes of our growing reputation for being unreliable suppliers.

I will now address several areas of the export controls with a view toward possible future implementation strategies.

1. The Need for U.S. Industry to Export

There is an obvious need for a positive balance of trade and for a strong United States economy. It must be understood that many technologies developed within the United States for commercial use are more advanced than the technologies currently used for military purposes. The Department of Defense must rely increasingly on technologies developed for commercial purposes. The quality of commercial technology available to the Department of Defense from U.S. companies depends upon the competitiveness of those companies in the world market. Therefore, export control measures whch put U.S. high technology companies at a competitive disadvantage to foreign companies in Western markets adversely affect our national security in the long run and must be avoided to the maximum extent possible.

2. Multilateral Controls

It is essential to establish effective export controls on goods and technologies which can make a direct and significant contribution to the military capabilities of specific adversary countries. Such militarily critical goods and technologies can be acquired in many western industrial countries. Therefore, multilateral agreement with our allies and other non-adversary countries is the only effective means to deny access to such goods and technologies by adversary countries.

3. Foreign Policy Controls

The United States Government is one of the few governments in the world that imposes foreign policy controls on its exporters. An objective examination of the effectiveness of foreign policy controls which have been implemented over the past years shows that these controls have not served their intended purpose. Indeed, in most cases, the opposite effect has been achieved.

The imposition of foreign policy controls by the President is one of the major reasons why U.S. exporters have gained the reputation over the past years as being unreliable. With increasing regularity, this is causing foreign customers to no longer consider U.S. exporters for their procurements. This coupled with the increasing availability of equivalent commodities from foreign manufacturers is causing U.S. industry to loose increasing segments of the foreign market.

The imposition of export controls for national security reasons gives the administration plenty of tools to protect the national security.

It seems that the imposition of foreign policy controls has been for the primary reason of the incumbent administration's desire to send signals to certain countries with which it is not pleased. For the U.S. exporter the result is a spigot-like mechanism being turned on and off, causing industry to be regarded as an unreliable supplier along with severe economic losses that are associated with this on-off process and of course the jobs that are lost in the process.

In summary, the ability of the President to impose foreign policy controls should be severely curtailed if not removed completely. The national security would not suffer because of this because of the very adequate control mechanisms available to the President under the national security controls process.

Serious consideration should be given to trading freely with all countries with whom the United States has diplomatic relations within the constraints of national security controls. This is the process by which most other countries operate and they do it quite successfully recognizing the need for a strong internal economy and the need to not present their exporters with the disincentives associated with the on-off spigot of foreign policy controls.

4. Exports to COCOM Countries

The requirement for individual validated licenses for exports of goods or technologies subject to multilateral controls to COCOM countries should be removed.

The purpose of controls is to deny adversary countries (not allies) access to specified goods and technology. This purpose can be achieved effectively only by multilateral controls. Individual review of license requests for exports of goods or technologies subject to multilateral controls to allies is irrelevant to the purpose of the controls and diverts enforcement resources from achieving that purpose.

5. Reexport Controls Within COCOM Countries

The requirement for reexport controls on goods and technologies exported to COCOM countries when such goods and technologies are subject to multilateral controls should be removed.

Controls will be effective only if all sources, not only the United States, are controlled. As a practical matter, this can only be achieved through multilateral controls. Under such controls each COCOM country must be responsible for controlling reexports from its territory to adversary countries.

6. Exports to Third World Countries

Less stringent licensing requirements should be imposed on exports of goods and technologies to non-adversary, non-COCOM countries which agree bilaterally with the United States Government to impose controls on exports and reexports which are similar or identical to COCOM controls.

Because all sources must be controlled, every effort must be made to expand multilateral controls to as many countries as possible. Effective bilateral agreements with non-adversary neutrals would allow allocation of enforcement resources to more serious problems such as illegal acquisition efforts by adversary countries. The precise level of controls under a bilateral agreement would depend on the stringency of the agreement.

7. Foreign Availability

What industry needs in the area of foreign availability is an implementation of the spirit of the words covering foreign availability in the Export Administration Act of 1979. There needs to be a thorough assessment capability for foreign availability within the Department of Commerce and associated export control agencies. This assessment capability must be extremely responsive to the needs of industry in a situation where a United States company is competing for business with a foreign manufcturer who will not experience any licensing delays. The United States company must have a very quick assessment of foreign availability such that it can continue to compete for that specific business.

Delays in foreign availability assessment and verification will serve only to deprive the United States manufacturer of the ultimate contract because the foreign competitor has in the meantime already delivered the commodities and taken the business away from the United States manufacturer.

In fact, U.S. business has been experiencing this scenario more and more over recent years. There does not exist at this point in time a viable foreign availability assessment capability within the Department of Commerce much less the

capability to respond to the needs of U.S. industry within any reasonable timeframe. There also does not exist within the United States Government a capability to verify claims of foreign availability that may be submitted from manufacturers as part of their export license applications.

In summary, there needs to be a viable foreign availability assessment capability that is responsive to the needs of the U.S. industry within a very short timeframe so that U.S. industry can remain competitive in the foreign marketplace.

8. Indexing

As time passes the state of the art in technology sophistication and performance increases. The current export regulations, both within the U.S. Government and within COCOM take into account the technology levels that existed prior to 1974. U.S. manufactuers have long since gone beyond the technology levels that existed in 1974 in their current product lines.

U.S. manufacturers cannot afford to continue to build obsolete product lines for export which would fit under the current export control guidelines when our foreign competitors are building products and technology which are state of the art and contemporary. Consequently, U.S. manufacturers are finding it more and more difficult and sometimes impossible to export contemporary products. Meanwhile, foreign sources of the same and equivalent products are able to take the business away from U.S. manufacturers because the export controls which govern their exports are either non-existent or less stringent than those imposed unilaterally on U.S. exporters.

This situation must be rectified so that the indexing of the export control guidelines is kept up with the advancement that occurs over a period of time in technologies and products so that the United States can remain competitive in the foreign market place and is not unnecessarily impeded by a lack of an indexing process within the U.S. export control guidelines. The Export Administration Act of 1979 clearly calls for a periodic indexing of the guidelines for export controls. This has not happened.

9. Unilateral Controls

Export controls imposed unilaterally by the U.S. Government on goods and technologies should terminate one year after the

date on which they were imposed. If COCOM countries agree to multilateral controls on such goods and technologies, an extension or renewal of such unilateral controls should be prohibited.

10. Militarily Critical Technologies List

The contents of the Militarily Critical Technologies List must not be unilaterally imposed on United States exporters. The proper way for the MCTL to be implemented is to first seek multilateral agreement on those technologies and products which must be controlled from export to our adversaries and then, and only then, should the regulatory language which encompasses the contents of the MCTL find its way to the United States Commodity Control List.

Only multilateral controls will be effective and an imposition of unilateral controls on U.S. manufacturers will only serve to decrease the market share in the foreign market place of U.S. exporters.

11. Enforcement

Government enforcement resources must be focused effectively on illegal activities. This goal can only be achieved through measures which promote voluntary compliance by responsible companies to the maximum extent possible. This in effect places export controls on free world trade into the framework of "pre-emptive" controls whose main purpose is not the regulation of U.S. business but the forcing of Soviet acquisition programs into the open.

Effective regulation under the export controls must force adversary countries to employ illegal means if they attempt to acquire militarily critical goods or technology from the West.

Control Data is grateful for the opportunity to share its views on export controls with you. I would be pleased now, to address your questions.

There are four key elements ... today. These are areas in which we believe government support can help the private sector become more competitive. The four areas are: foreign trade barriers; fiscal policy; government supported research and development; and industry cooperation. Export control policy is also a critical element but that will be discussed later in the meeting by Robert Price of Control Data.

I would also like to point out that we do not believe that the U.S. should adopt the industry targeting methods used by other countries. Each country has to develop policies that reflect its own culture, its own history, its own economy. We believe that the U.S.' economic strength is its free market system. We need policies that improve the efficiency and adaptability of that system.

We have four policy areas where we think improvements can be made:

negotiating. In particular, the trade representative needs to search out and publicize countries and regulations that treat U.S. and other foreign firms differently from domestic firms.

Congress should also restore the President's authority to negotiate tariff reductions in specific industries.

2. Fiscal Policy

We believe the recent steps to increase cash flow in some industries by speeding depreciation schedules, to stimulate investment in new businesses by reducing capital gains taxes, and to lower income taxes are very positive. Over a period of time these steps will increase the productivity and competitiveness of American industry. It is true that the 1981 and 1982 depreciation changes have had little effect on cash flow in the computer industry. However, we do believe they have had a positive impact on the economy as a whole, and, not incidentally, on many of our important customers.

been attacked by other countries as a violation of GATT rules. If DISC must be replaced, an alternative must be found that is consistent with GATT rules and that provides equivalent cash flow benefits.

Federal Deficit. We are not here to discuss the specifics of reducing the federal deficit. But it must be reduced if we are not to have higher interest rates and a resulting early return of inflation.

3. Government-Supported Research

The federal government has played a major role in industrial development, with substantial fall-out from government contracts benefiting related products subsequently sold in the private sector. The computer industry, in fact, grew out of government contracts in the 1940s.

many research and development projects too large and costly for them to handle individually. But they are reluctant to engage in cooperative efforts with other companies because of anti-trust risk. There are some innovative efforts in the cooperative R&D area which minimize these risks.

One example would be the Semiconductor Research Consortium created by the Semiconductor Industries Association. The approximately 30 members of this consortium contribute on the basis of their integrated circuit use and/or sales. The consortium distributes its funds in response to proposals from universities and will initiate new areas of research most need by U.S. industry.

Another example is the Microelectronic and Computer Technology Corporation established under the leadership of Control Data. MCC is similar to a limited partnership for R&D in which companies combine to form a vehicle that performs the R&D at arm's length and licenses the results to avoid anti-trust problems. It is also similar in some respects to the R&D consortium idea developed by Dr. Merrifield of the Department of Commerce.

maintain and improve the competitive position of the United States.

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work carried out for national security purposes, [illegible] United States and its allies. The exchange of ideas is the basis for much of our industry's development work.

A technological parity exists with our trading partners and with the realization of that fact we must develop policies toward effective controls which will retard the flow of technology to our adversaries, recognizes our industry's multi-national nature and does not further, but removes, the causes of our growing reputation for being unreliable suppliers.

I will now address several areas of the export controls with a view toward possible future implementation strategies.

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