Asian Semiconductor and Electronics Technology Conference

November 7–8, 1988
Hotel Shilla
Seoul, Korea

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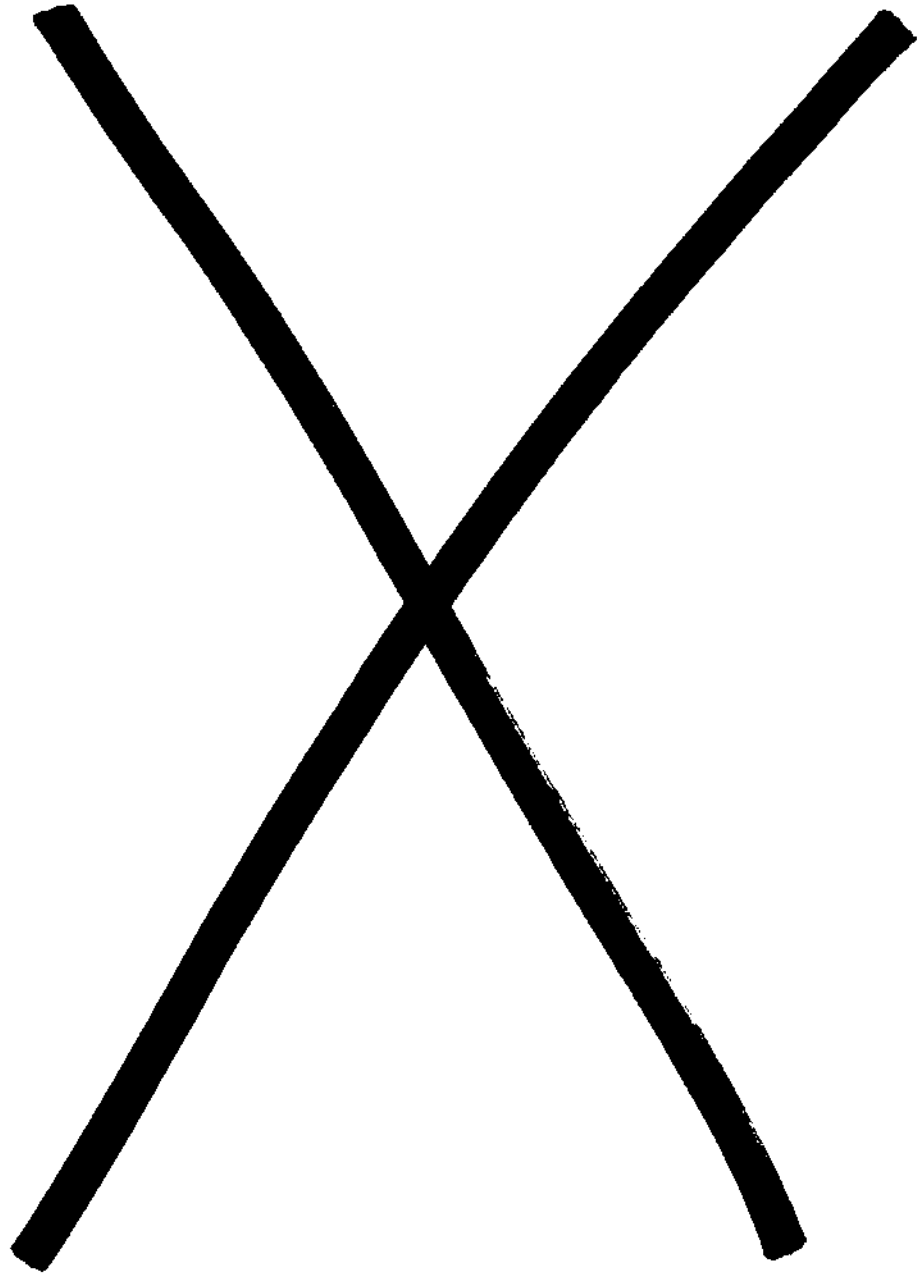

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ASIAN SEMICONDUCTOR AND ELECTRONICS TECHNOLOGY CONFERENCE

Approaching the Asian Age

November 6–8, 1988
Hotel Shilla
Seoul, Korea

SUNDAY, November 6

4:00 p.m.	**Registration**	*Dynasty Hall*
6:00 p.m. to 8:00 p.m.	**Cocktail Reception**	*Dynasty Hall*

MONDAY, November 7

7:00 a.m.	**Registration Continues**	*Dynasty Hall*
8:30 a.m.	**Welcome** Tom Wang Director, Asian Components Group Dataquest Incorporated	*Dynasty Hall*
8:45 a.m.	**Approaching the Asian Age** Tom Wang Director, Asian Components Group Dataquest Incorporated	*Dynasty Hall*
9:00 a.m.	**World Semiconductor Outlook** Gene Norrett Corporated Vice President and General Manager Components Division Dataquest Incorporated	*Dynasty Hall*
9:30 a.m.	**Asian Semiconductor Industry Update** Tom Wang Director, Asian Components Group Dataquest Incorporated	*Dynasty Hall*
9:50 a.m.	**Korea Semiconductor Industry Update** J.H. Son Senior Industry Analyst, Asian Components Group Dataquest Incorporated	*Dynasty Hall*
10:15 a.m.	**Break**	*Dynasty Hall*
10:30 a.m.	**Technology Innovation in South Korea** Jin Ku Kang President Samsung Semiconductor and Telecom	*Dynasty Hall*
11:00 a.m.	**Changing PC Manufacturing and Marketing Strategies** Dr. Irving Ho President Institute for Information Industry (III)	*Dynasty Hall*
11:30 a.m.	**Emerging Intellectual Property Issues** Dr. Judith Larsen Senior Industry Analyst, Research Operations Dataquest Incorporated	*Dynasty Hall*
12:30 p.m.	**Lunch**	*Dynasty Hall*
2:00 p.m.	**Emerging Telecom Market Opportunities** Dr. In Ku Kang Senior Managing Director Goldstar Co., Ltd.	*Dynasty Hall*

(Continued)

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2:30 p.m. **Taiwan's New Manufacturing Frontier** ..... *Dynasty Hall*
Dr. Ding-Yuan Yang
President
Winbond Electronics Co.

3:00 p.m. **Entering the ASIC Market** ..... *Dynasty Hall*
Dr. Hong Jo Chang
Executive Managing Director
Daewoo Telecom Co. Ltd.

3:30 p.m. **Break** ..... *Dynasty Hall*

4:00 p.m. **Developing Small Electronics Business in South Korea** ..... *Dynasty Hall*
Dr. K.O. Park
Senior Vice President
Hyundai Electronics Industries Co.

4:30 p.m. **A New Player in the Asian Semiconductor Game—India** ..... *Dynasty Hall*
Rahul Sud
Vice President, Marketing
Microchip Technology Inc.

5:00 p.m. **The Rise of China's Semiconductor Industry** ..... *Dynasty Hall*
Xu Juyan
Chief Engineer
Wuxi Microelectronics Complex

6:00 p.m. **Cocktails** ..... *Dynasty Hall*

7:00 p.m. **Dinner** ..... *Dynasty Hall*

8:00 p.m. **Dinner Speech** ..... *Dynasty Hall*
Speaker to Be Announced

9:00 p.m. **Entertainment** ..... *Dynasty Hall*

9:30 p.m. **Adjourn** ..... *Dynasty Hall*

TUESDAY, November 8

8:30 a.m. **Approaching the Asian Age** ..... *Dynasty Hall*
J.H. Son
Senior Industry Analyst, Asian Components Group
Dataquest Incorporated

8:45 a.m. **America After the Election—A New Direction?** ..... *Dynasty Hall*
John Wilson
Vice President, Business and Technology Analysis
Dataquest Incorporated

9:15 a.m. **U.S. Market Strategies in Asia: An Outsider's View** ..... *Dynasty Hall*
Jerry Lynch
Director of Strategic Program and Southeast Asia Sales
Advanced Micro Devices

9:45 a.m. **Market Opportunities for U.S. Companies: An Insider's View** ..... *Dynasty Hall*
Goh Guek Ling
Vice President, Asia Pacific Division
Texas Instruments Singapore Pte. Ltd.

10:15 a.m. **Break** ..... *Dynasty Hall*

10:30 a.m. **Japanese Electronics Manufacturing in Asia: An Outsider's View** ..... *Dynasty Hall*
Arthur T. Suyama
General Manager, International Marketing Division
Matsushita Electronics Co.

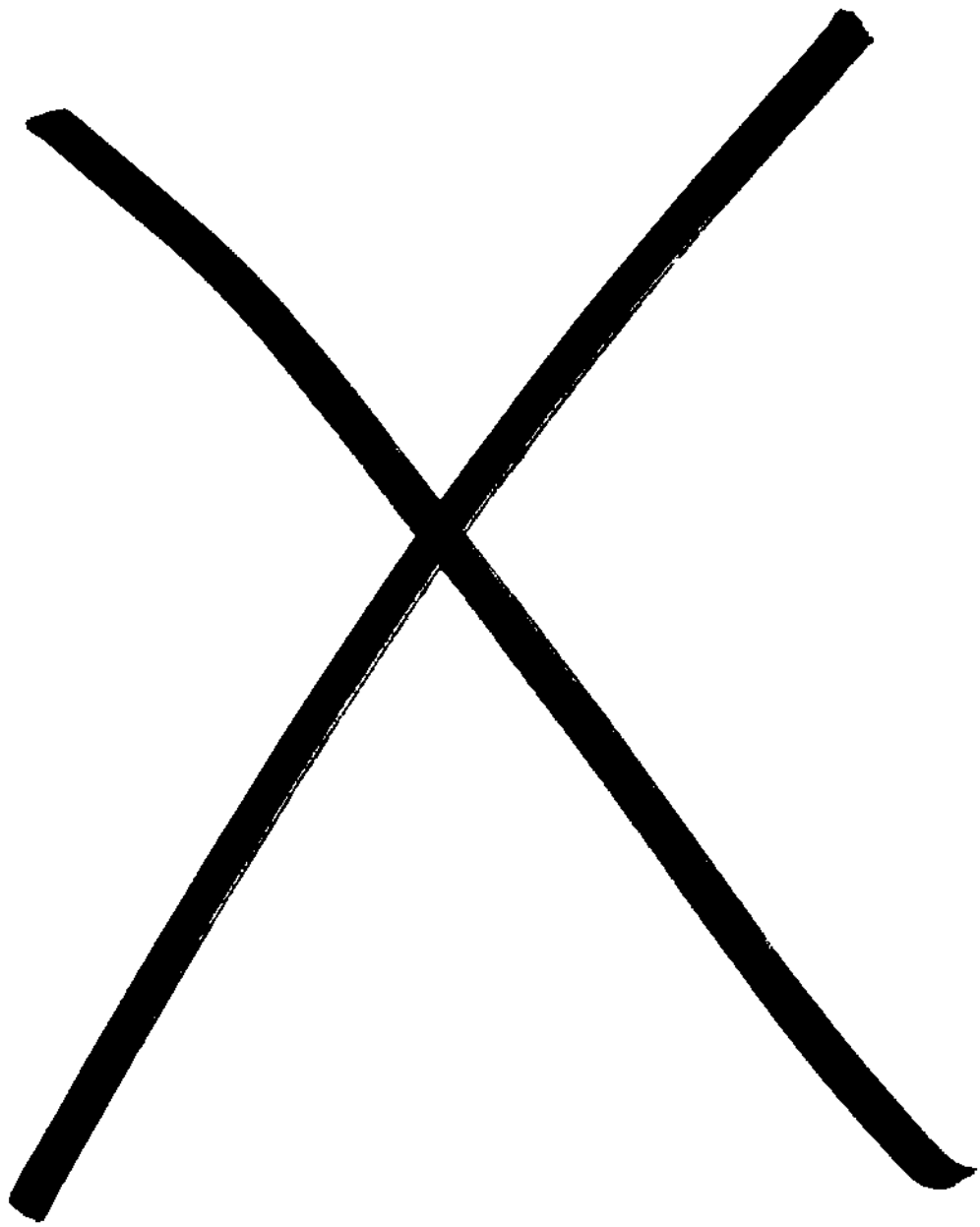
11:00 a.m. **The Emerging European—Asian Connection** ..... *Dynasty Hall*
Y.C. Lo
President
Philips Taiwan Ltd.

11:30 a.m. **Beyond the Clone: Personal Computer Market Opportunities in Europe** ..... *Dynasty Hall*
Sheridan Tatsuno
Senior Industry Analyst, Asian Components Group
Dataquest Incorporated

12:30 p.m. **Lunch** ..... *Dynasty Hall*

2:00 p.m. **Workshop: Pacific Rim Megatrends in the 1990s** ..... *Dynasty Hall*

4:00 p.m. **Conference Adjourns** ..... *Dynasty Hall*



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Seoul, Korea

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Daewoo Telecom Co.,Ltd.	Soo Ik Chae, General Manager Hong Jo Chang, Executive Managing Director Yong Bae Kim, Executive Vice President Chong Man Lee, Manager, Sales Byoung Kil Yoo, Deputy General Mgr, Sales
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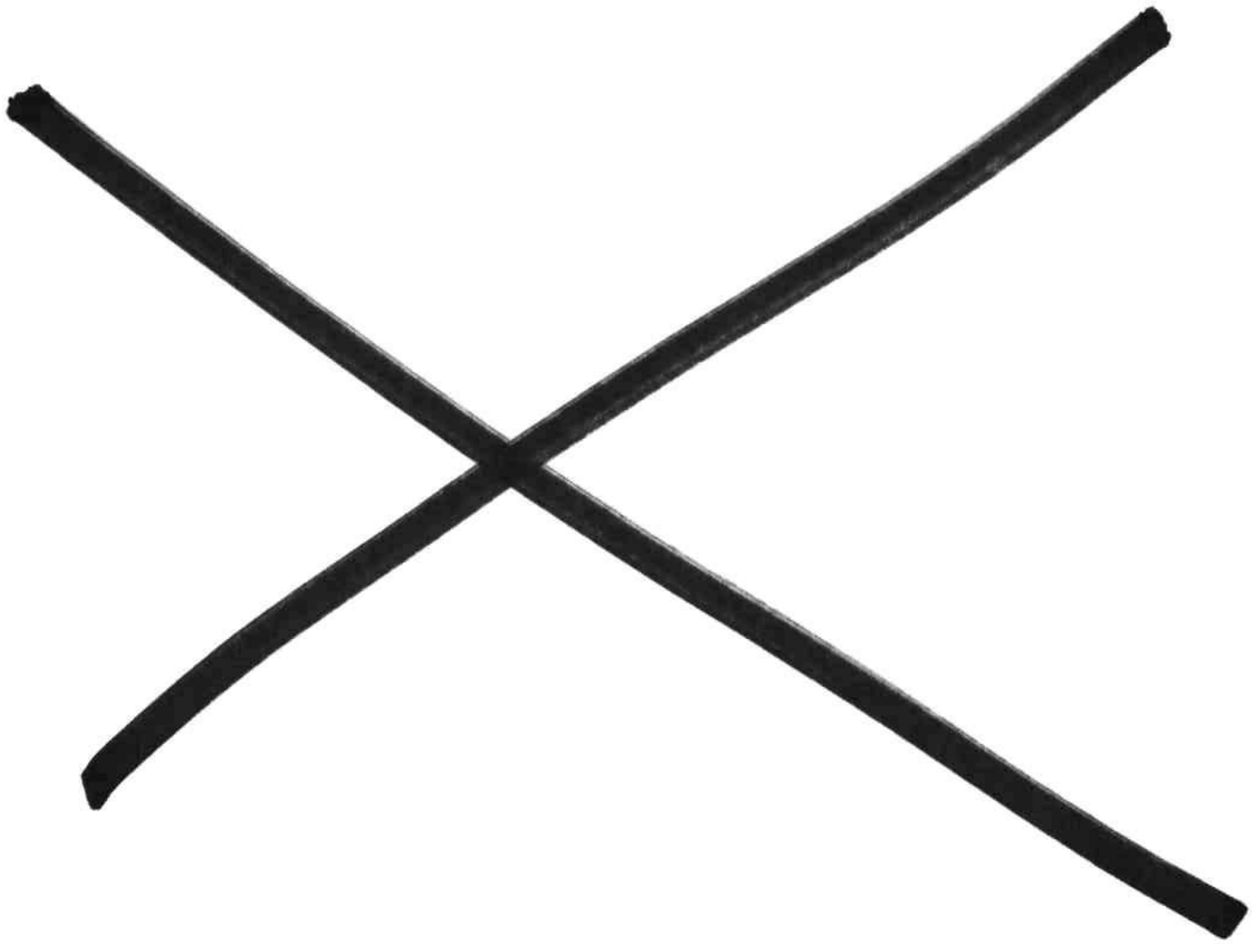

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APPROACHING THE ASIAN AGE

Tom Wang
Director
Asian Components Group
Dataquest Incorporated

Mr. Wang is Director of Dataquest's Asian Components Group and Associate Director of the Asian Semiconductor and Electronics Technology Service (ASETS). He is responsible for strategic research of the semiconductor and electronics industries of Korea, Taiwan, Hong Kong, Singapore, China, India, and other parts of Asia. Prior to joining Dataquest, Mr. Wang was employed at National Semiconductor as Applications Manager and Market Research Manager. Earlier, he worked as a Project Leader designing mainframes, personal computers, and disk drive controllers at several systems houses. He has also taught graduate courses at San Jose State University. Mr. Wang received B.S.E.E. and M.S.E.E. degrees from National Cheng Kung University in Taiwan, an M.S.E.E. degree from San Jose State University, and an M.B.A. degree from Golden Gate University in San Francisco. He has also completed courses toward a Ph.D. at the University of California at Berkeley. In addition, he has published a textbook and 26 technical papers and is fluent in Mandarin, Cantonese, and Taiwanese.

Dataquest Incorporated
ASIAN SEMICONDUCTOR AND ELECTRONICS TECHNOLOGY CONFERENCE
November 6-8, 1988
Seoul, Korea

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Approaching
the Asian Age

APPROACHING THE ASIAN AGE

Tom Wang
Director
Asian Components Group
Dataquest Incorporated

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INDUSTRIAL REVOLUTION OF THE LAST 500 YEARS STARTED WITH . . .

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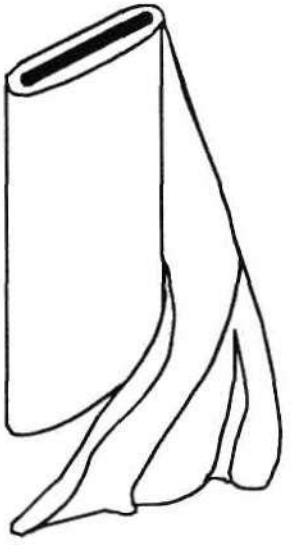

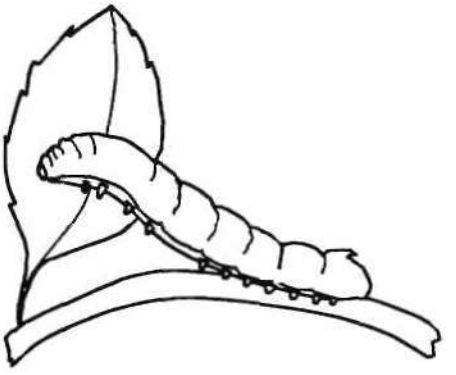

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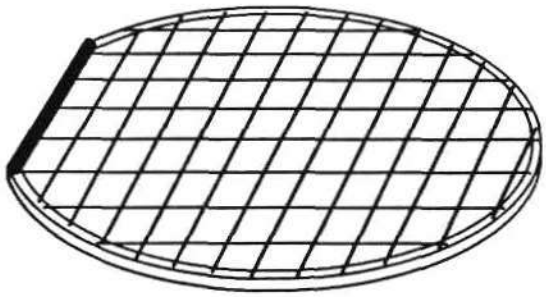

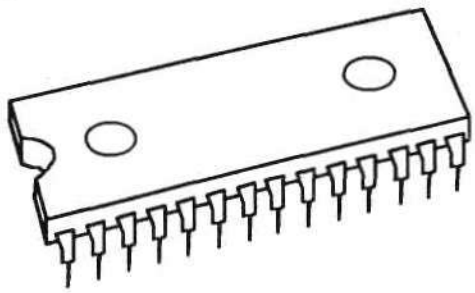

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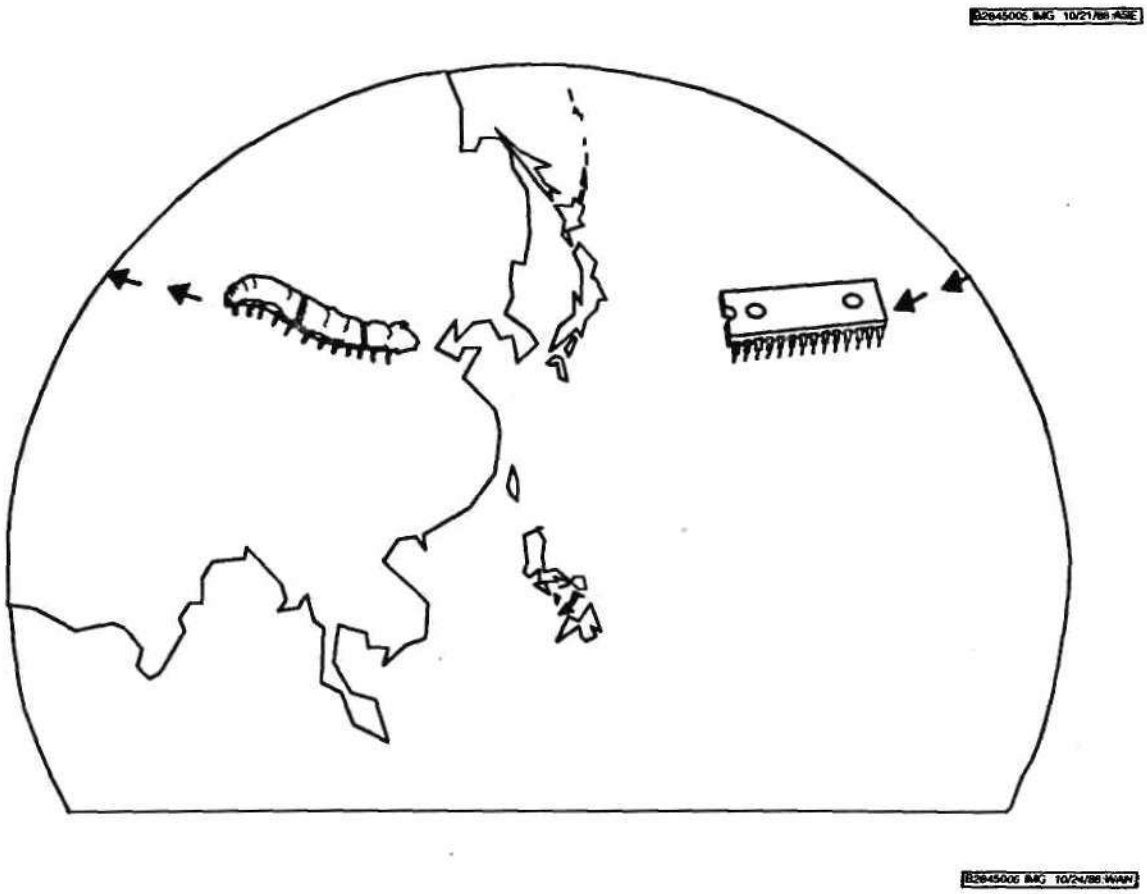

Without semiconductor technology, no one will be competitive in the next century!

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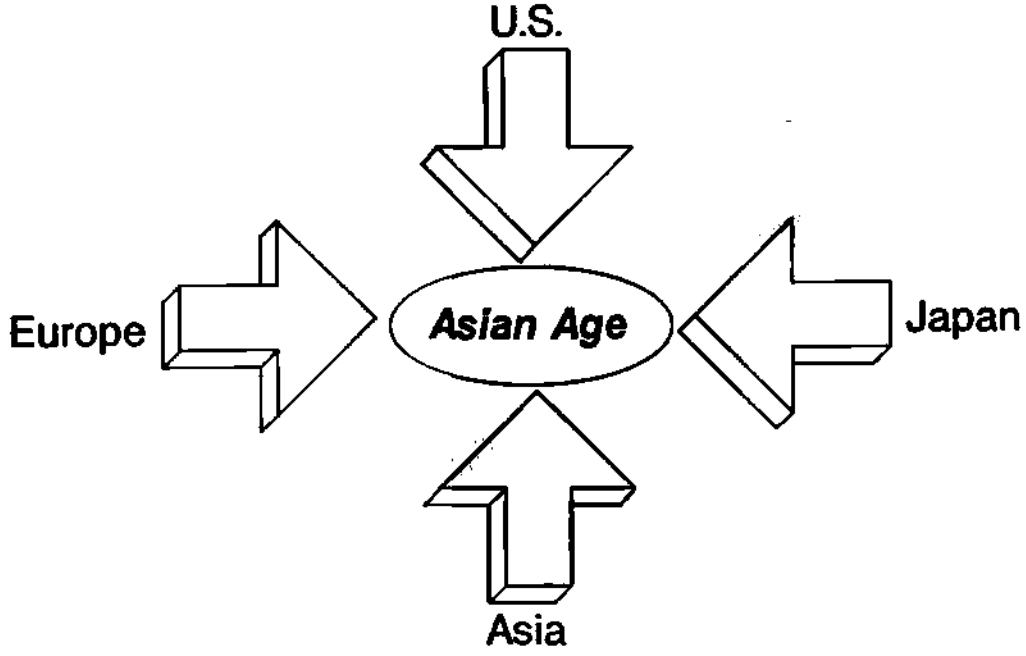
WHAT HAPPENED IN THE ASIAN SEMICONDUCTOR INDUSTRY IN 1988

- Korean semiconductor manufacturers heavily expanded capital spending
- Taiwan's new start-ups built their own fabs
- China invested in Wuxi and Shanghai fabs
- Singapore established Chartered Semiconductor
- Motorola launched Silicon Harbour project in Hong Kong
- Philips and Motorola invested in China

APPROACHING THE ASIAN AGE



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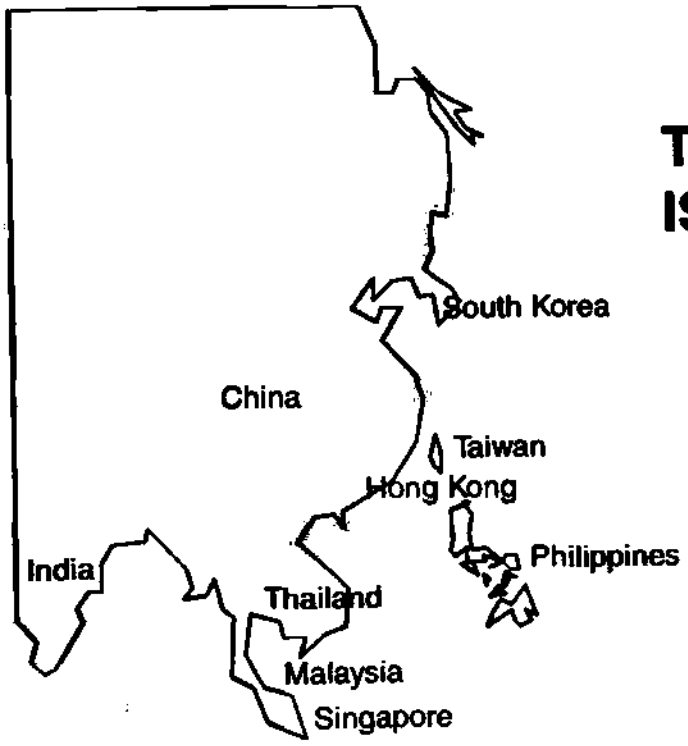

THE ASIAN AGE IS COMING!

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WORLD SEMICONDUCTOR OUTLOOK

Gene Norrett
Corporate Vice President and Division General Manager
Components Division
Dataquest Incorporated

Mr. Norrett is a Corporate Vice President of Dataquest and General Manager of its Components Division. In this capacity, he has direct responsibility for all U.S. research and coordinates European and Japan-based research. Prior to becoming Division General Manager, he founded Dataquest's Japanese Semiconductor Industry Service and was Acting Managing Director of Dataquest Japan K.K. Before joining Dataquest, Mr. Norrett spent 14 years with the Motorola Semiconductor Product Sector, serving in various marketing and management positions. He has traveled extensively in Japan, Hong Kong, Taiwan, Korea, China, and Europe. Mr. Norrett's educational background includes a B.A. degree in Mathematics from Temple University and an M.S. degree in Applied Statistics from Villanova University. He has also taken graduate courses in Marketing from Arizona State University.

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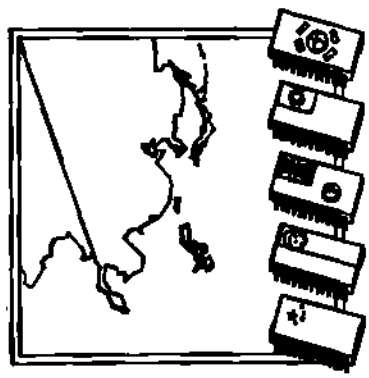

Approaching
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WORLD SEMICONDUCTOR OUTLOOK

Gene Norrett

Corporate Vice President and General Manager
Components Division
Dataquest Incorporated

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NEW AREAS OF RESEARCH – 1988

Services	Launch Date
Japanese Semiconductor Application Markets	2/88
MilAero Technology	8/88
Analog	9/88
North American Semiconductor Markets	12/88
Direct Products	
A Decade of Semiconductor Companies	6/88
IC Europe	8/88
The Drive for Dominance	9/88

AGENDA

- Overview of historical factors
- Status of electronics industry
- Status of semiconductor industry
- Forecasts
- Summary

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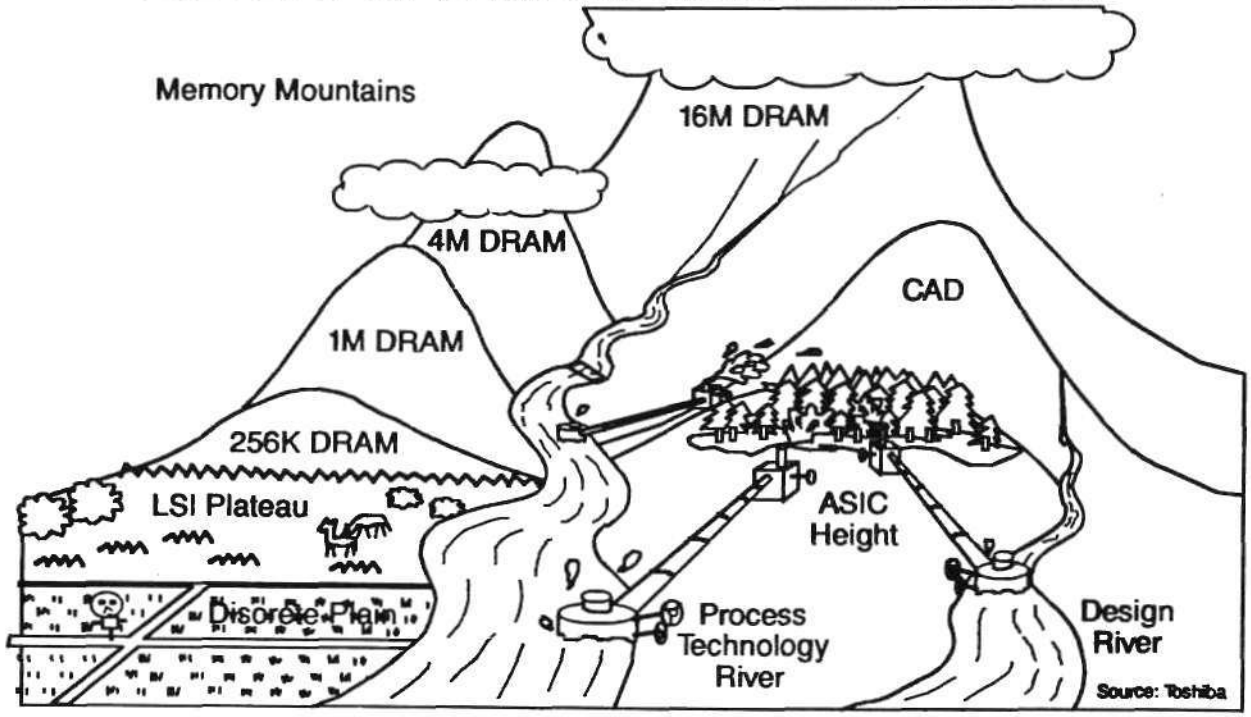
THE FLOW OF SEMICONDUCTOR TECHNOLOGY



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WHAT CAN WE LEARN FROM HISTORY?

Worldwide -- Millions of Dollars

Previous Recessions		Annual Growth/Decline
1967	$ 1,926	(1.8%)
1971	$ 2,487	(3.5%)
1975	$ 4,496	(13.7%)
1981	$14,828	5.0%
1982	$15,261	2.9%
1985	$24,823	(14.7%)

Source: Dataquest

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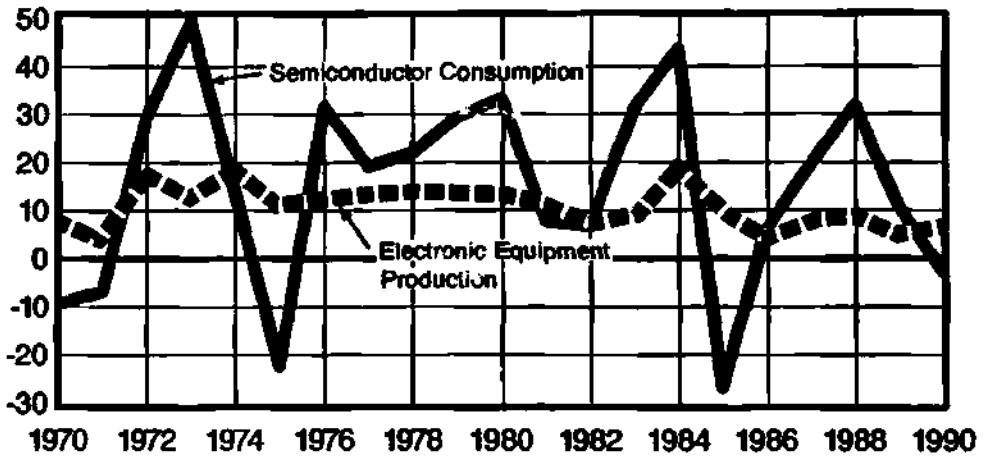
U.S. ELECTRONICS INDUSTRY'S RELATIONSHIP TO U.S. SEMICONDUCTOR INDUSTRY

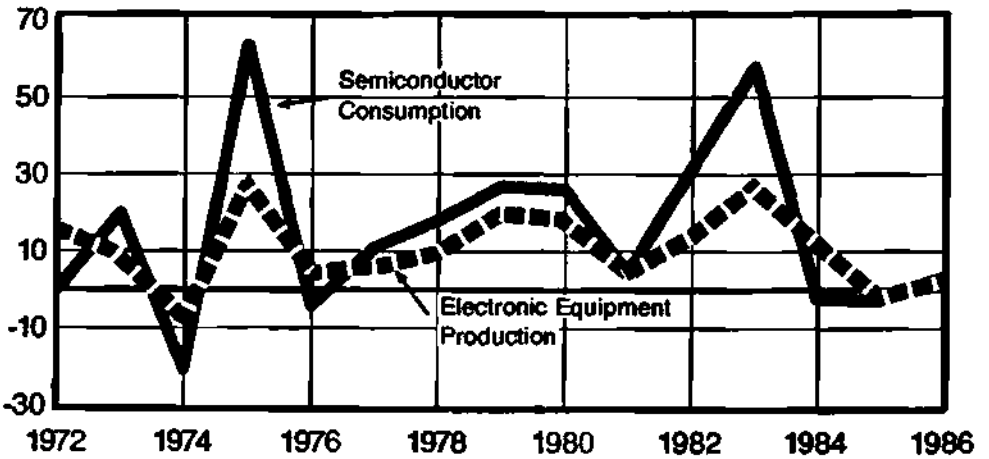
Percent Change Year to Year



Source: Dataquest

JAPANESE ELECTRONICS INDUSTRY'S RELATIONSHIP TO JAPANESE SEMICONDUCTOR INDUSTRY

Percent Change Year to Year



Source: Dataquest

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OTHER QUALITATIVE FACTORS AFFECTING SEMICONDUCTOR RECESSION

1971	System driver – mainframe computers and defense industry
1975	Significant double ordering Excess capacity Severe price attrition in commodity logic System driver – calculators, watches, and CB radios
1980-1982	System driver – video games
1985	Significant double ordering Excess capacity Severe price attrition in commodity memories System driver – personal computers

STATUS OF ELECTRONIC MARKETS

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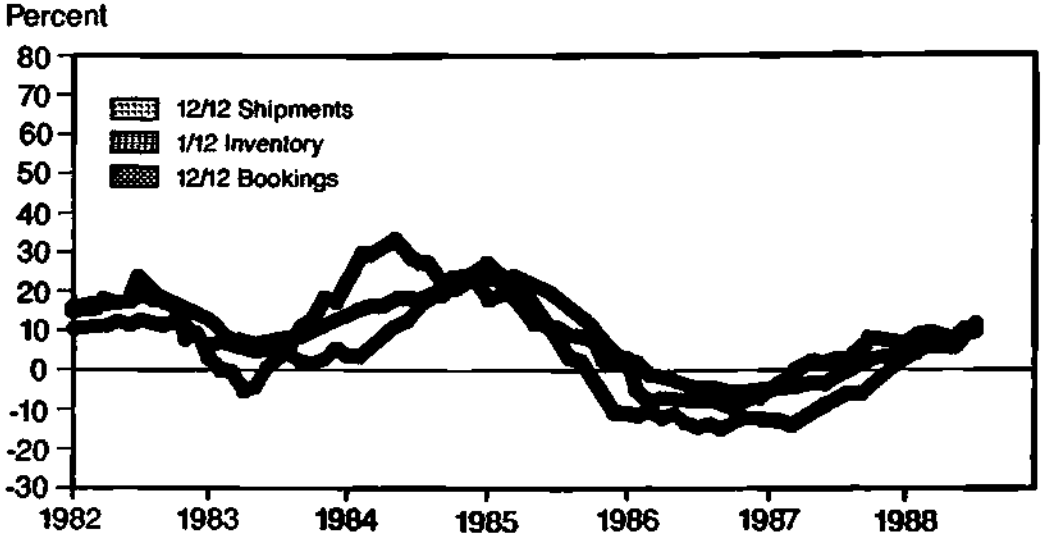
STATUS OF COMPUTER MARKETS

- Emergence of Extended Industry Standard Architecture (EISA) consortium
- Major segments of PC market moving in different directions
- Shortage of DRAMs limiting '88 growth
- 286 machines in pricing squeeze

STATUS OF COMPUTER MARKETS

U.S. Office Equipment and Computer Rates of Change



Source: Department of Commerce
Dataquest

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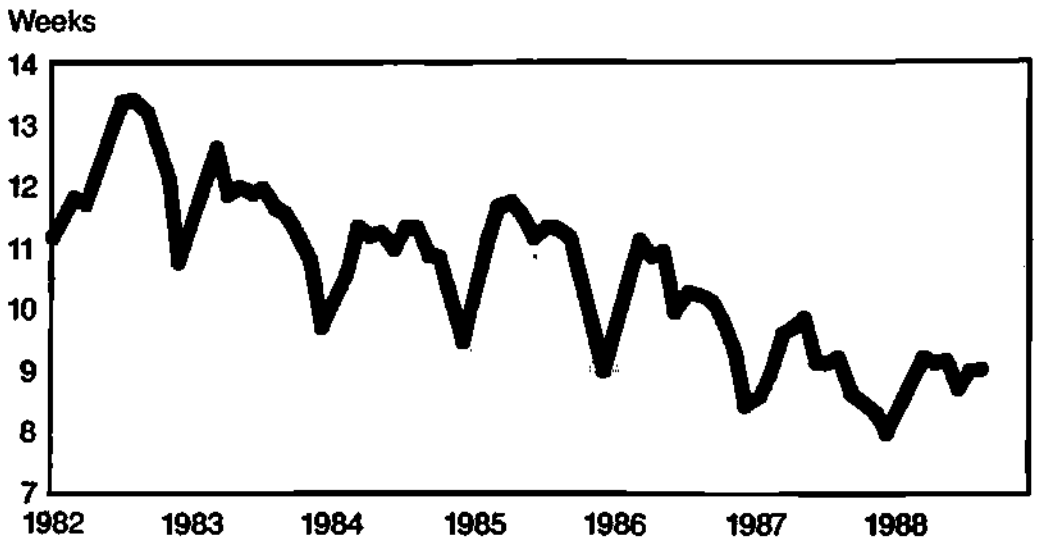
STATUS OF COMPUTER INDUSTRY

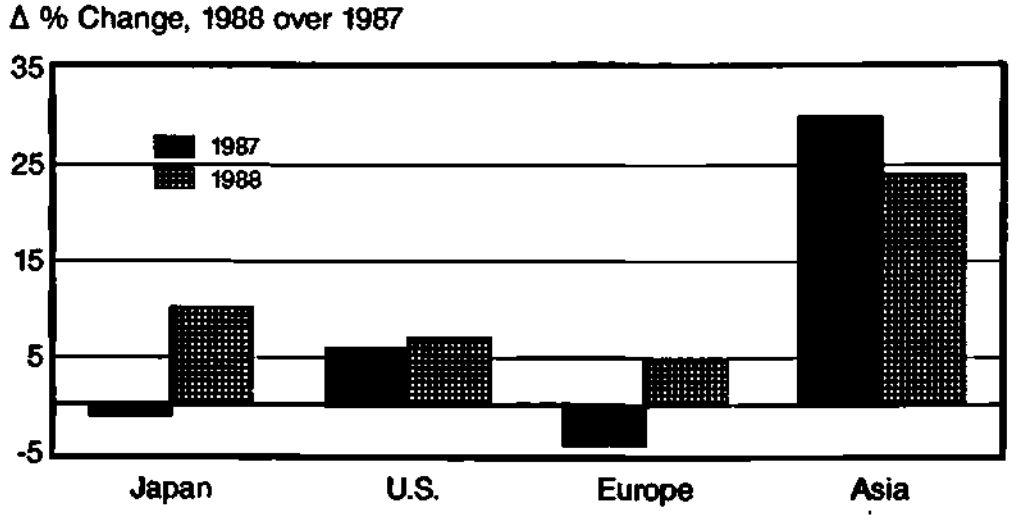
U.S. Computer Inventories in Weeks of Sales



Source: Dataquest

1988 ELECTRONICS MARKETS

World by Region



Note: Japan and Europe are in local currency to reflect appreciation of yen and ECU

Source: Dataquest

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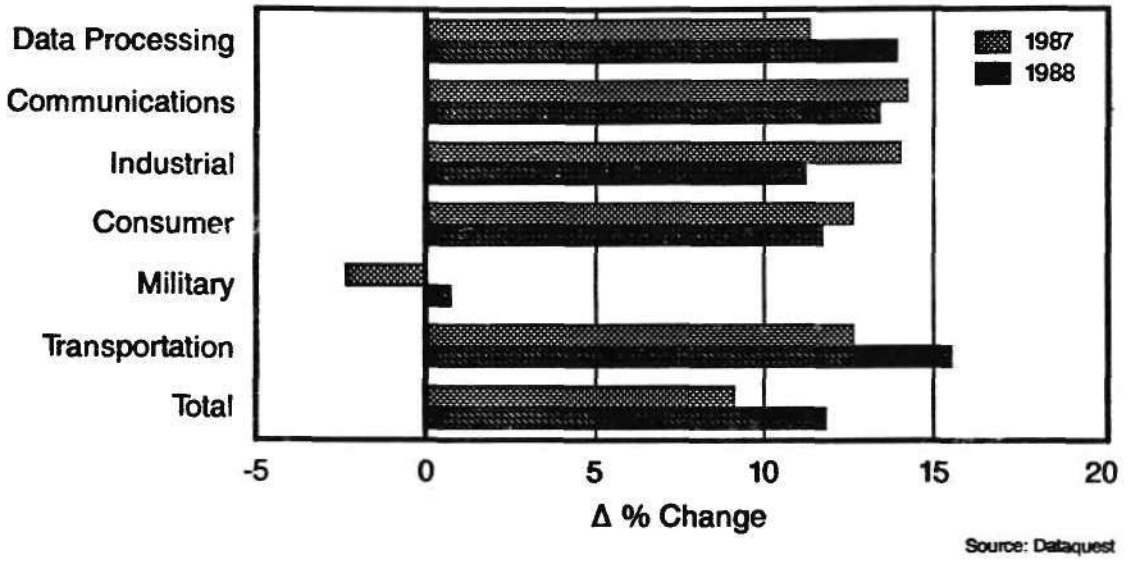
[S2610016.BMG 05/17/88:NOF]

1988 ELECTRONICS MARKETS

World by Application



Source: Dataquest

STATUS OF SEMICONDUCTOR INDUSTRY

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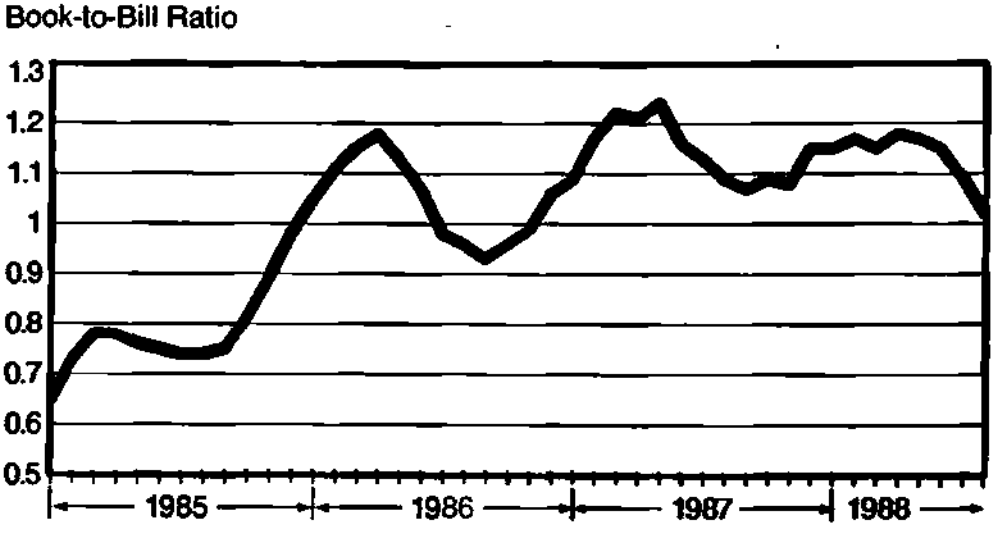
U.S. SEMICONDUCTOR BOOK-TO-BILL RATIO

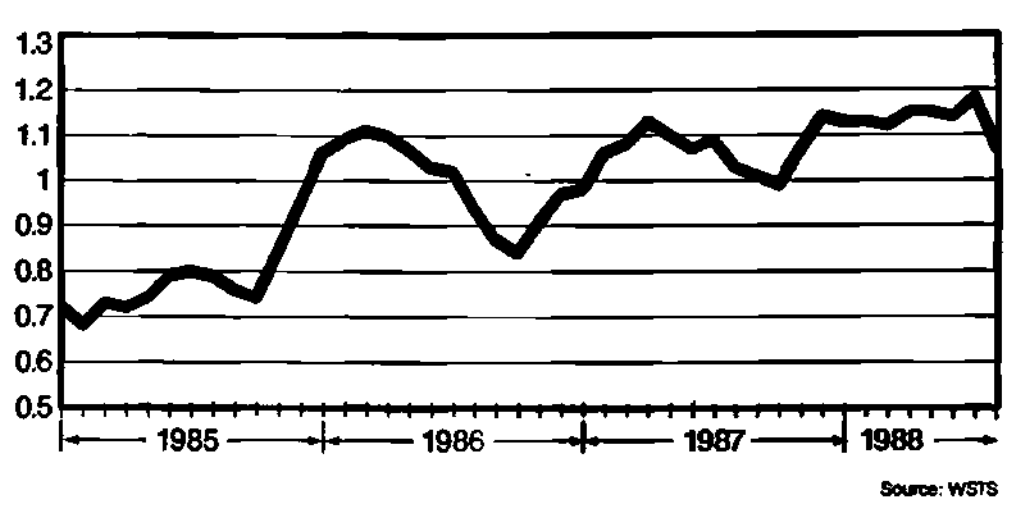
Three-Month Moving Average



Source: WSTS

EUROPEAN SEMICONDUCTOR BOOK-TO-BILL RATIO

Three-Month Moving Average



Source: WSTS

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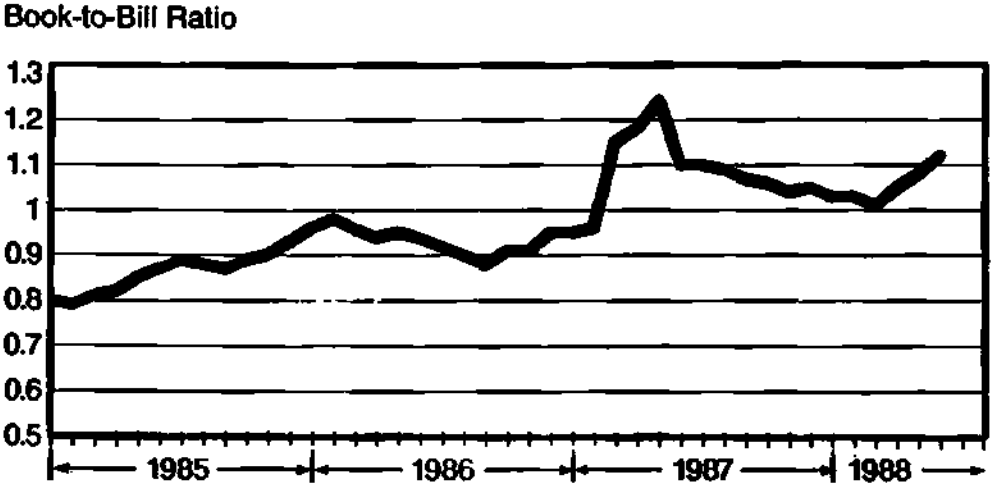
JAPANESE SEMICONDUCTOR BOOK-TO-BILL RATIO

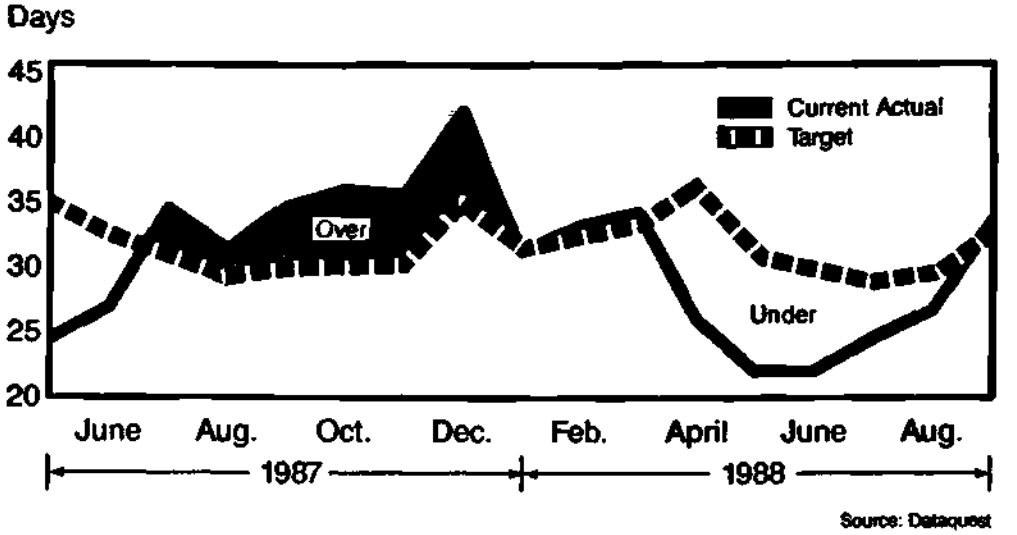
Three-Month Moving Average



Source: WSTS

STATUS OF SEMICONDUCTOR INVENTORIES THE BOOM/BUST CYCLES

Current Actual versus Target
Semiconductor Inventory Levels (Computer OEMs)



Source: Dataquest

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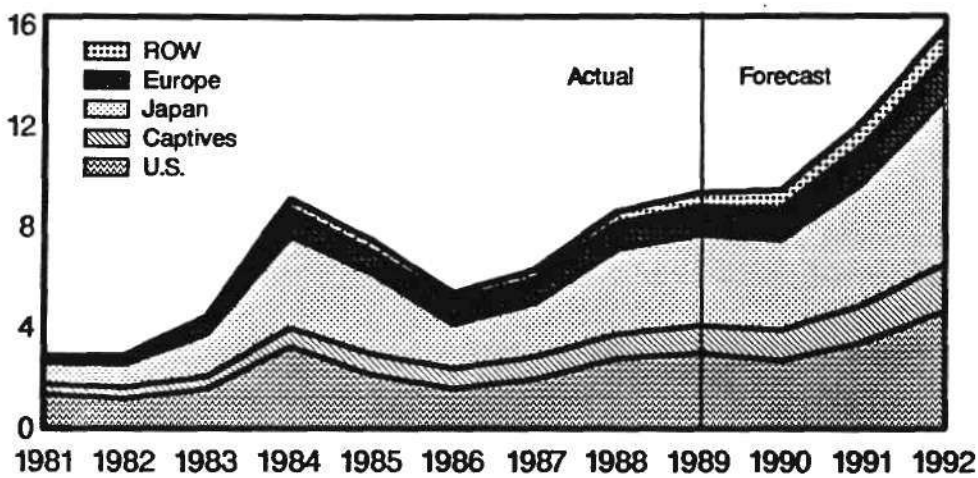
STATUS OF SEMICONDUCTOR INDUSTRY

Captial Spending

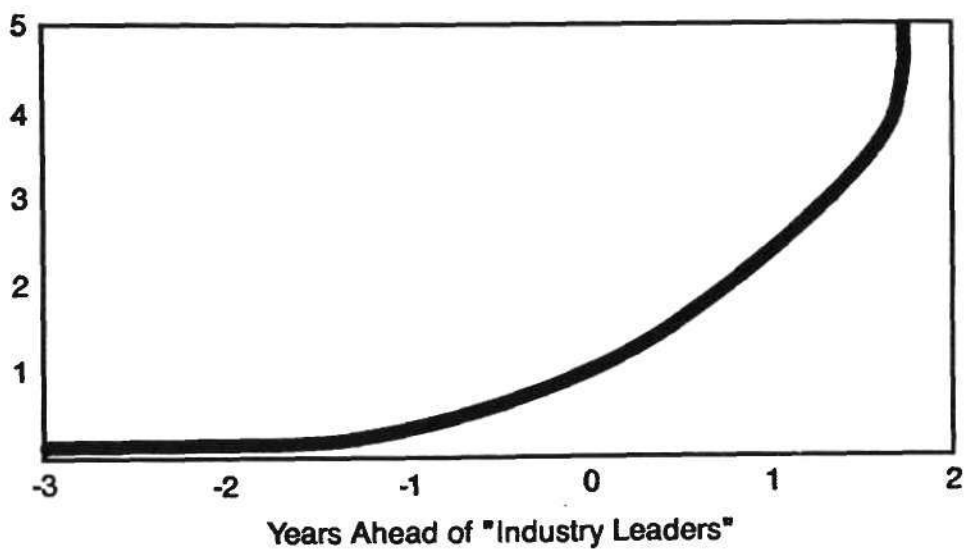
Billions of Dollars



Source: Dataquest

THE COST OF TECHNOLOGY LEADERSHIP

Relative Cost



Source: Intel Corporation
Gordon Moore

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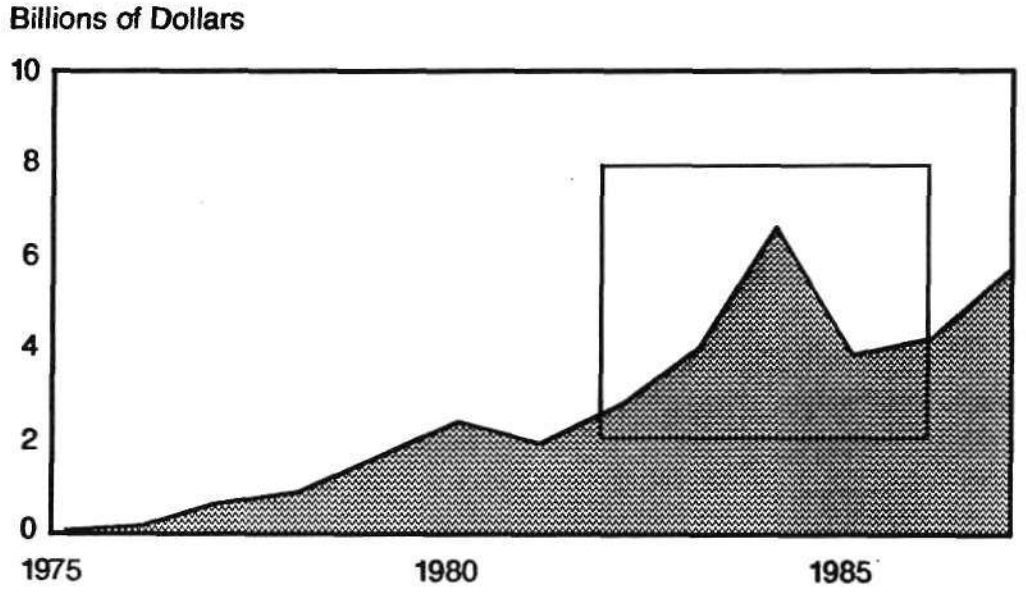
STATUS OF SEMICONDUCTOR INDUSTRY

Current High-Volume Contract Price

	U.S.	Japan	Europe
256K DRAM	$ 3.85	$ 2.62	$ 5.15
1M DRAM	$20.50	$15.30	$17.50
80286-10	$31.00	$41.05	$28.00
74LS245	$ 0.30	$ 0.41	$ 0.30
74HC245	$ 0.25	$ 0.34	$ 0.28
256K EPROM	$ 4.00	$ 4.56	$ 4.20

Source: DQ Monday

STATUS OF MOS MEMORY INDUSTRY



Source: Dataquest

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STATUS OF TOTAL SEMICONDUCTOR INDUSTRY

Worldwide Shipments (Millions of Dollars)

	1987	1988	Percent Change
Total Semiconductor	36,449	49,509	35.8%
IC	28,619	39,403	37.7%
MOS Memory	6,019	10,633	76.7%
MOS Logic	5,950	7,612	27.9%
MOS Microdevices	4,770	7,005	46.9%
Bipolar Logic	4,107	4,918	19.7%
Bipolar Memory	565	652	15.4%
Analog	7,208	8,583	19.1%
Discrete and Opto.	7,830	10,016	29.1%

Source: Dataquest

FORECASTS

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DATAQUEST'S FORECAST RECORD

October 1987
Percent Change

Region	Currency	1988F	1988A
Japan	Yen	20.5	23.7
North America	$	23.0	32.3
Europe	ECU	19.0	24.6
ROW	$	41.4	56.9

Source: Dataquest

OUR FORECAST RECORD

Worldwide Semiconductor Industry
(Millions of Dollars)

Forecast Date	1988	Percent Growth 88 over 87	1989	Percent Growth 89 Over 88
10/87	47,542	23.7%	47,364	(0.4%)
1/88	46,099	21.1%	46,348	0.5%
4/88	45,343	24.2%	49,564	9.3%
7/88	49,362	35.4%	54,621	10.7%
10/88	49,509	35.8%	54,571	10.2%

Source: Dataquest

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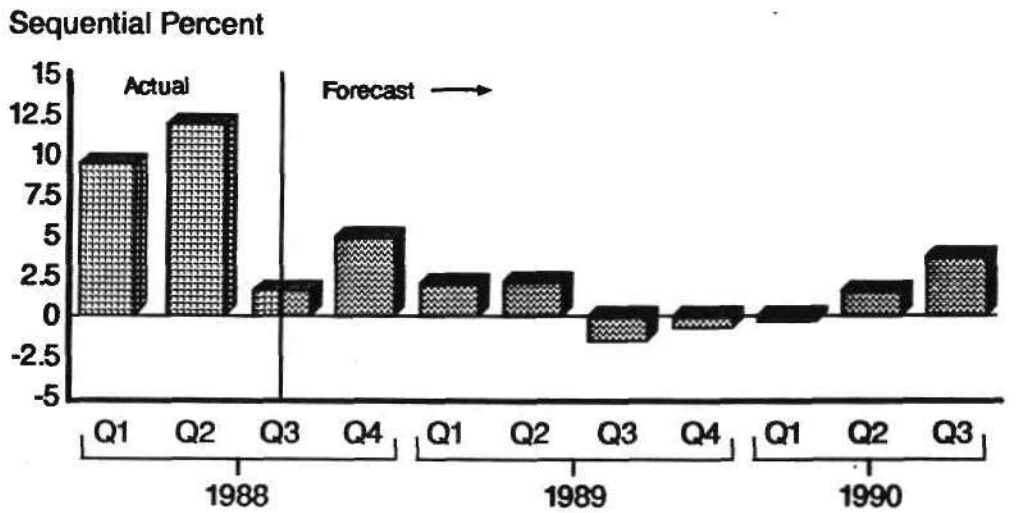
SEMICONDUCTOR INDUSTRY FORECAST

Eight-Quarter Rolling
World Shipments



Source: Dataquest

SEMICONDUCTOR INDUSTRY FORECAST

Assumptions for 1989 Semiconductor Growth

	≃20.0%	≃10.0%	≃3.0%
U.S. Real GNP	2.6	2.0	1.3
Business Fixed Investment	8.2	6.9	5.9
U.S. Computer Industry Growth	12%	7.5%	5.0%
1Mb DRAM Prices			
ASP ($)	9.50	8.16	8.50
Units (Millions)	650	530	480

Source: Dataquest

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SUMMARY

- We do expect a slower industry in 1989
- DRAM supply < demand until Q2 1989
- Capital investment slowing
- Higher electronics growth predicted for Asia than for the West

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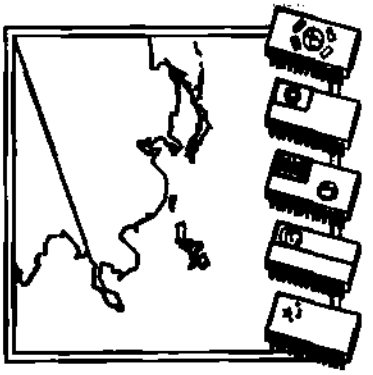

Approaching
the Asian Age

ASIAN SEMICONDUCTOR INDUSTRY UPDATE

Tom Wang

Director
Asian Components Group
Dataquest Incorporated

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2834002.IMG 10/24/88:WAN

AGENDA

- Asian semiconductor industry outlook
- Semiconductor manufacturers in Asia
- Asian semiconductor goals and status
- Key issues in 1989
- Summary and conclusion

2834003.IMG 10/24/88:WAN

ASIAN SEMICONDUCTOR INDUSTRY OUTLOOK

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B2834004.IMG 10/24/88 WAH

- Market growing drastically
- Production increasing significantly
- Manufacturing moving offshore
- Business opportunities growing

B2834005.IMG 10/24/88 WAH

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S2834006.IMG 10/24/88:WAN

ESTIMATED WORLDWIDE SEMICONDUCTOR CONSUMPTION

(Billions of U.S. Dollars)

	1987	1988	1989	1992
ROW	$ 4.0	$ 6.1	$ 7.3	$12.7
Europe	$ 6.4	$ 8.2	$ 8.8	$11.3
Japan	$14.3	$19.5	$21.3	$30.5
United States	$11.9	$15.7	$17.2	$24.8

Source: Dataquest

S2834007.IMG 10/24/88:WAN

PRODUCTION INCREASING SIGNIFICANTLY FROM ASIA

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2804006.IMG 10/24/88 WAN

SEMICONDUCTOR PRODUCTION

(Millions of Dollars)

Company	1986	1987	1988*
Samsung	$170	$317	$900
GoldStar	$ 48	$ 68	$120
Hyundai	$ 5	$ 40	$150
KEC	$ 50	$ 78	$100
UMC	$ 68	$ 90	$110

*Estimated

Source: Dataquest

2804008.IMG 10/24/88 WAN

MANUFACTURING MOVING OFFSHORE

Main Reasons for Moving Offshore

Before:
- Low labor cost

Now:
- Low labor cost + superior talent + closeness to market

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2634010.IMG 10/24/88 WAH

FUNCTIONS OF OFFSHORE FACILITY

Before:
Assembly and testing

Now:
Design + fabrication +
assembly and testing

2634011.IMG 10/24/88 WAH

BUSINESS OPPORTUNITIES GROWING

High-Technology Business Opportunities

- Semiconductor manufacturing
- Semiconductor equipment and materials manufacturing
- Systems manufacturing

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SEMICONDUCTOR MANUFACTURERS IN ASIA

SEMICONDUCTOR MANUFACTURERS -- SOUTH KOREA

- Samsung
- Goldstar
- Hyundai
- Daewoo
- KEC

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SEMICONDUCTOR MANUFACTURERS – TAIWAN

- ERSO
- UMC
- TSMC
- Fine
- Rectron
- Winbond
- HMC
- AMPI

SEMICONDUCTOR MANUFACTURERS – HONG KONG

- Elcap
- Hua Ko
- RCL

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SEMICONDUCTOR MANUFACTURERS -- SINGAPORE

- Chartered
- HP
- SGS-Thomson

SEMICONDUCTOR MANUFACTURERS -- CHINA

- Wuxi
- BETF
- Beijing Semiconductor Factories #3, 6, and 109
- Shanghai #5, 7, 14, and 19 Radio Components Factory
- Li shan
- Others

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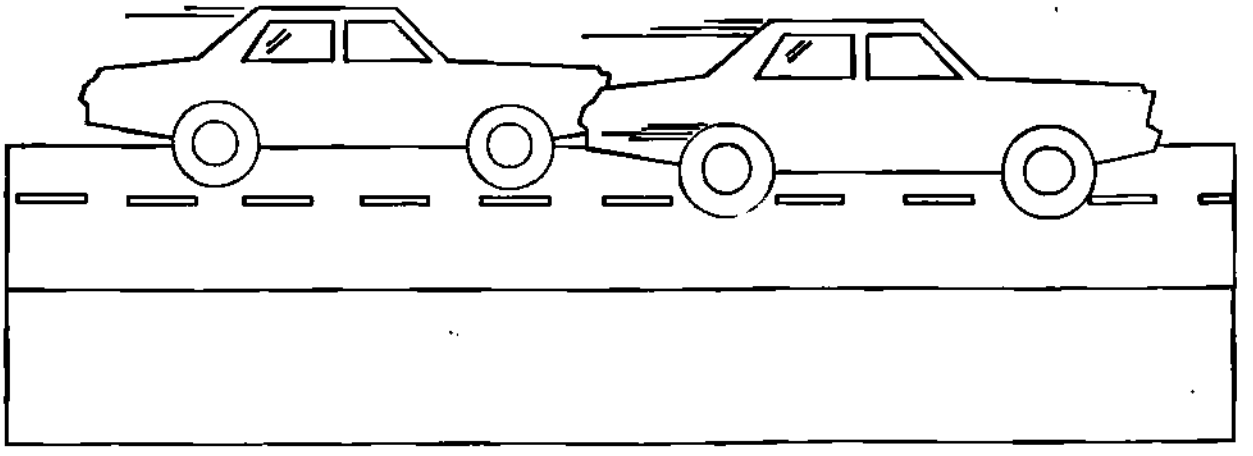
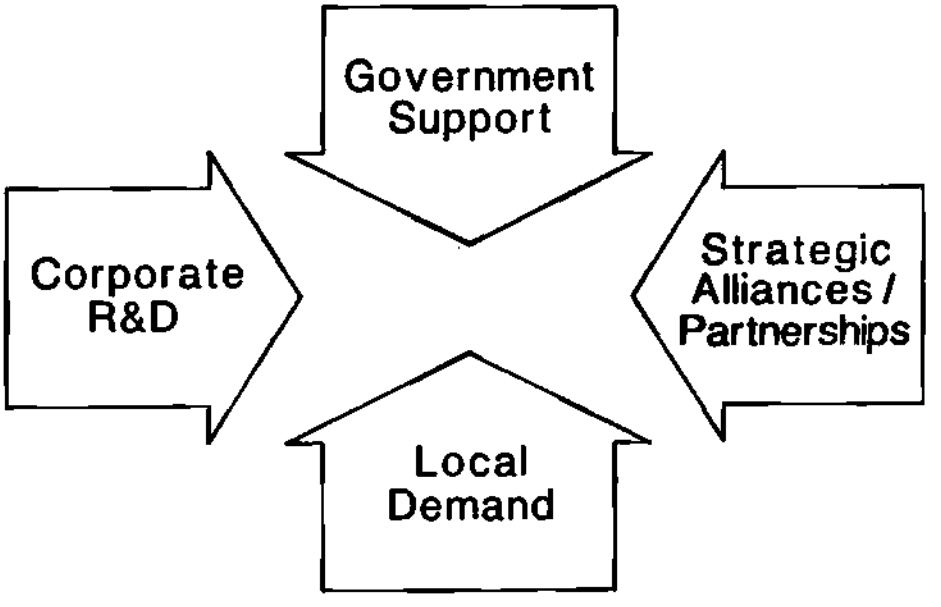
ASIAN SEMICONDUCTOR GOAL

Catch up in four years



FOUR REQUIREMENTS TO MEET THE GOAL:



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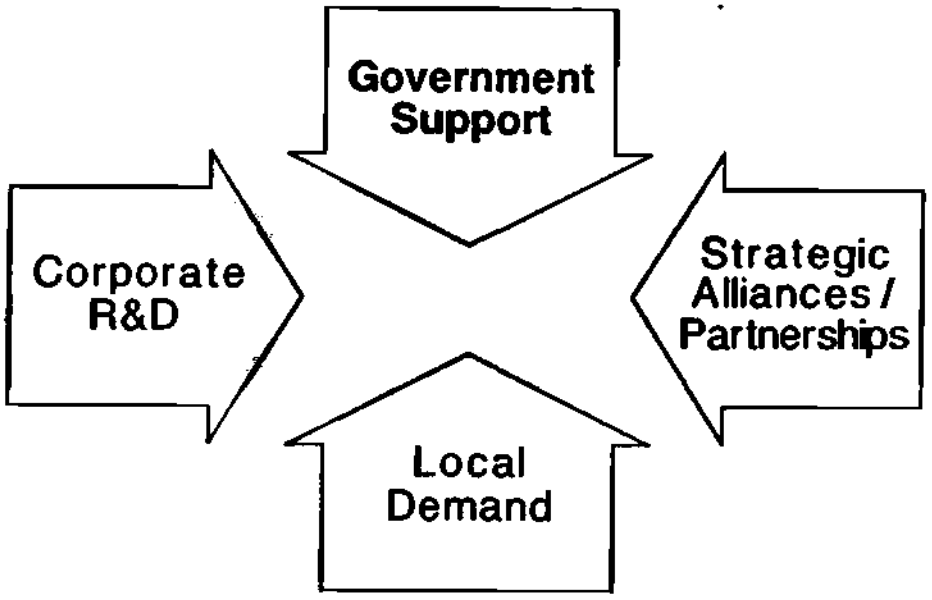
TO MEET THE GOAL:



Government is heavily involved in semiconductor business.

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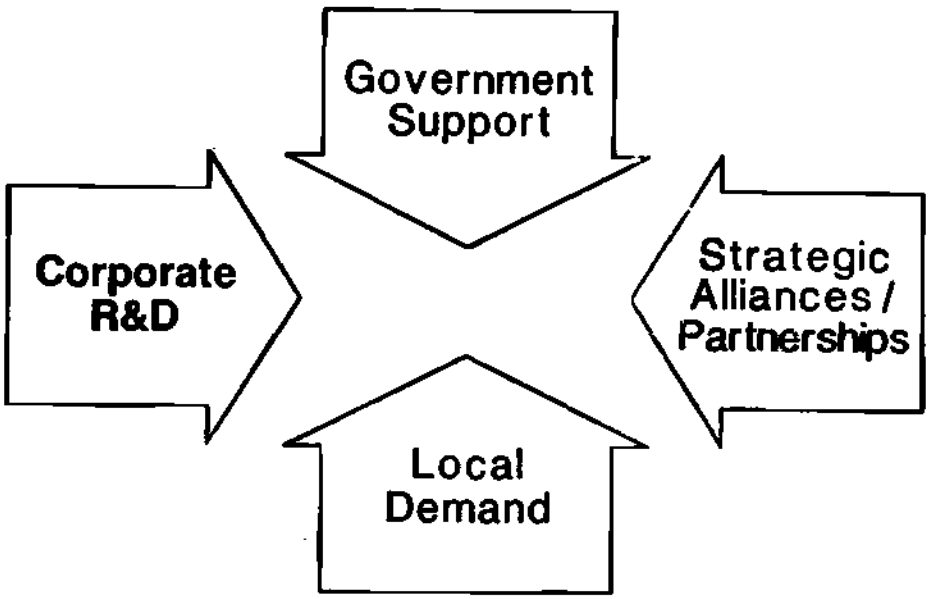
TO MEET THE GOAL:



CORPORATE CAPITAL AND R&D SPENDING

(Millions of U.S. Dollars)

	1984	1985	1986	1987
Samsung	$176	$220	$150	$130
GoldStar	$112	$107	$ 90	$109
Hyundai	$138	$141	$ 43	$ 71

Source: Dataquest

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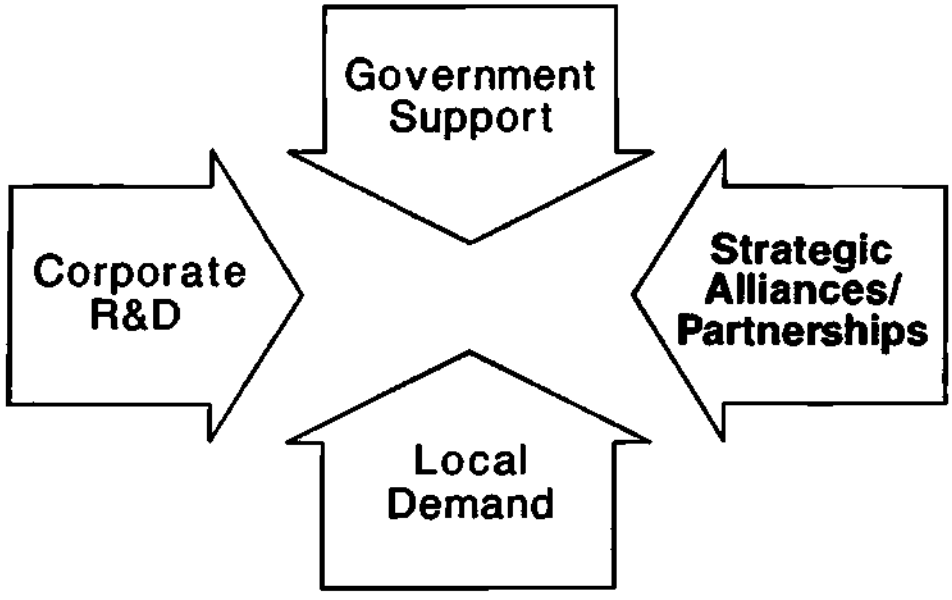
TO MEET THE GOAL:



STRATEGIC ALLIANCES/PARTNERSHIPS

- Foundry
- Licensing
- Acquisitions

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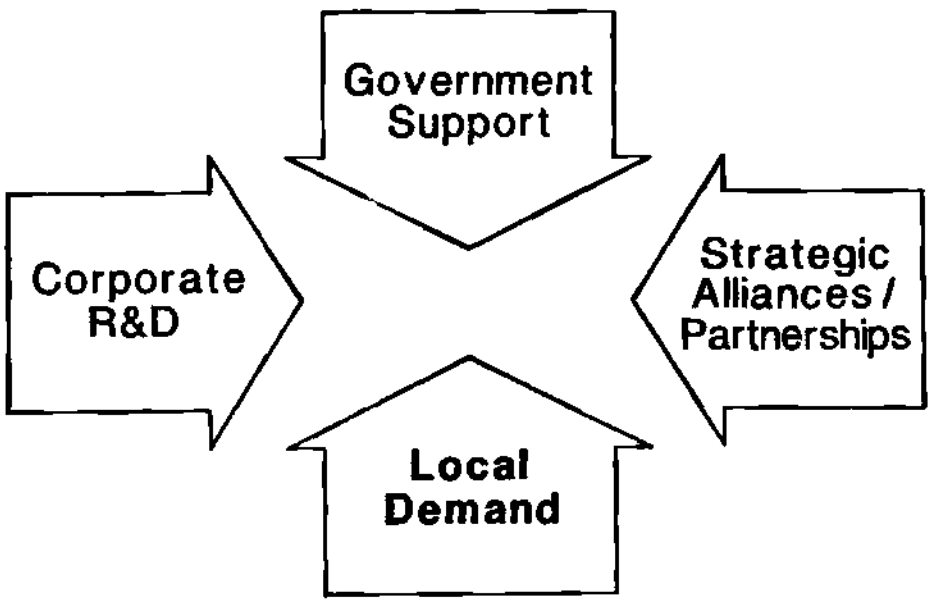
TO MEET THE GOAL:



SEMICONDUCTOR CONSUMPTION -- ASIA

(Millions of Dollars)

	1985	1986	1987	1988*
South Korea	$436	$799	$1,296	$1,815
Taiwan	$496	$696	$1,051	$1,576
Hong Kong	$334	$478	$ 593	$ 890
Singapore	$271	$350	$ 510	$ 714

*Estimated

Source: Dataquest

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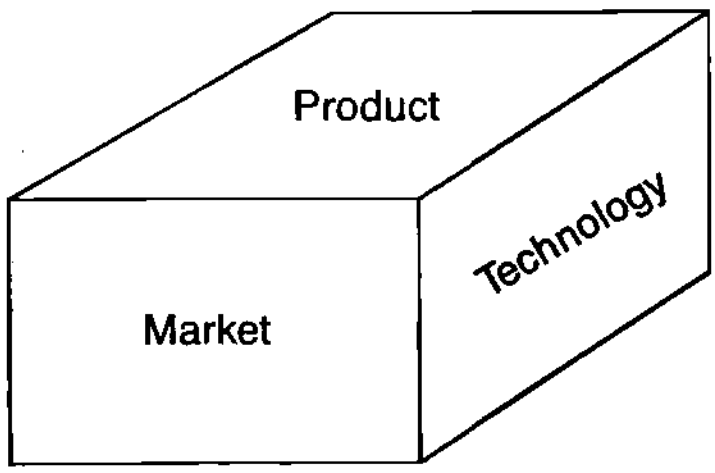
CHECKLIST -- 1988

	Government Support	Corporate R&D	Strategic Alliances/ Partnerships	Local Demand
South Korea	Strong	Strong	Strong	Strong
Taiwan	Strong	Medium	Medium	Strong
Hong Kong	Medium	Weak	Weak	Medium
Singapore	Medium/Strong	Weak/Medium	Strong	Medium
China	Strong	Medium	Weak	Medium

Source: Dataquest

THREE ADDITIONAL ELEMENTS TO MEET THE GOAL



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KEY ISSUES IN 1989

- Recession
- Protectionism
- Currency value appreciation
- New marketplace
- Japanese influence

SUMMARY

- Asia will be the worldwide leader in semiconductor consumption growth.
- Asian semiconductor industry's worldwide influence will grow.

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SUMMARY

- Asia will be the worldwide leader in semiconductor consumption growth.
- Asian semiconductor industry's worldwide influence will grow.
- Asia will be a significant producer of:
  - MOS memory
  - Chip sets
  - Consumer ICs

SUMMARY

- Asia will be the worldwide leader in semiconductor consumption growth.
- Asian semiconductor industry's worldwide influence will grow.
- Asia will be a significant producer of:
  - MOS memory
  - Chip sets
  - Consumer ICs
- Asian semiconductor-related industry will grow

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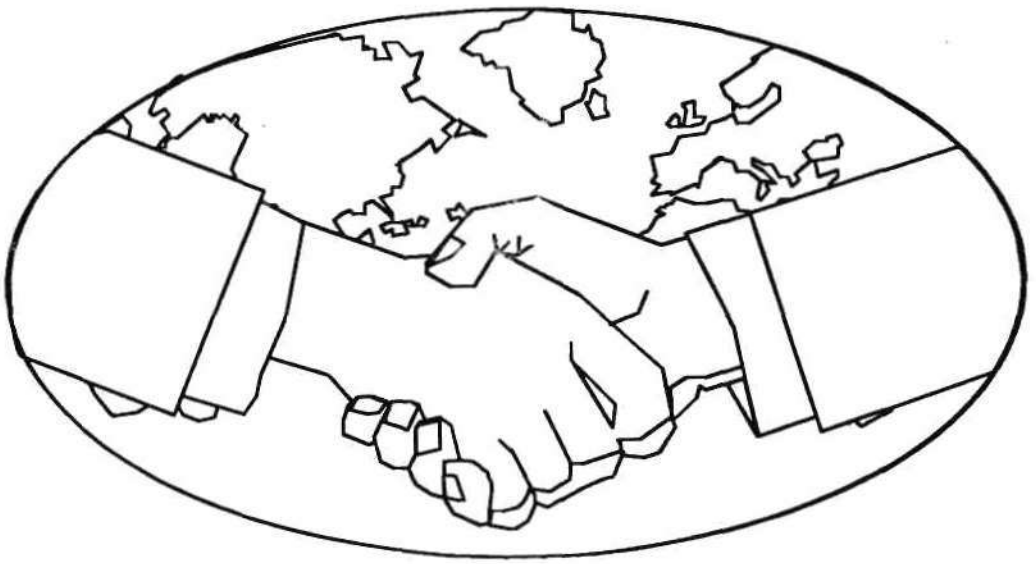
CONCLUSION



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KOREAN SEMICONDUCTOR INDUSTRY UPDATE

J.H. Son
Senior Industry Analyst
Asian Components Group
Dataquest Incorporated

Mr. Son is a Senior Industry Analyst for Dataquest's Asian Components Group. He is responsible for Korean semiconductor and electronics industry research and manages Dataquest's office in Seoul, Korea. Prior to joining Dataquest, Mr. Son worked for Goldstar Semiconductor Ltd., most recently as General Manger of International Sales. Previously, he was General Manager of Planning and Marketing. Earlier, he held a variety of other management and engineering positions at Goldstar. Mr. Son received B.S.E.E. and M.S.E.E. degrees from Hanyang University in Korea. He has also taken courses toward a Ph.D. in Electrical Engineering.

Dataquest Incorporated
ASIAN SEMICONDUCTOR AND ELECTRONICS TECHNOLOGY CONFERENCE
November 6-8, 1988
Seoul, Korea

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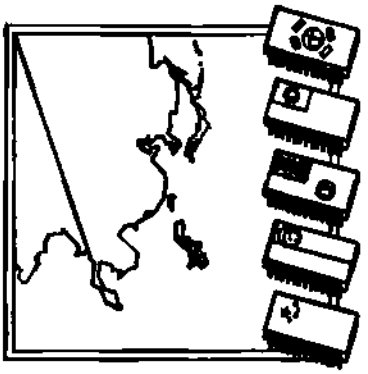

Approaching
the Asian Age

KOREAN SEMICONDUCTOR INDUSTRY UPDATE

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AGENDA

- Korean Electronics Industry Outlook
- Korean Semiconductor Industry Update
- Semiconductor Companies in Korea
- Key Issues in 1988
- Summary and Conclusion

KOREAN ELECTRONICS INDUSTRY OUTLOOK

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OVERVIEW

1960s
- Introduction period
- Simple assembly (Radio, B/W TV)
- Semiconductor packaging
- 0.8% of GNP (1968)

1970s
- Growth period
- Export oriented policy
- 1st, 2nd, 3rd plans for electronics promotion
- Wafer processing
- 31 times expansion in production ('70 vs '79)
- 2.5% of GNP (1980)

1980s
- Maturity period
- 4th plan for electronics promotion
- Bring up 3 strategic items (Semiconductor, Computer, Communication)
- 14.7% of GNP (1987)
- Top 6th in electronics export

GDP GROWTH

Real GDP Growth Rates (%)

	1986	1987	1988 *
South Korea	12.4	12.0	10.0
Taiwan	11.0	10.1	7.3
Hong Kong	11.0	12.6	8.9
Singapore	1.9	6.9	5.5
China	8.0	9.7	9.1
Japan	2.4	2.5	3.0
United States	2.2	3.1	2.8
Europe	2.5	2.2	2.0

* Estimated

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KOREAN ELECTRONICS INDUSTRY (I)

($ Billion)

	1984	1985	1986	1987	1988*	AGR
Production	8.4	8.5	12.1	17.4	21.0	25.7%
Export	4.6	4.6	7.4	11.2	13.0	29.7%
Import	3.2	2.9	4.6	5.9	8.0	25.7%
Consumption	7.0	6.8	9.3	12.2	16.0	23.0%

* Estimated

Source: Dataquest

KOREAN ELECTRONICS INDUSTRY (II)

($ Billion)

• Production	1985	1986	1987	1988*
– GNP	83.7	95.3	118.6	N/A
– Electronics Total	8.5	12.1	17.4	21.0
– Shares of Electronics (%)	10.2%	12.7%	14.7%	N/A
• Export				
– Export Total	30.3	34.7	47.3	52.0
– Electronics Total	4.6	7.4	11.2	13.0
– Shares of Electronics (%)	15.2%	21.3%	23.6%	25.0%

* Estimated

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ELECTRONICS PRODUCTION

	1985	1986	1987	($M) AGR(%)
Consumer				
Color	672	1,001	1,349	41.7
VTR	510	758	1,088	46.1
Cassette	484	584	1,214	58.4
MWO	258	542	709	65.8
Industrial				
PC	183	436	479	61.8
Monitor	177	223	573	79.9
Telephone	192	258	463	55.3
Parts & Components				
Semiconductor	1,141	429	2,083	35.1
CRT	394	544	821	93.6
Transformer	219	406	522	54.4

Source: Dataquest

ELECTRONICS EXPORT

	1985	1986	1987	(SM) AGR(%)
Consumer				
Cassette	384	500	1,136	72.0
VTR	205	592	895	108.9
Color	405	687	977	55.3
MWO	214	483	639	72.8
Industrial				
Monitor	168	182	449	63.5
PC	148	395	379	60.0
Telephone	113	183	344	74.5
Parts & Components				
Semiconductor	1,049	1,317	1,893	34.3
Magnetic Tape	229	432	540	53.6
CRT	196	245	324	28.6

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ELECTRONICS IMPORT

	1985	1986	1987	(SM) AGR(%)
Consumer				
Recorder	77	114	173	49.9
Industrial				
Measuring Ins't	116	167	171	21.4
Business computer	109	177	164	22.7
Disk	54	100	136	58.7
Parts & Components				
Semiconductor				
Finished	340	687	1,102	80.0
Material	663	763	1,030	24.6
CRT	117	192	260	49.1

Source: Dataquest

ELECTRONICS CONSUMPTION

	1985	1986	1987	(SM) AGR(%)
Consumer				
Refrizerator	360	345	418	7.8
Color TV	271	318	375	17.7
Amp/Stereo	217	208	279	17.0
Industrial				
ESS	427	317	314	(14.2)
Business computer	134	220	210	25.2
Measuring Ins't	125	179	185	21.7
Parts & Components				
Semiconductor				
Finished	432	799	1,296	73.2
Material	664	765	1,037	25.0
CRT	315	491	757	55.0
Transformer	195	435	536	65.8

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KOREAN SEMICONDUCTOR INDUSTRY UPDATE

STATISTICS OF KOREAN SEMICONDUCTOR INDUSTRY

($ Billion)

	1984	1985	1986	1987	1988*	AGR
• Production	1.3	1.1	1.4	2.1	2.7	21.0%
• Export	1.3	1.0	1.3	1.9	2.2	14.7%
• Import	0.3	0.3	0.7	1.1	1.4	41.6%
• Consumption	0.3	0.4	0.8	1.3	1.8	56.3%

* Estimeted

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SEMICONDUCTOR CONSUMPTION

($M)	1984	1985	1986	1987	1988*
Total Semiconductor	303.9	432.3	793.0	1,291.4	1,815.0
Total IC	176.0	318.9	582.1	992.8	1,390.0
Bipolar Digital	29.5	41.5	75.3	118.8	161
Memory	2.1	3.0	4.8	7.7	
Logic	27.4	38.4	70.6	111.0	
MOS Digital	67.2	133.9	244.2	438.9	617
Memory	22.8	45.4	83.3	151.0	
Micro	18.2	38.9	73.7	136.8	
Logic	26.1	49.7	87.2	151.0	
Linear	79.3	143.4	262.5	435.1	612
Total Discrete	121.0	98.1	187.9	273.7	385.0
Optoelectronics	6.9	15.3	23.0	24.9	40.0

* Estimated

Source: Dataquest

CAPITAL SPENDING (5 FAB COMPANIES)

($ Million)

	1984	1985	1986	1987	1988*
Facility	421	429	275	304	511
R & D	42	61	53	77	164
	463	490	328	381	675
Semiconductor Sales	114	175	299	513	1,280
Capital Spending (% of Sales)	406%	280%	110%	74%	52.7%

* Estimated

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COMPETITION IN MEMORY CHIPS

	Samsung	Goldstar	Hyundai
1M DRAM			
Mass Prod.	2Q'88	1Q'90	1Q'90
Wafer Size	6″	6″	6″
Capacity(Wf/D)	600	600	300
4M DRAM			
Mass Prod.	4Q'89	2Q'90	2Q'90

Source: Dataquest

JOINT R & D PROJECT

4M DRAM Project	• '86—'89
	• ETRI, Samsung, Goldstar, Hyundai
	• S100M
16M/64M Project	• '89—'91
	• MOST, MOC, MTI, ETRI.
	• Samsung, Goldstar, Hyundai, Daewoo
	• S100M
1G DRAM	• 1992—2000
10M G/A	

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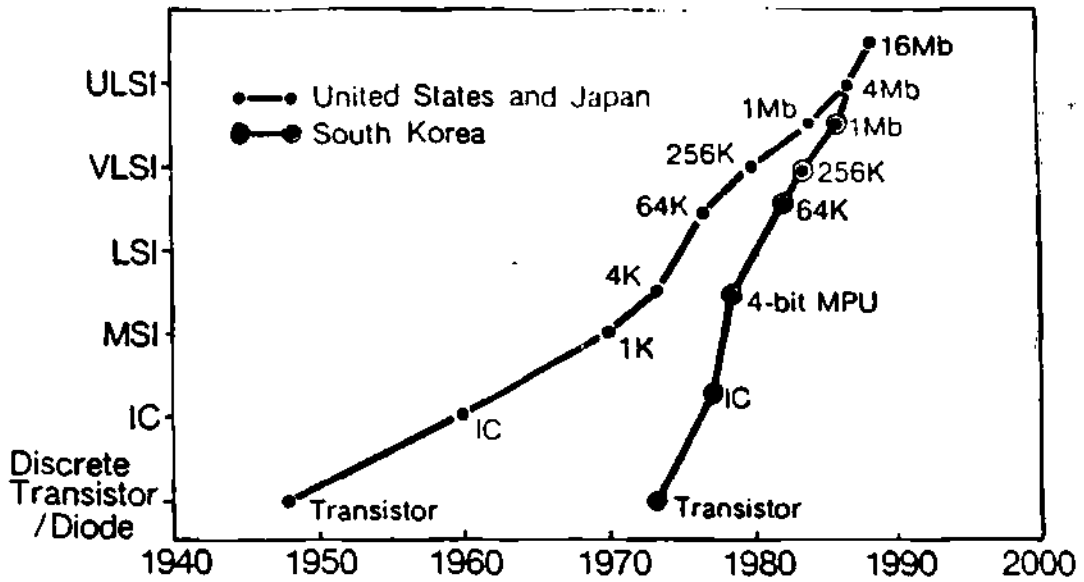
SEMICONDUCTOR TECHNOLOGY DEVELOPMENT TRENDS
1940–2000



Source: '87 Korea Electronic Times.

SEMICONDUCTOR MANUFACTURERS IN KOREA

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SAMSUNG

Sales	$316 million('87) $900 million('88)	New Products	1M DRAMs 512K EPROMs 256K SRAMs CTV/VTR ICs Codec/Combo
Rank	22		
Products	256K DRAMs-25% 64K DRAMs -20% CMOS Logic -25% Linear ICs -10% Transistors -20%	New Project Line 3	1M DRAM 1Q'89
Capacity (Wafers/year)	4″ BIP -360,000 5″ MOS-600,000 6″ MOS-200,000	Line 4	4M DRAM 1Q'90

Source: Dataquest

GOLDSTAR

Sales	$ 69 million('87) $120 million('88)	New Products	1M DRAMs 256K DRAMs 2Kx8 SRAMs 8Kx8 SRAMs Fast TTLs
Products	TTL-30% Gate arrays-20% 74HC/HCT -10% Hybrids -30% Linear ICs -10%	New Project Step 1 (88-90)	$2.2 billion 1M DRAM 0.8μ 6″ MOS-540,000
Capacity (Wafers/year)	4″ BIP -200,000 5″ MOS-250,000 6″ MOS-150,000	Step 2 (92-93)	4M DRAM 0.6μ 6″~8″—1,080,000
		Step 3 (95-96)	Mega DRAM 0.4μ 6″~8″—1,620,000

Source: Dataquest

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HYUNDAI

Sales	$ 40 million('87) $150 million('88)	New Products	1M DRAMs
Products	256K DRAMs-50% 16K SRAMs -15% Mask ROMs -15% MPUs -10% Others -10%	New Project Line 4	 1M/4M DRAM 1Q'90 6" MOS-480,000 Wf/y $450 million
Capacity (Wafers/year)	5" MOS-250,000 6" MOS-300,000		

Source: Dataquest

DAEWOO

Sales	$10 million('88)	New Products	ICs for PC ICs for telecom
Products	Audio ICs-50% Custom -50%		
Capacity (Wafers/year)	4" BIP -90,000 4" MOS-90,000		

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KEC

Sales	$78 million	Sales Channels	Domestic - direct International - through Toshiba
Products	Transistors - 70% Linear ICs - 30%	New Products	Linear ICs
Capacity (Wafers/year)	4" BIP - 200,000		

Source: Dataquest

ASSEMBLY HOUSES

	'86 Revenue	'87 Revenue	Assembly Start	Employee	Capital
Fairchild	$ 52M	$ 45M	1966	550	$ 20M
Motorola	222	266	1967	5,200	10
Signetics	95	52	1967	2,500	40
KMI	6	7	1970	500	6
Tokyo Silicon	61	63	1972	1,560	3
Anam	148	191	1972	9,700	40

Source: Dataquest

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DESIGN CENTERS

	Start	Products	Tech. Source	Design Rule
• Goldstar	1983	G/A, Std Cell	LSI Logic	3μ, 2μ
• Samsung	1986	G/A	–	3μ
• LSI Logic	1987	G/A	LSI Logic	3μ, 2μ, 1.5μ
• VTI Korea	1987	Std Cell	VTI	2μ
• Daewoo	1988	Std Cell	Zimos	3μ, 1.8μ
• Hyundai	1988	G/A	LSI Logic	1.5μ
• TI Korea	1988	G/A	TI	N/A
• SGS-Thonsc	1988	G/A, Std Cell	SGS-Thomson	N/A

Source: Dataquest

MASK MAKERS

- Hanryu Development
- Asia Cement

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SILICON WAFER SUPPLIER

- LAMI
  - 4", 5" Polished Wafer
  - $ 0.7 million Sales('87)
  - 900,000 Sq. inches
  - Licensed from Siltech
- KOSIL
  - 4", 5", 6" Polished Waber
  - $ 5.0 million Sales('87)
  - 5,000,000 Sq. inches
  - Licensed from Monsanto

Source: Dataquest

GaAs SUPPLIERS

Sammi
- 1988
- $ 65 million invest

Kukje
- 1988
- $ 70 million invest

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KEY ISSUES IN 1988

KEY POSITIVE ISSUES IN 1988

- Government support
- Capital spending
- Local demand
- GNP growth
- Technology perception

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KEY NEGATIVE ISSUES IN 1988

- Currency value appreciation
- Protectionism
- Competition from other-NICs
- U.S.-dependent industry

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SUMMARY

- Korean semiconductor industry's worldwide influence will grow
- Korea will be Asian leader in semiconductor consumption growth
- Korea will be a significant DRAM producer

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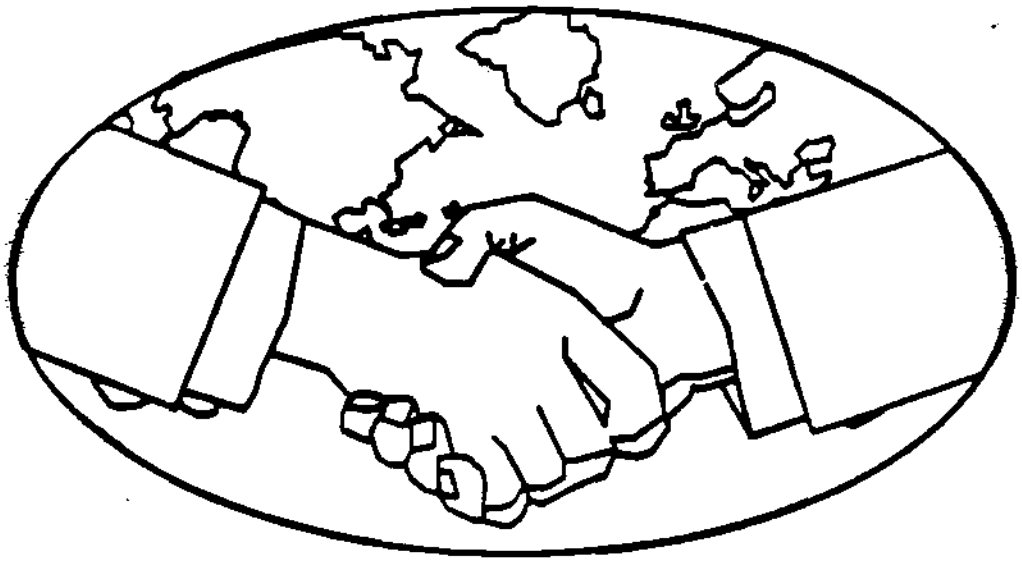
CONCLUSION



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Mr. Kim received an B. S. degree in Physics from the Drury College and an M. S. degree in Physics from the University of Arkansas, Fayetteville, both in U. S. A.

TECHNOLOGY INNOVATION IN KOREA

– WITH A FOCUS ON SEMICONDUCTOR & COMPUTER –

YOUNG-SOO KIM
EXECUTIVE VICE PRESIDENT
SAMSUNG ELECTRONICS CO., LTD.

AGENDA

- KOREAN ELECTRONICS INDUSTRY AT A GLANCE
- TECHNOLOGY LEVEL OF KOREAN ELECTRONICS INDUSTRY
  – WITH A FOCUS ON SEMICONDUCTOR & COMPUTER –
- STATUS OF RESEARCH INSTITUTE AND R&D INVESTMENT
- DEVELOPMENT PROSPECTS OF KOREAN ELECTRONICS TECHNOLOGY
- REQUIREMENTS FOR KOREAN ELECTRONICS DEVELOPMENT

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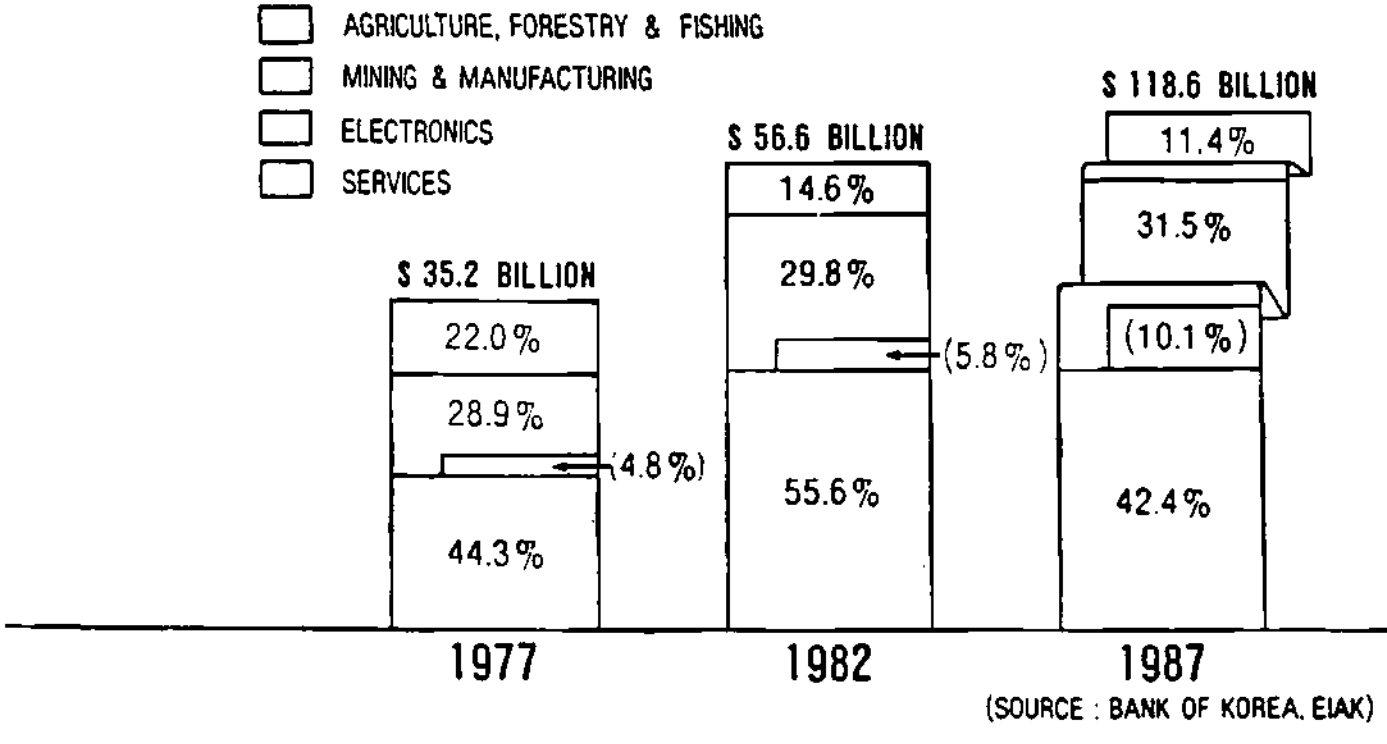
CHANGES IN MAJOR INDUSTRIES IN KOREA

	1960 s	1970 s	1980 s
PREVAILING INDUSTRIES	TEXTILE CEMENT FERTILIZER ELECTRICITY OIL REFINERY	IRON & STEEL PETROCHEMISTRY SHIP BUILDING TEXTILE ELECTRONICS	ELECTRONICS (SEMICONDUCTOR, COMPUTER) MACHINERY AUTOMOBILE
HIGH TECH INDUSTRIES	ELECTRICITY ELECTRONICS (CONSUMER) PLANT ENGINEERING	ELECTRONICS (INDUSTRIAL) AUTOMOBILE	SEMICONDUCTOR COMPUTER OPTO ELECTRONICS PRECISION CHEMISTRY

KOREAN ELECTRONICS INDUSTRY IN THE NATIONAL ECONOMY



(SOURCE : BANK OF KOREA, EIAK)

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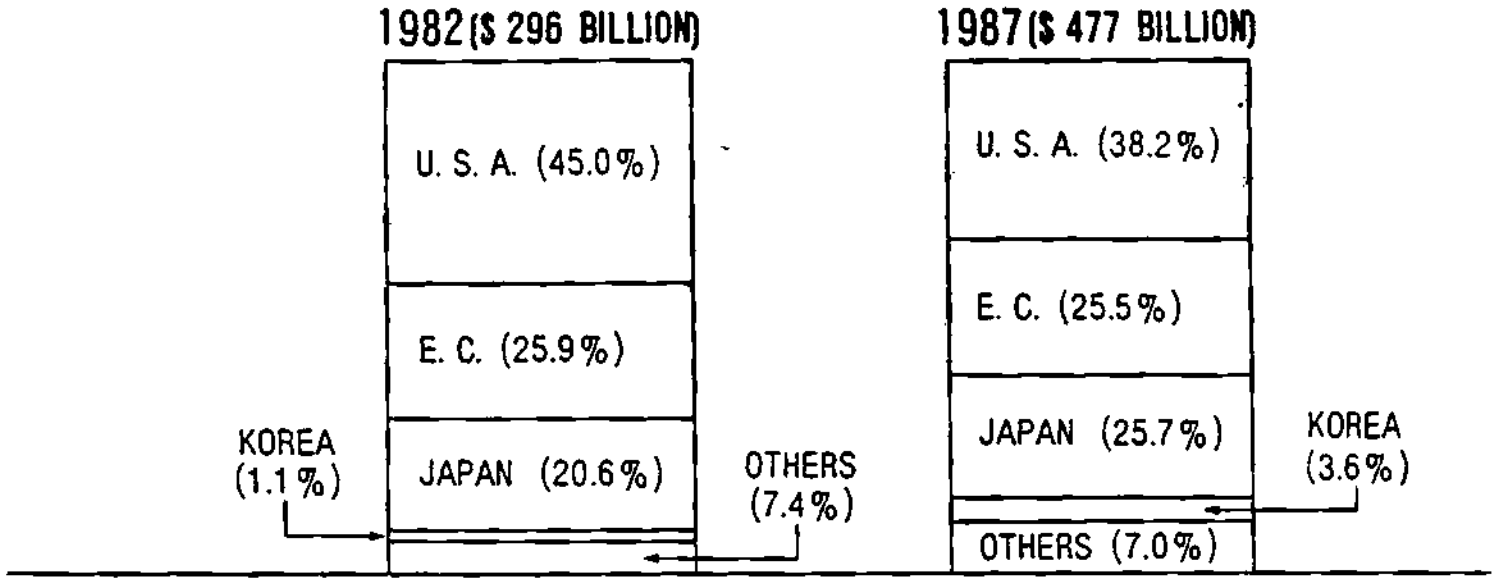
KOREAN ELECTRONICS INDUSTRY IN THE WORLD: PRODUCTION



(SOURCE : MACKINTOSH YEAR BOOK)

FACTORS LEADING TO KOREA'S PRESENT POSITION IN THE WORLD ELECTRONICS MARKET

- CONGLOMERATES' COMMITMENT TO ELECTRONICS INDUSTRY (TECHNOLOGY & CAPITAL)
- SUCCESS IN SECURING AND TRAINING TECHNICAL MANPOWER
- EXECUTIVES' OUTSTANDING LEADERSHIP
- EMPLOYEES' CONCERTED EFFORTS
- WILLINGNESS TO MEET THE CHALLENGES OF THE FUTURE

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EVALUATION OF TECHNOLOGICAL COMPETITIVENESS

	DESIGN		PRODUCTION			
	PROCESS	PRODUCT	PRICE/PER-FORMANCE	RELIABILITY	PRODUCTI-VITY	DESIGN
CONSUMER ELECTRONICS	□	□	○	□	□	□
(COLOR TV)	○	○	□	□	○	□
INDUSTRIAL ELECTRONICS	×	×	×	×	□	×
(COMPUTER)	□	×	□	□	□	×
PARTS & COMPONENTS	□	×	□	□	□	□
(IC)	□	×	□	□	□	□
ELECTRONICS TOTAL	□	×	□	□	□	□

(SOURCE : EIAK)

(NOTE) ○ : COMPETITIVE WITH DEVELOPED COUNTRIES
□ : APPROACHING TO DEVELOPED COUNTRIES' LEVEL
× : FAR BEHIND LEVEL OF DEVELOPED COUNTRIES

STATUS OF KOREAN SEMICONDUCTOR TECHNOLOGY

	TECHNOLOGY & PRODUCT	
	PRESENT	FUTURE
DESIGN	• MEMORY (DRAMs) : APPROACHING LEADING EDGE • OTHERS : INFANT STAGE	• MEMORY : HIGH SPEED ASIC MEMORY • ASIC LOGIC & MICRO PRODUCT
PROCESS	• DRAM TECHNOLOGY (TECHNOLOGY DRIVER)	• SPECIAL UNIT PROCESS FOR HIGH DENSITY PRODUCT • HIGH PERFORMANCE PROCESS TECHNOLOGY
GEOMETRY	1u ~ 2u	0.5u ~ 1u
PRODUCT • MEMORY	• 256K/1M DRAM	• ASIC MEMORY
• MICRO	• 4BIT MCU	• 8 BIT MCU, 16 BIT MPU
• ASIC	• 6,000 GATE ARRAY	• 10,000 ~ 12,000 GATE ARRAY STANDARD CELL

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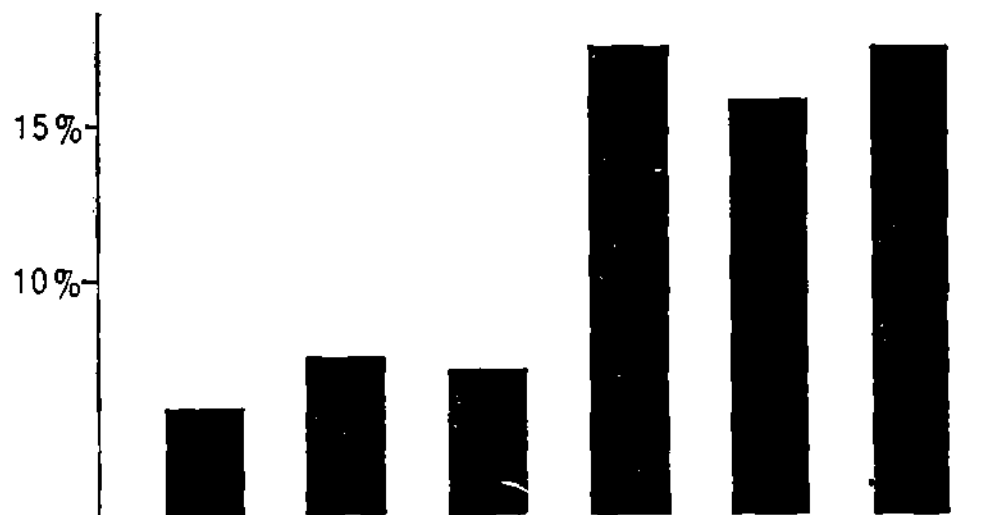
STATUS OF KOREAN COMPUTER TECHNOLOGY

	TECHNOLOGY & PRODUCT	
	PRESENT	FUTURE
SUPER MINICOMPUTER	• PRODUCTION OF 32BIT MULTI-FUNCTION COMPUTER	• IN-HOUSE DESIGN
TERMINAL	• IN-HOUSE DESIGN • INTELLIGENCE • GENERAL-PURPOSE TERMINAL	• HIGH-RESOLUTION TECHNOLOGY
FDD/HDD	• PRODUCTION OF HIGH-DENSITY FDD & LOW-DENSITY HDD	• MECHANISM & PRECISION MOTOR
MODEM	• IN-HOUSE DESIGN & PRODUCTION OF HIGH-SPEED MODEM (9,600BPS)	• DESIGN OF ULTRA-HIGH SPEED MODEM

(SOURCE : EIAK)

COMPARISON OF R&D INVESTMENT



	ELECTRONICS TOTAL ('86)			SEMICONDUCTOR ('87)		
	KOREA	U.S.A.	JAPAN	KOREA	U.S.A.	JAPAN
INVESTMENT RATIO TO SALES (%)	4.1	6.0	5.5	18	16	18

SOURCE : DATAQUEST, KOREA INDUSTRIAL RESEARCH INSTITUTE

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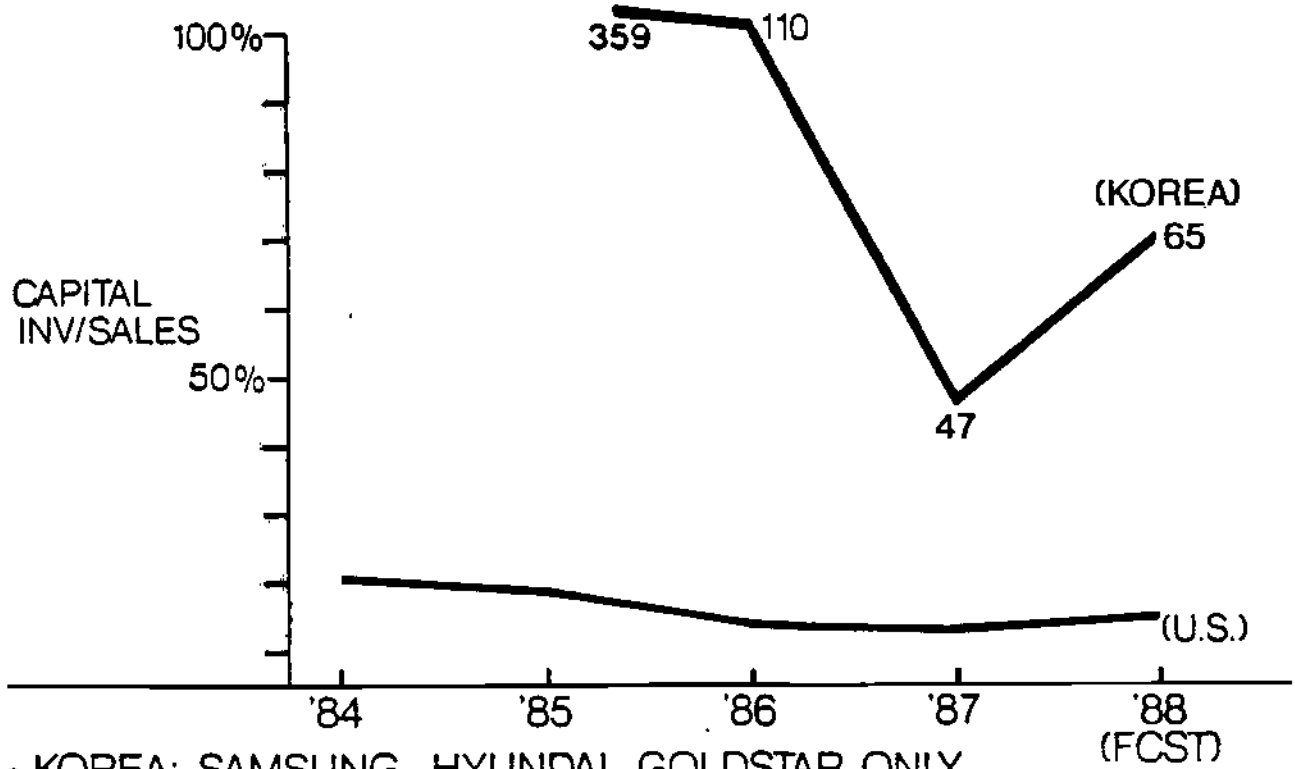
AGGRESSIVE CAPITAL INVESTMENT BEING DONE IN KOREA



- KOREA: SAMSUNG, HYUNDAI, GOLDSTAR ONLY
  (SOURCE: SAMSUNG)

BACKGROUND OF KOREAN AGGRESSIVE R&D INVESTMENT

- KOREAN COMMITMENT TO EARLY ENTRANCE INTO HIGH-TECH INDUSTRY
  - BUILDING UP INDUSTRIAL LEADERSHIP FOR THE FUTURE
  - ENHANCEMENT OF COMPETITIVENESS
- KOREAN'S POTENTIALITY IN HIGH TECH INDUSTRY
  - HIGHLY EDUCATED MANPOWER
  - SOLID GROUND OF MANUFACTURING CAPABILITIES
- DEVELOPED COUNTRIES' PROTECTION OF INTELLECTUAL PROPERTY RIGHTS
  - PATENTS AS A WEAPON
  - TRADE RESTRICTION

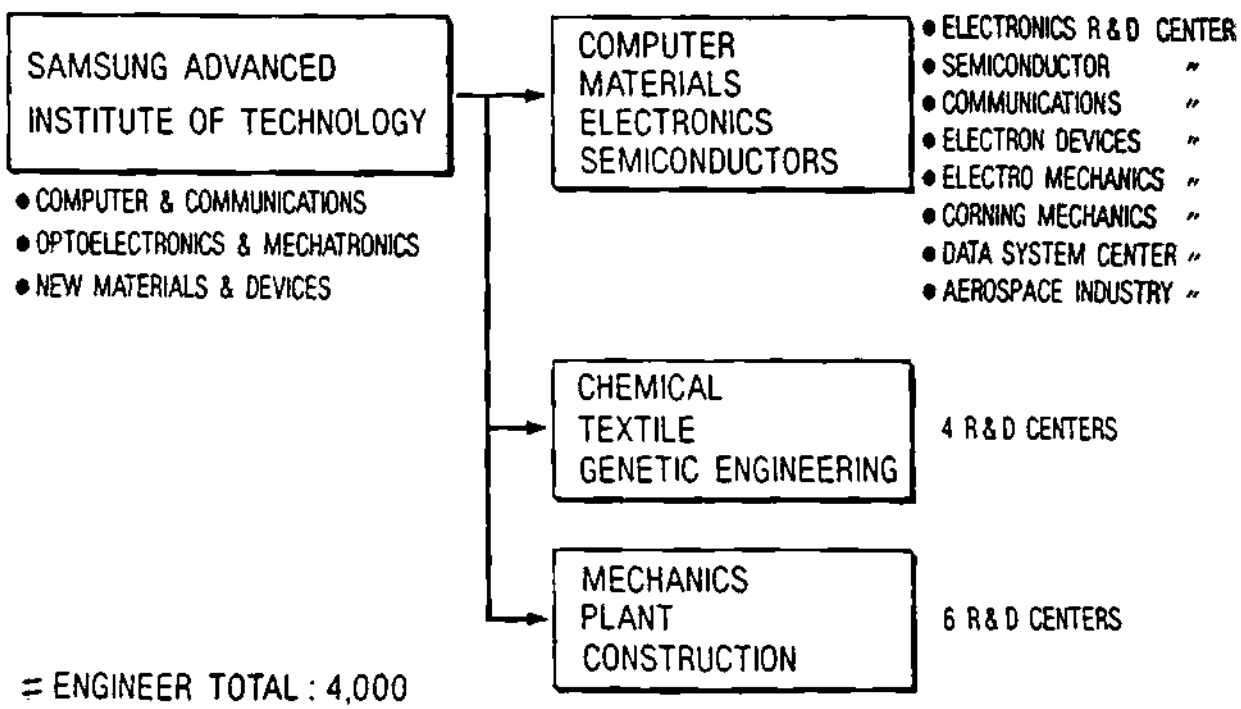
MAJOR INDEXES IN KOREAN SCIENCE TECHNOLOGY

DESCRIPTION		'83	'85	'87
R&D INVESTMENT	• R&D INVESTMENT TO SALES RATIO (%)	0.66	1.23	2.20
	• R&D INVESTMENT PER RESEARCHER (₩ MIL)	19.4	27.9	59.6
RESEARCH MANPOWER	• NUMBER OF RESEARCHERS PER 1,000 PEOPLE	0.80	1.01	N/A
ORGANIZATION FOR R&D	• PRIVATE RESEARCH INSTITUTES	124	183	455
	• RESEARCH COOPERATIVES	15	22	35
PATENT	• PATENTS REGISTERED	2,433	2,268	2,330
TECHNOLOGY IMPORT	• NUMBER OF TECHNOLOGY IMPORTS	247	454	637

(SOURCE : KOREA INDUSTRIAL RESEARCH INSTITUTE)

EXAMPLE OF RESEARCH INSTITUTE OPERATION

– SAMSUNG GROUP –



= ENGINEER TOTAL : 4,000

(AS OF DEC. 1987)

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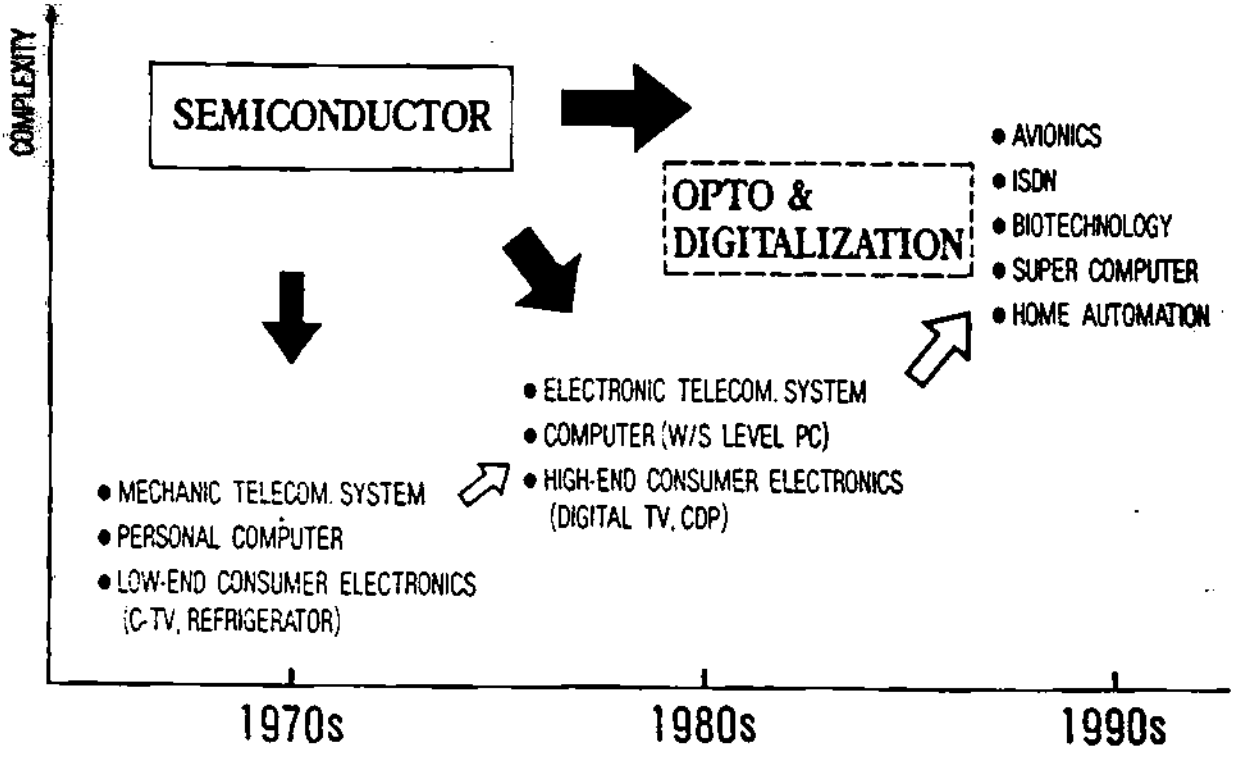
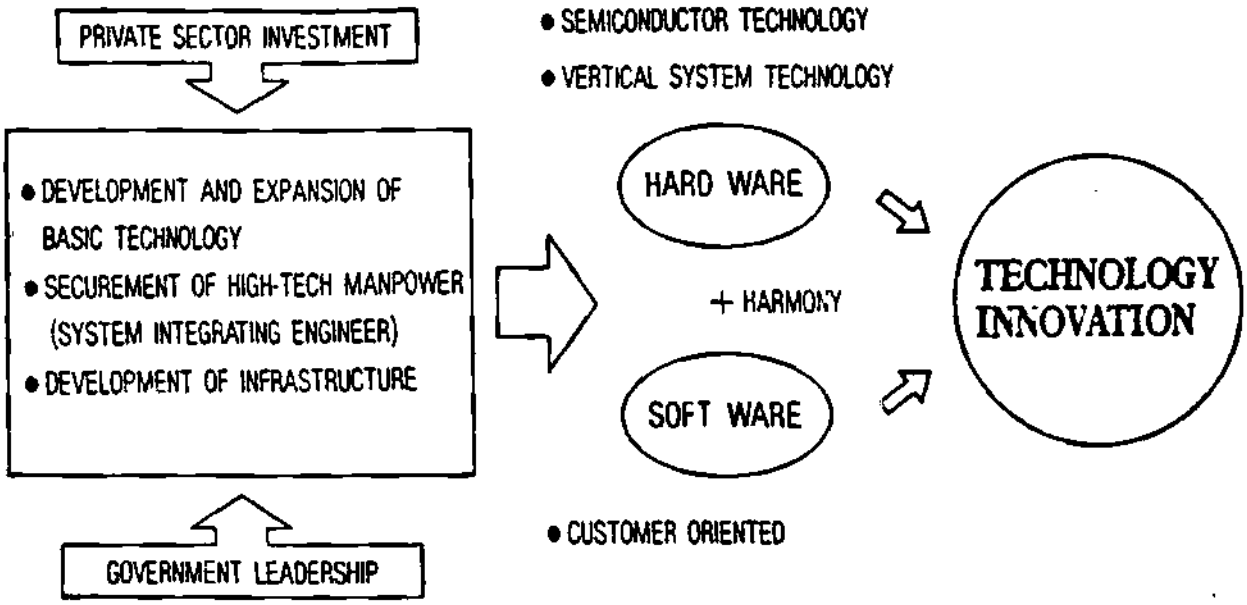
GOVERNMENT-FUNDED RESEARCH INSTITUTES

	MAJOR AREAS OF RESEARCH
• KOREA ADVANCED INSTITUTE OF SCIENCE & TECHNOLOGY	• GOVERNMENT-INITIATED R&D PROJECTS • BASIC SCIENCES • TECHNOLOGY SUPPORT TO PRIVATE ENTERPRISES
• ELECTRONICS & TELECOMMUNICATIONS RESEARCH INSTITUTE	• R&D, MARKET SURVEY & ANALYSIS ON SCIENCE TECHNOLOGY • TECHNOLOGY ADVICE & INFORMATION SUPPORT TO PRIVATE ENTERPRISES
• KOREA ELECTROTECHNOLOGY RESEARCH INSTITUTE	• ELECTRIC MATERIALS AND QUALITY ASSURANCE • SURVEY & ANALYSIS OF TECHNOLOGICAL TRENDS
• OTHERS (10 INSTITUTES)	• BASIC SCIENCE-ORIENTED R&D

KOREAN TECHNOLOGY ROAD MAP



WHAT SHOULD BE DONE FOR HIGH-TECH INNOVATION IN KOREA



KOREAN ELECTRONICS INDUSTRY WILL BE IN THE LEADING EDGE BY 1990s

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CHANGING PC MANUFACTURING AND MARKETING STRATEGIES

Dr. Irving T. Ho
President
Institute for Information Industry

Dr. Ho is President of the Institute for Information Industry (III). The III's mission is to upgrade the ROC's information industry and help speed up the country's computerization program. Dr. Ho also serves as the Executive Secretary of the Information Promotion Committee of Executive Yuan, which is the ROC cabinet. Prior to working at III, he was Director General of the Hsinchu Industrial Science-Based Park. Dr. Ho came to Taiwan from the United States to set up the Hsinchu Industrial Park. Previously, he held a variety of engineering management positions at IBM. While at IBM, he won the IBM invention award 12 times. He holds many U.S. patents and has written numerous technical disclosures and publications. Dr. Ho received an M.S. degree and a Ph.D. degree in Electrical Engineering from Stanford University.

Dataquest Incorporated
ASIAN SEMICONDUCTOR AND ELECTRONICS TECHNOLOGY CONFERENCE
November 6-8, 1988
Seoul, Korea

[illegible]

Approaching
the Asian Age

CHANGING PC MANUFACTURING AND MARKETING STRATEGIES

Dr. Irving Ho

President

Institute for Information Industry (III)

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CHANGING PC MANUFACTURING AND MARKETING STRATEGIES

Dr. Irving Ho

President

Institute for Information Industry

CONTENT

- CURRENT STATUS OF ROC'S PC INDUSTRY
- PRODUCT DEVELOPING TREND AND STRATEGIES
- CHANGING MANUFACTURING AND MARKETING STRATEGIES

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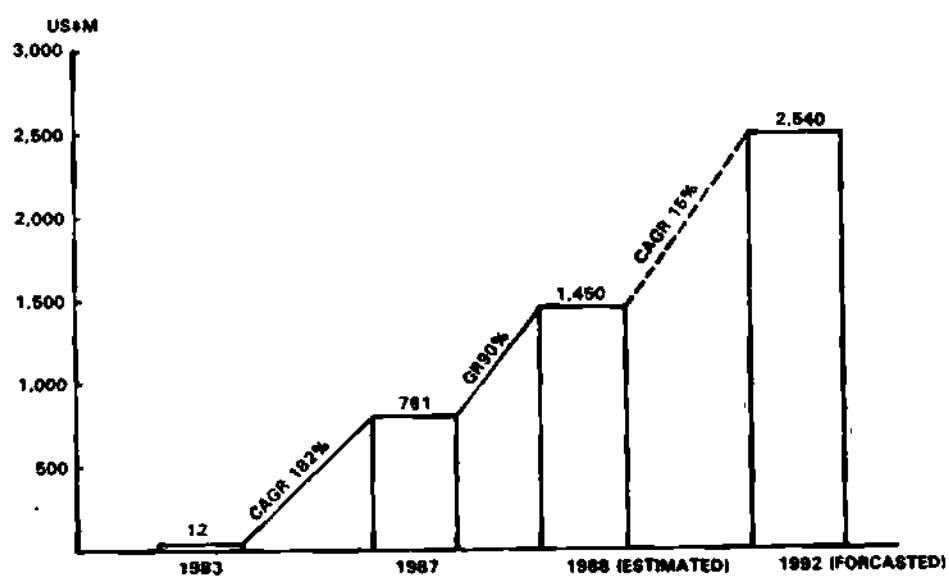
CURRENT STATUS OF R.O.C. (1987)

POPULATION (M)	19.7
GNP PER CAPITA (US$)	4,989
PC INSTALLATION (1,000 SETS)	350
PC PER 1,000 INHABITANTS	18
PC PRODUCTION/EXPORT VALUE (US$M)	868/761
PC PRODUCTION/EXPORT QUANTITY (1,000 SETS)	2,098/1,958

EXPORT OF PCs IN R.O.C.



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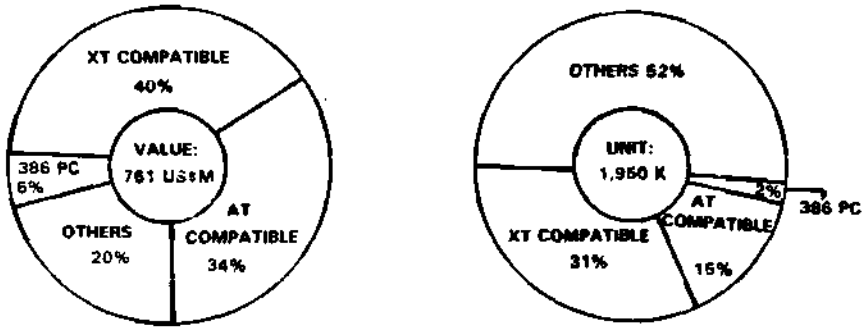
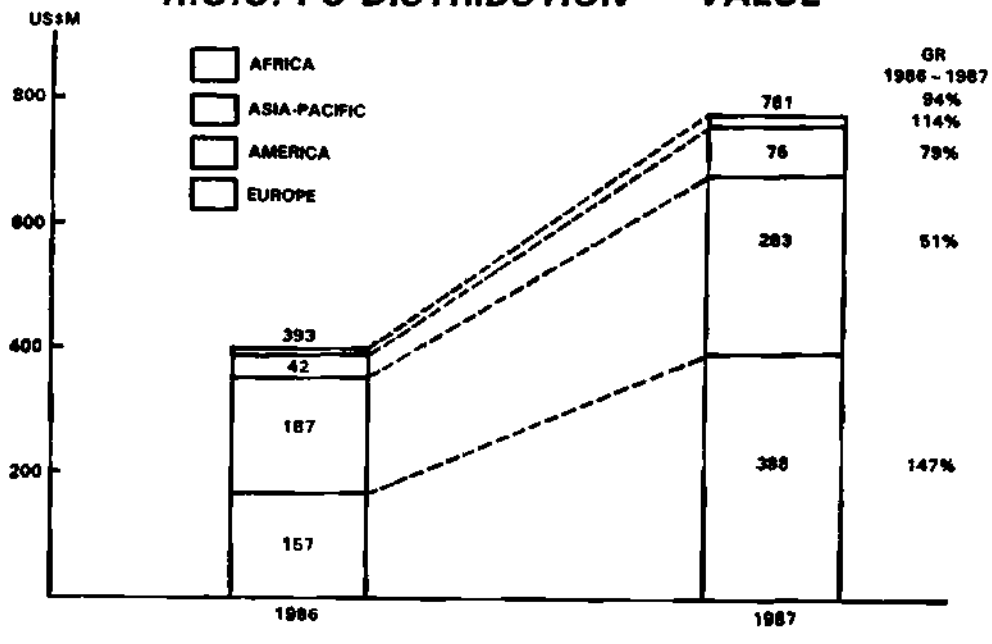
PRODUCT MIX (1987)



"others" includes Atari, Commodore etc....

R.O.C. PC DISTRIBUTION — VALUE



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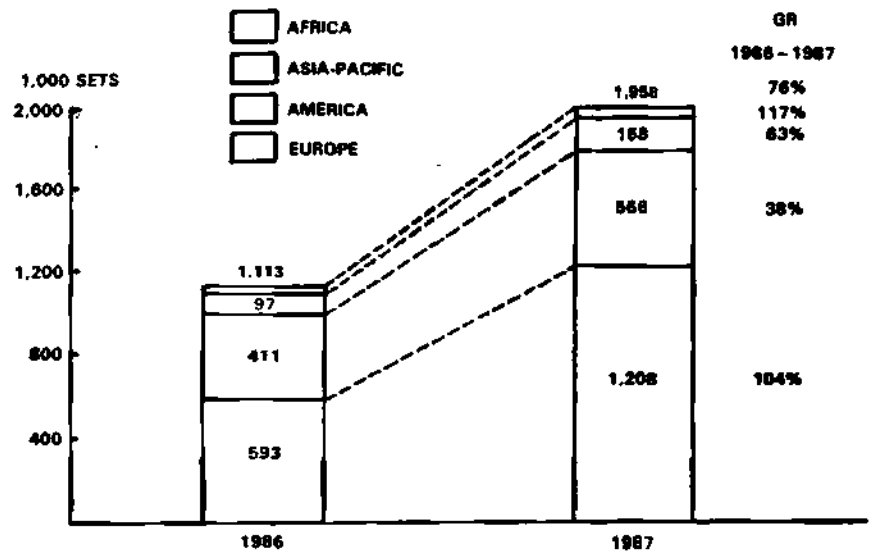
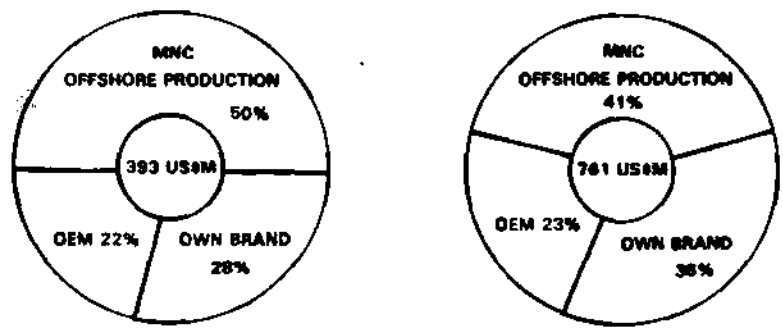
R.O.C. PC DISTRIBUTION — QUANTITY



MARKETING CHANNEL



MNC = MULTINATIONAL COMPANY

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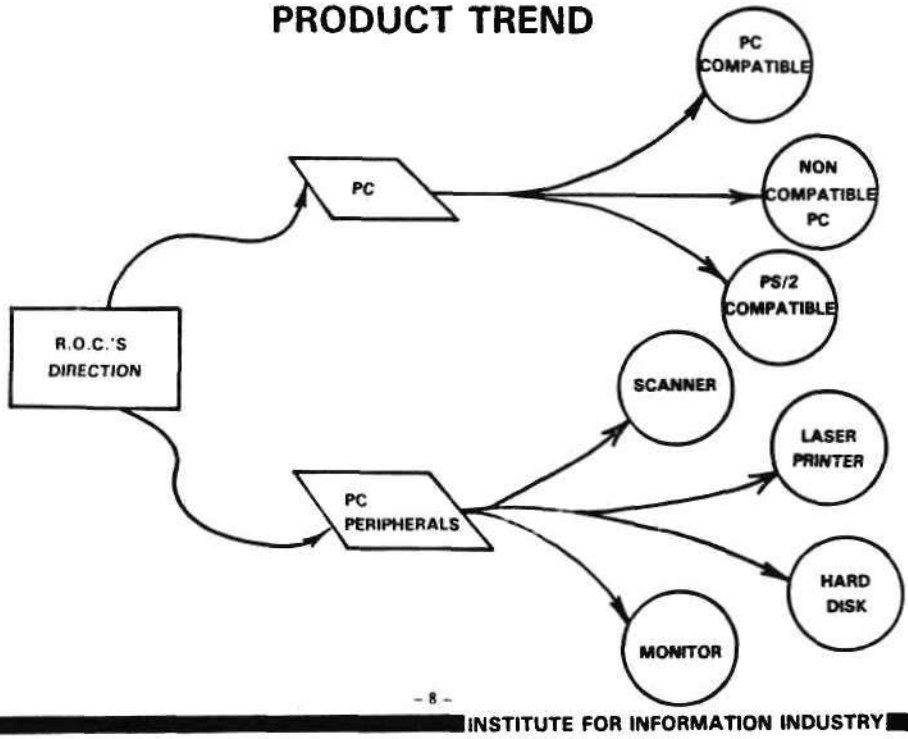
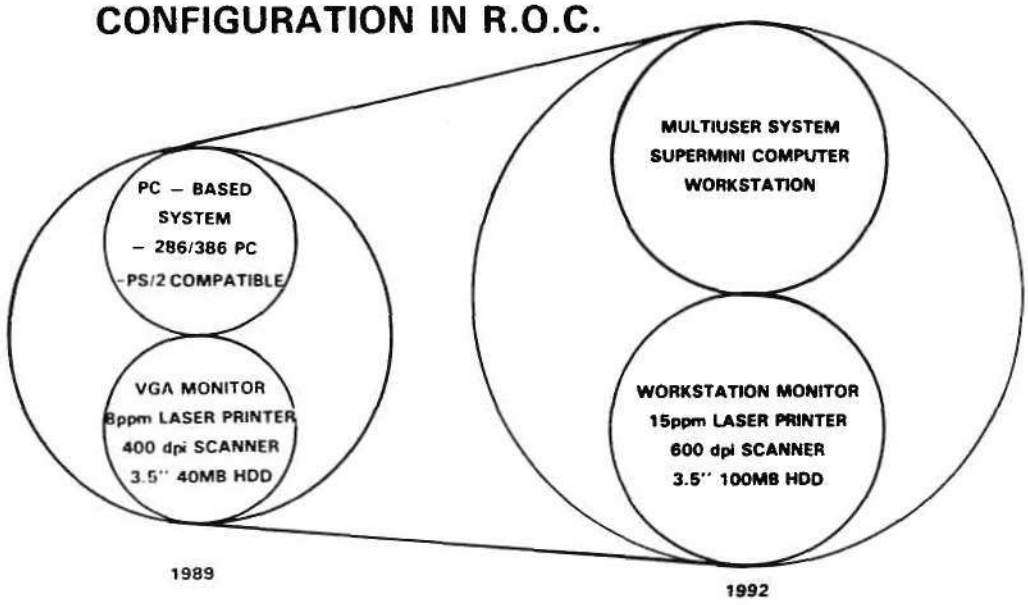
PRODUCT TREND



EVOLUTION OF PC INDUSTRY CONFIGURATION IN R.O.C.



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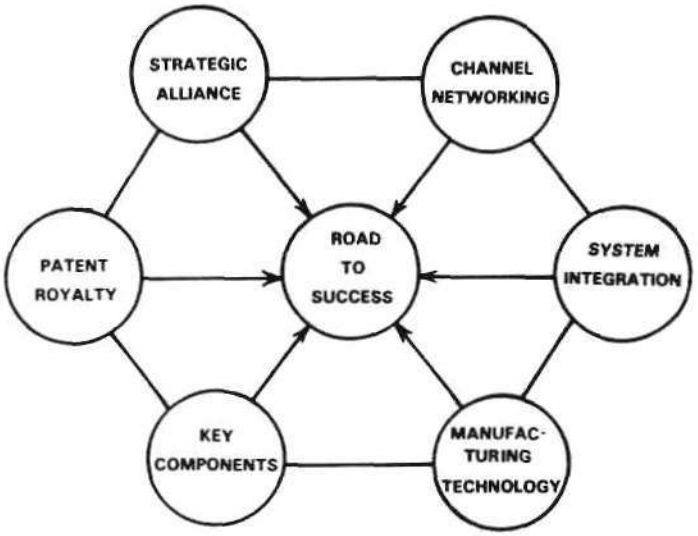
KEY FACTORS TO MEET THE FUTURE



CHANGING MANUFACTURING STRATEGIES

- QUALITY FIRST
- INTRODUCTION OF SMT
- APPLICATION OF ASIC
- ADAPTABLE TO DIFFERENT REQUIREMENT
- OVERSEAS PRODUCTION

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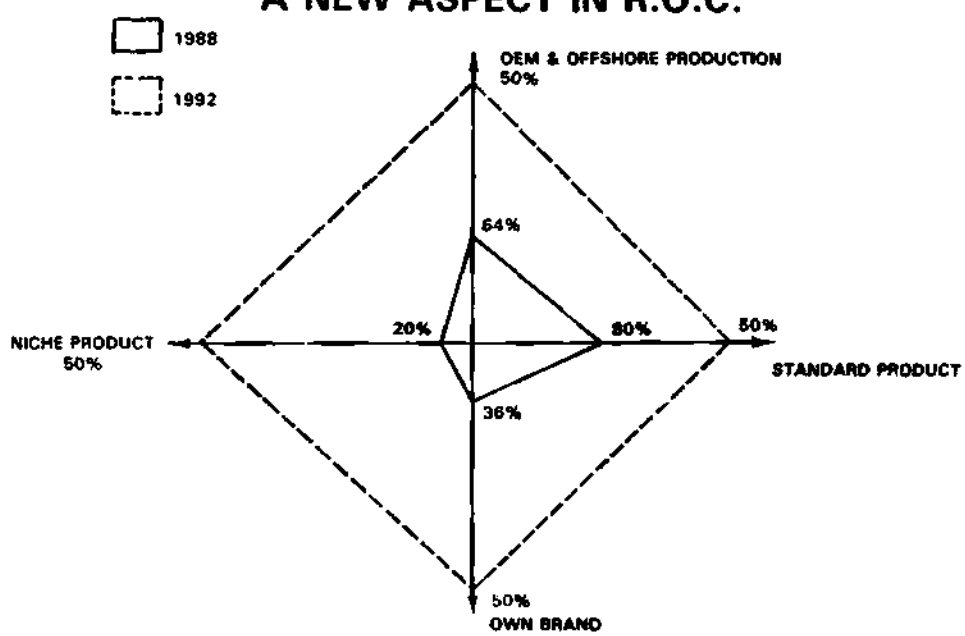
CHANGING MARKETING STRATEGIES

- PROMOTE WORLDWIDE BRAND IMAGE
- ESTABLISH OVERSEAS DISTRIBUTION CENTERS
- PENETRATE INTO NEW EMERGING MARKETS
- ESTABLISH OVERSEAS SERVICE NETWORK

A NEW ASPECT IN R.O.C.



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EMERGING INTELLECTUAL PROPERTY ISSUES

Judith K. Larsen, Ph.D.
Senior Industry Analyst
Research Operations
Dataquest Incorporated

Dr. Larsen is a Senior Industry Analyst with Dataquest's Research Operations Group. Her responsibilities include tracking emerging technologies and analyzing strategic issues that cut across all the technologies that Dataquest covers. Intellectual property rights and technology transfer are among her areas of special concern. Before joining Dataquest, Dr. Larsen was with Cognos Associates, where she directed the policy research program in electronics. As Senior Research Scientist, she worked in the area of national and international technology transfer and conducted studies of policy alternatives in the electronics industry. Dr. Larsen began her career as an Engineer at Philco-Ford and later spent 16 years with the American Institutes for Research. She serves on several national advisory panels on topics related to emerging technologies and the electronics industry. Dr. Larsen received an M.A. degree from Syracuse University and a Ph.D. degree from the University of California.

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ASIAN SEMICONDUCTOR AND ELECTRONICS TECHNOLOGY CONFERENCE
November 6-8, 1988
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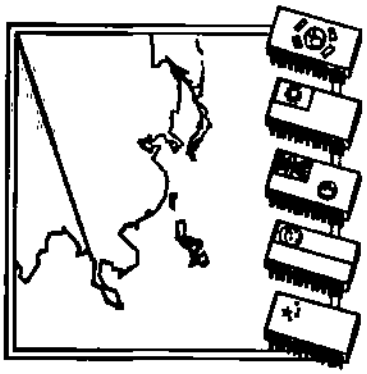

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EMERGING INTELLECTUAL PROPERTY ISSUES

Judith Larsen

Senior Industry Analyst
Research Operations
Dataquest Incorporated

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AMD will not tolerate the unlicensed manufacture and sale of products resulting from our substantial investment in research and development.

Jerry Sanders
AMD

You could lose a ton of money and market share if you don't care . . . about your intellectual property.

William Keefauver
AT&T

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We are going to protect our intellectual properties and license them to ensure that we are, in fact, protecting the future.

Arthur Goldberg
IBM

We spend a lot of money on research and development, and we'll do anything to protect it.

Thomas Dunlap
Intel

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We are not willing to subsidize R&D development for our competitors.

James Smaha
National Semiconductor

Intellectual property rights protect one of NEC's most important assets -- the creative abilities of our employees.

Hank Josefczyk
NEC

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The patent budgets of several of my clients are up significantly.

David Lovejoy
Fleisler, Dubb, Meyer & Lovejoy

Costs of not protecting your intellectual property rights may be . . . astronomical. It's hard to overestimate the damage of doing nothing. It can take away the lifeblood of a company.

Jack Brown
Brown & Bain

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INTELLECTUAL PROPERTY:
What is it?

PATENT

- Applies to any process, machine, or manufacture
- Gives the owner the right to make, use, or sell the application of an idea

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PATENT

The invention must be:

- Useful
- Novel
- Unobvious

PATENT

- Administered by the U.S. Patent and Trademark Office (Dept. of Commerce)
- Can cost $5,000 or more
- Lasts 17 years

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COPYRIGHT

- Covers the "expression" of an idea, not the basic idea
- Gives the owner the right to copy a particular expression

COPYRIGHT

The work must be:

- Original
- Recorded in tangible form
- An expression of an idea

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COPYRIGHT

- Administered by the U.S. Copyright Office (Library of Congress)
- Application fee is $10
- Lasts for owner's lifetime plus 50 years (individual) or for 75 years (corporation)

TRADEMARK

- Symbol, word, or name used to identify goods or services
- Registration includes drawing of symbol or words

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TRADEMARK

- Administered by the U.S. Patent and Trademark Office
- $200 filing fee
- Lasts 20 years or as long as in use

TRADE SECRET

Information that is:

- Not generally known
- Useful in business
- Gives the owner an advantage over competitors

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TRADE SECRET

- Laws defined by states
- No nationwide standards
- No consistent years of protection

SEMICONDUCTOR CHIP PROTECTION ACT

- Protects a mask work fixed in a semiconductor chip
- ***Sui generis*** law (one of a kind)

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SEMICONDUCTOR CHIP PROTECTION ACT

- Administered by the U.S. Copyright Office
- $20 application fee
- Lasts 10 years
- Never brought to court

INTELLECTUAL PROPERTY:
Why is it important now?

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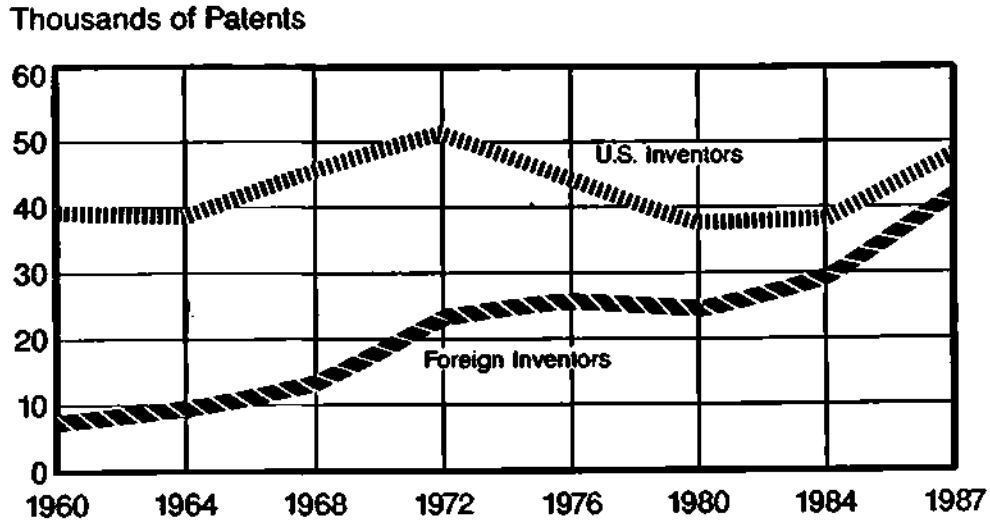
WHY IS IT IMPORTANT NOW?

- Increased global competition

U.S. PATENTS GRANTED TO U.S. AND FOREIGN INVENTORS



Source: U.S. Patent and Trademark Office

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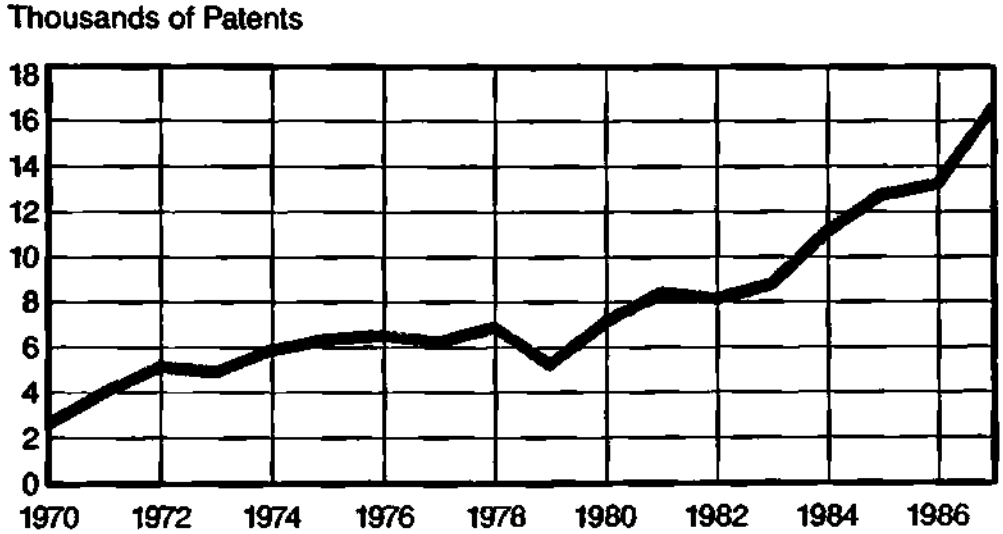
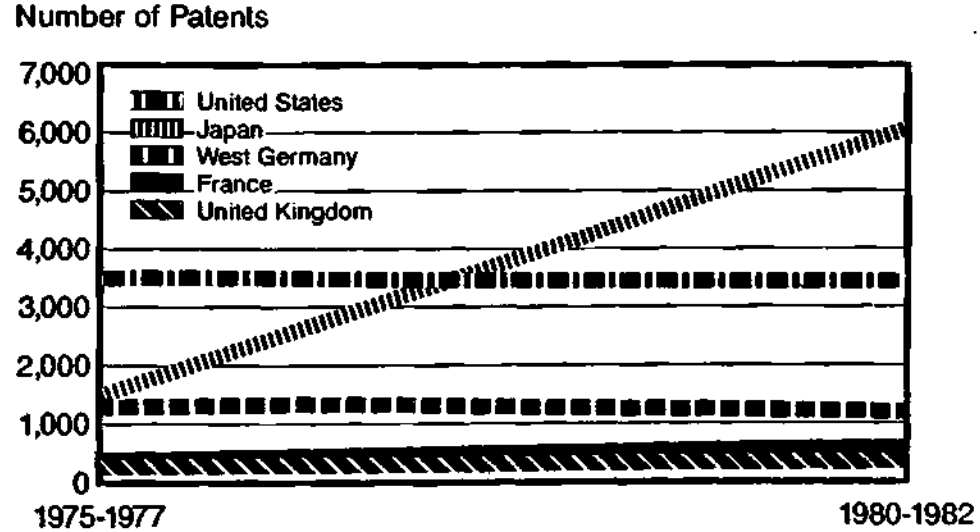
U.S. PATENTS GRANTED TO JAPANESE INVENTORS



Source: U.S. Patent and Trademark Office

PATENTS GRANTED FOR INTEGRATED CIRCUITS



Source: National Science Board

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COMPANIES OBTAINING MOST U.S. PATENTS IN 1975

General Electric	1,001
Westinghouse Electric	617
General Motors	584
IBM	568
AT&T	543

Source: U.S. Patent and Trademark Office

COMPANIES OBTAINING MOST U.S. PATENTS IN 1987

Canon Kabushiki	847
Hitachi	845
Toshiba	823
General Electric	779
Philips	687

Source: U.S. Patent and Trademark Office

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NUMBER OF U.S. PATENTS HELD BY SELECTED COMPANIES

1987

IBM	10,266	TI	3,473
AT&T	10,055	Mitsubishi	2,492
Philips	7,707	NEC	2,208
Hitachi	7,527	SGS-Thomson	1,758
Siemens	7,333	Fujitsu	1,563
Toshiba	5,109	Hewlett-Packard	1,125
Motorola	3,990	Varian	1,029
Matsushita	3,710		

Source: U.S. Patent and Trademark Office

WHY IS IT IMPORTANT NOW?

- Increased global competition
- Shorter product life cycles

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TIME BETWEEN NEW PRODUCT INTRODUCTIONS

- Logic families = 5.0 years
- Microprocessor families = 3.0 years
- ASICs = 1.3 years

Source: Dataquest

WHY IS IT IMPORTANT NOW?

- Increased global competition
- Shorter product life cycles
- Greater R&D investment

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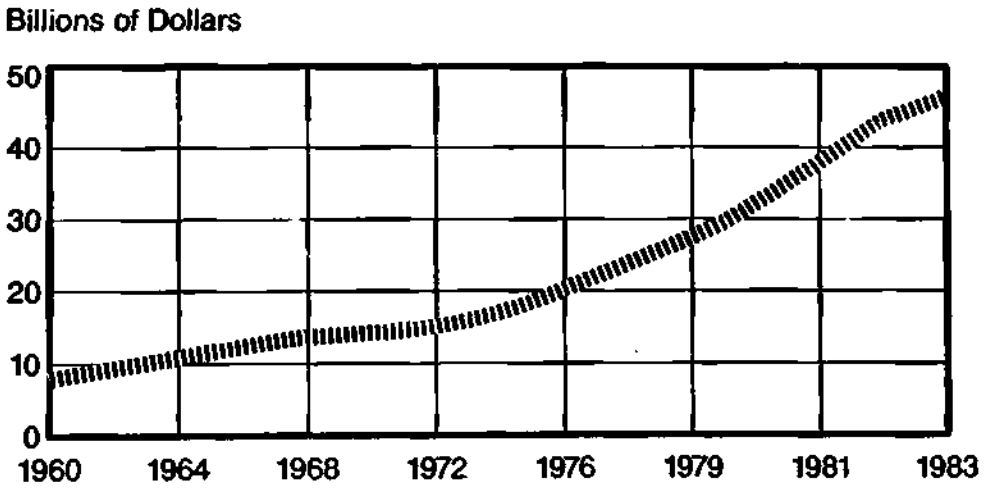
U.S. HIGH TECHNOLOGY MANUFACTURING INDUSTRIES' EXPENDITURES FOR INDUSTRIAL R&D



Source: National Science Board

WHY IS IT IMPORTANT NOW?

- Increased global competition
- Shorter product life cycles
- Greater R&D investment
- U.S. Court of Appeals for the Federal Circuit (CAFC)

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WHY IS IT IMPORTANT NOW?

- Increased global competition
- Shorter product life cycles
- Greater R&D investment
- U.S. Court of Appeals for the Federal Circuit (CAFC)
- $

SETTLEMENTS IN INTELLECTUAL PROPERTY CASES

- Texas Instruments has collected $264 million for DRAM patent infringements through the first half of 1988.
- Fujitsu paid IBM a "very substantial" settlement in 1983 and additional "significant" revenue in 1987.
- SJS-Thomson collected "as much as" $150 million from several memory manufacturers.

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INTELLECTUAL PROPERTY:
What are today's key issues?

KEY ISSUES

- Current litigation in the semiconductor industry
  - AMD v. Samsung, Atmel, Gazelle Microcircuits, Cypress Semiconductor
  - Samsung v. Monolithic Memories (AMD)
  - National v. Cypress Semiconductor, Aspen Semiconductor
  - Intel v. NEC
  - Zilog v. NEC

(Continued)

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KEY ISSUES

- Current litigation in the semiconductor industry
  - Intel v. Hyundai, Vitelic
  - Intel v. Hyundai, Atmel, International CMOS Technology, Cypress Electronics, Pacesetter Electronics, All-American Semiconductor
  - Intel v. AMD

KEY ISSUES

- Current litigation
- Final regulations to the Semiconductor Chip Protection Act

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KEY ISSUES

- Current litigation
- Final regulations to the Semiconductor Chip Protection Act
- Intellectual property issues in the Trade Bill

INTELLECTUAL PROPERTY: *What to do?*

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STRATEGIES

- Evaluate your technology
- Introduce a patent program
- Develop intellectual property resources
- Consider joint action

Ideas = Intellectual Property

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Intellectual Property = $

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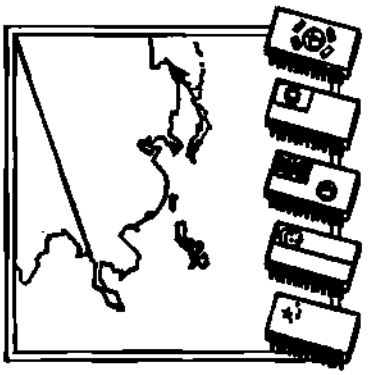
In Ku. Kang
Senior Managing Director
Goldstar Semicondutor Ltd.

Dr. Kang is a Senior Managing Director of Goldstar Semiconductor Ltd. and R&D and Business Development Group of C&C Sector of Goldstar Co,. Ltd. Prior to the position, he was a Managing Director of Goldstar Telecommunication Co., Ltd.

Dr. Kang received Ph.D. degree in Electronic Engineering from Univ. of New Mexico in the States in 1967.



Approaching
the Asian Age

EMERGING TELECOM MARKET OPPORTUNITIES

Dr. In Ku Kang

Senior Managing Director
Goldstar Co., Ltd.

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EMERGING TELECOM MARKET OPPORTUNITIES

NOV. 1988

IN - KU KANG

GoldStar Co., Ltd

CONTENT

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WORLDWIDE TELECOM TREND

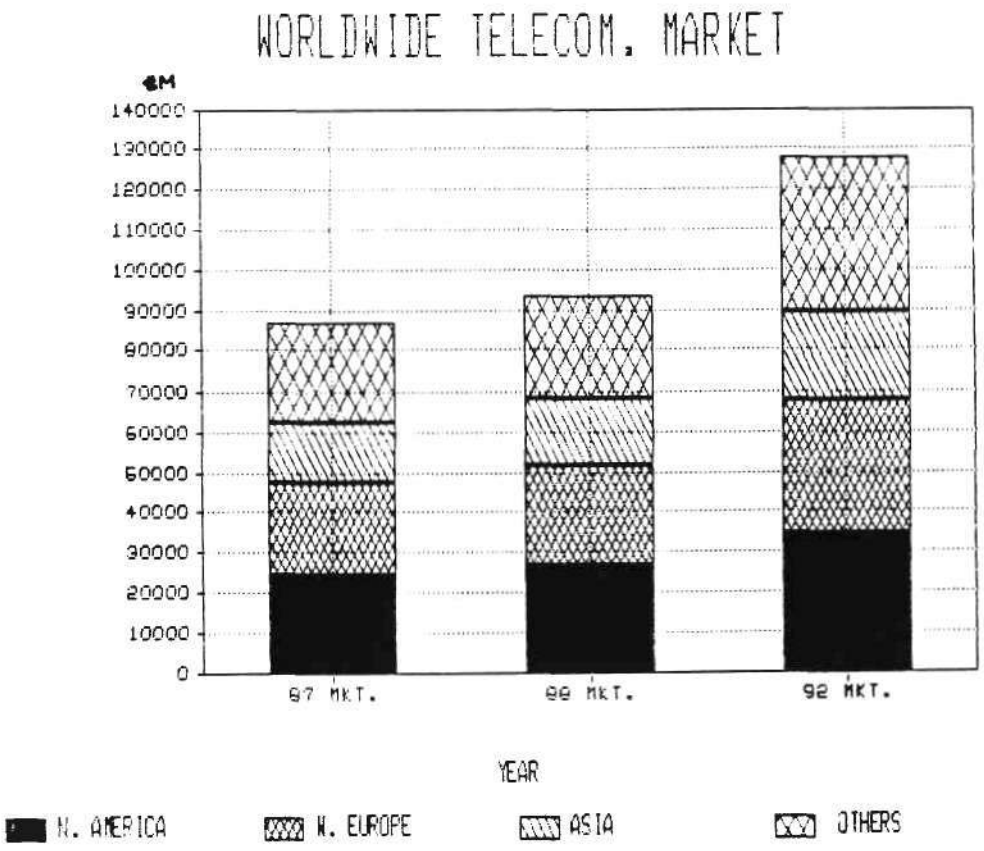
- RAPID GROWTH IN COMPUTER & COMMUNICATIONS
  . INCREASING COMMUNICATIONS & INFORMATION ACTIVITIES

- DE-REGULATION IN TELECOMMUNICATIONS
  . SEPARATING OPERATION FROM REGULATION

- INTERNATIONAL STANDARDIZATION (ISO, CCITT)
  . COMPLIANCE WITH STANDARDS

- TECHNOLOGY FUSION
  . NETWORK INTELLIGENCE INCREASING

- VARIETY OF VALUE-ADDED SERVICE TO ISDN
  . SOFTWARE SOLUTION & EMPHASIZING SERVICES



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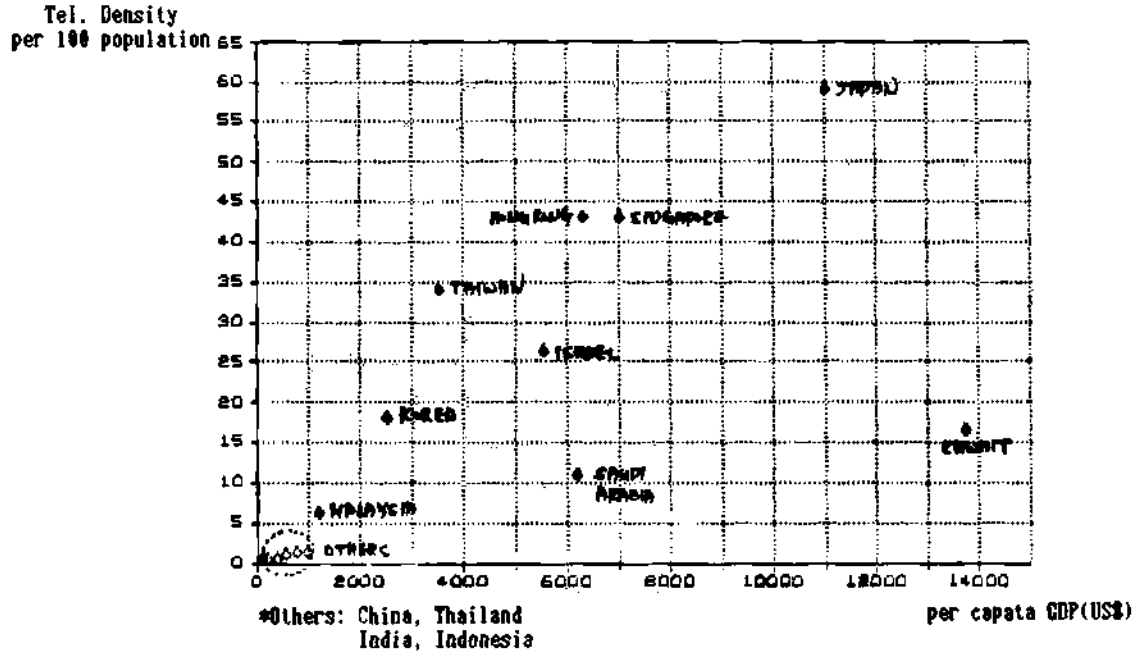
ASIA TELECOM STATUS

- ELECTRONIC TELECOMMUNICATIONS FALLING BEHIND
- DELAY OF TELECOM DEVELOPMENT PLAN BY FINANCIAL PROBLEMS

TELEPHONE DENSITY IN ASIAN COUNTRIES (1986)



ASIA TELECOM SUBJECT

- THE DEVELOPEMENT OF THE TELECOM IMFRASTRUCTURE
  . BACK-BONE TRANSMISSION SYSTEM TO EXTENDED SERVICE TO A REMOTE AREA
  . TELEPHONE POPULARIZATION
  . TELECOM MODERNIZATION

- R&D ACTIVITY
  . BUILD UP THE CAPABILITY OF HIGH TECHNOLOGY

- MARKETING
  . REDUCTION OF THE GAP BETWEEN SUPPLY AND DEMAND FOR ALL SERVICES

- TRAINING
  . IMPROVEMENT AND INCREASING TECHNICAL MANPOWER

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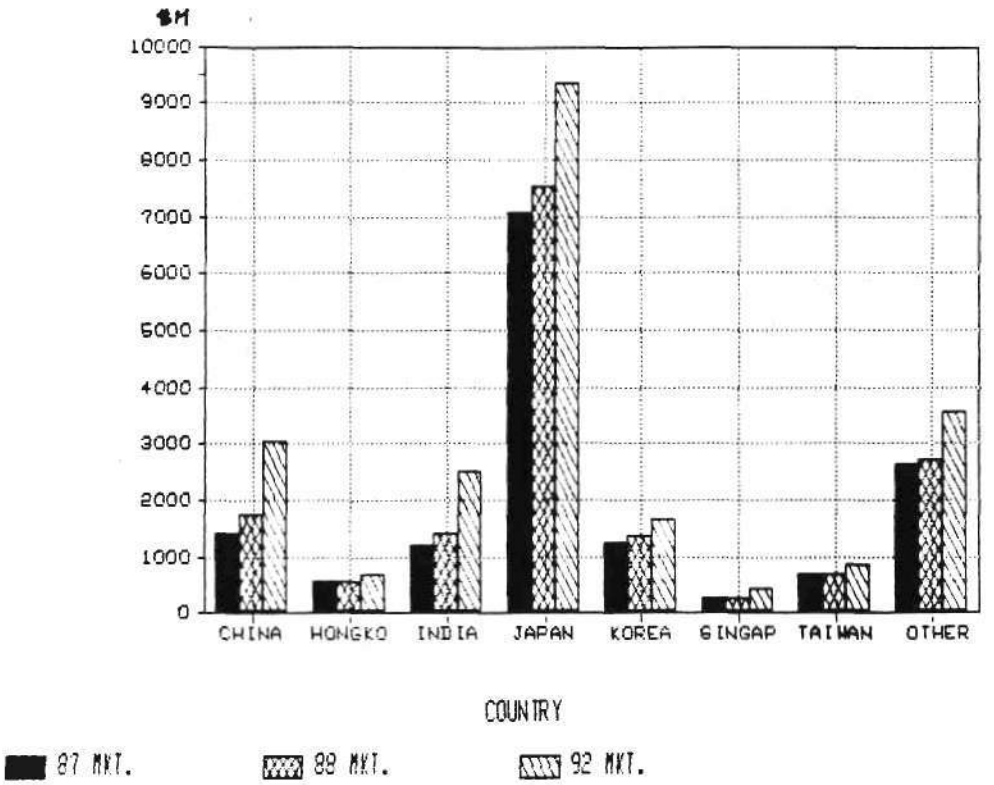
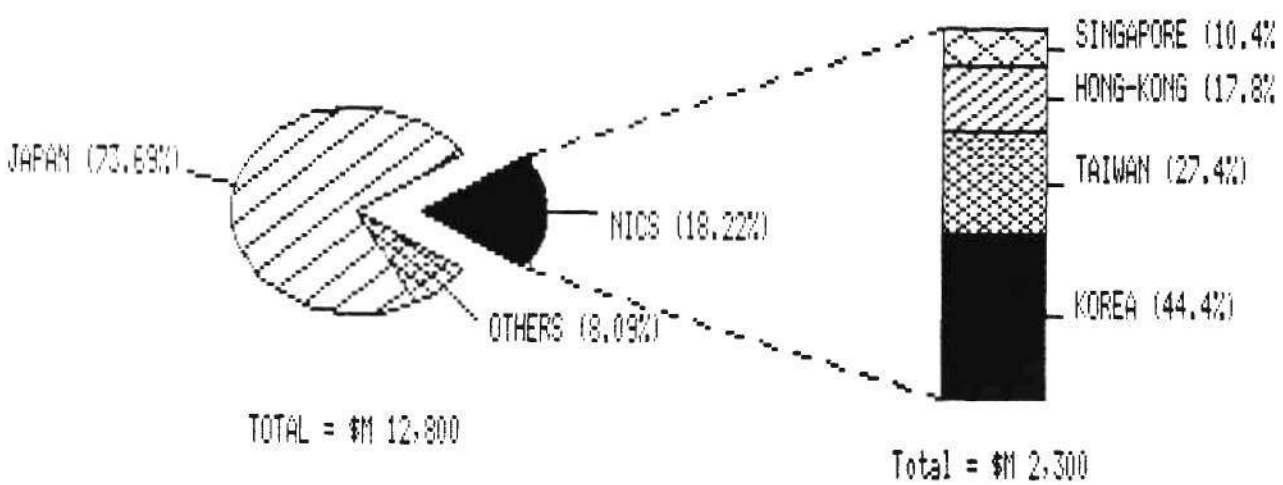
ASIA TELECOM. MARKET



NICS TELECOM PRODUCT ('87) IN ASIA



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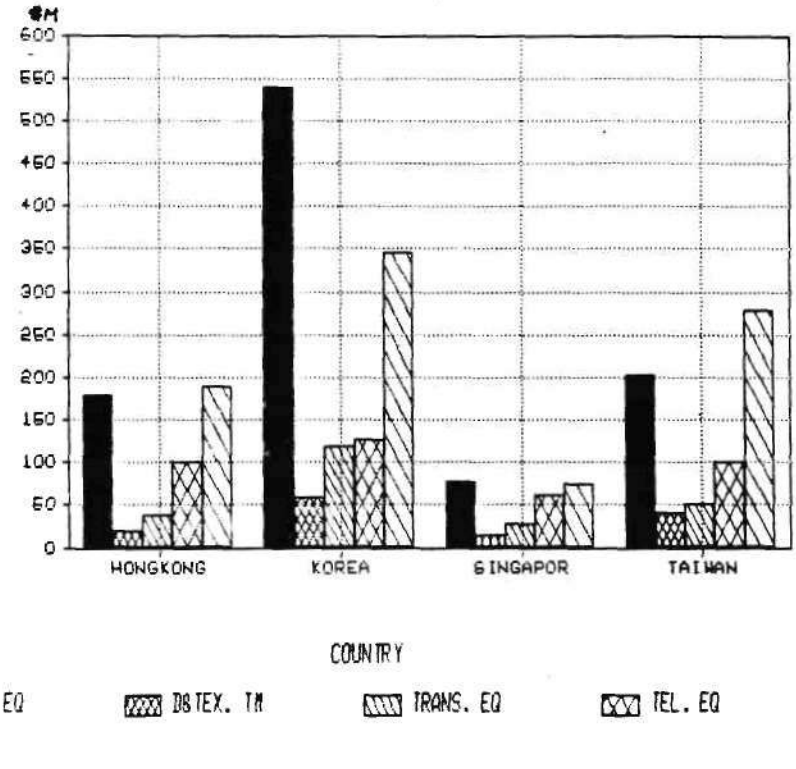
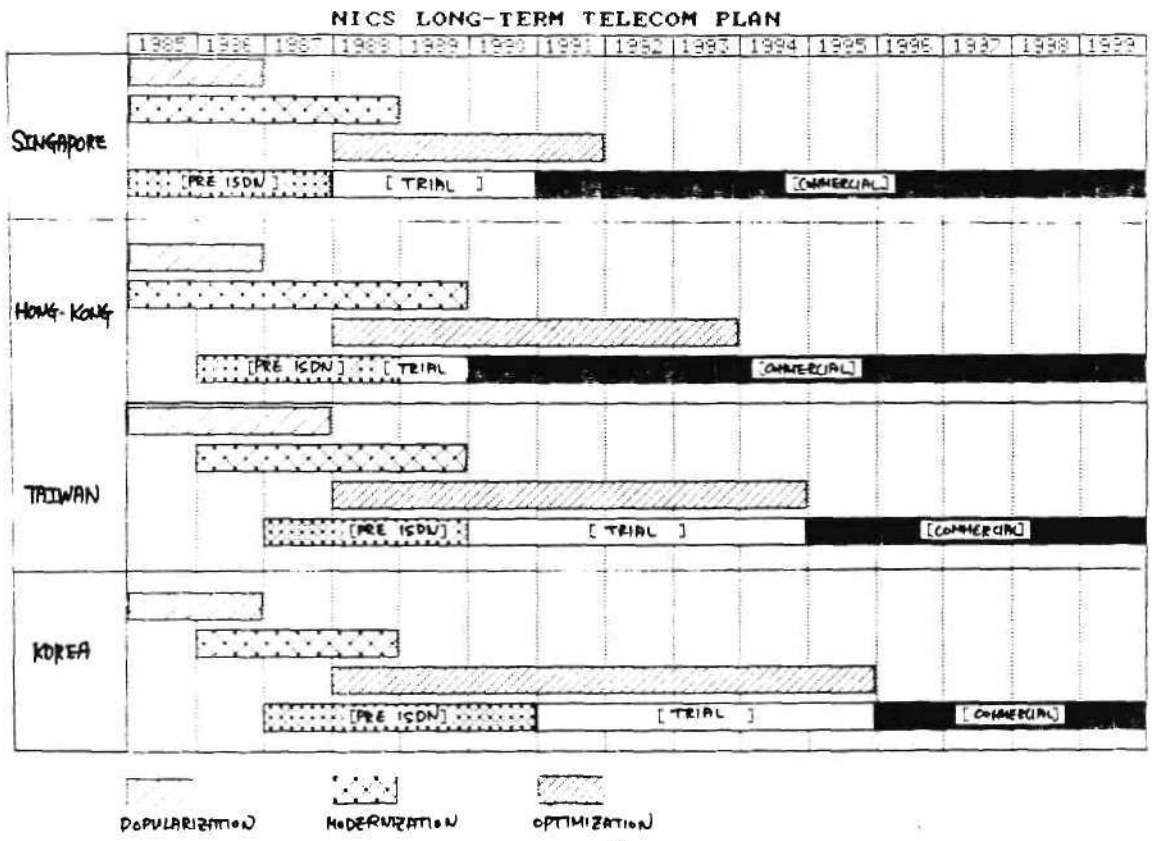
1987 NICS TELECOM MARKET PER SEGMENT





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KOREA ISDN PLAN

PRE-ISDN (1988-1991)	TRIAL (1992-1996)	COMMERCIAL (1997-2000)
- TELEPHONE NETWORK EXPANSION	- INFRASTRUCTURE DIGITAL TELECOM NETWORK COMPLETION	- NATIONWIDE ISDN
- INFRASTRUCTURE DIGITAL TELECOM NETWORK CONSTRUCTION	- UP-GRADE TELECOM NETWORK BY COMMON CHANNEL SIGNALING	- INFRASTRUCTURE BROADBAND ISDN CONSTRUCTION
- INFORMATION & TELECOM NETWORK EXPANSION	- APPLICABLE ISDN .STANDARDIZE ISDN TERMINAL	

HOT NEW PRODUCT AREA WORLDWIDE

UNIT: $M

ITEM	88 MKT	92 MKT	CAGR(88-92)
T-1 MULTIPLEXER	403	740	16.4 %
LANS	2,508	5,692	22.4 %
VOICE MAIL SYSTEM	513	998	18.1 %
FAX	1,041	2,005	17.8 %
VSAT	119	251	20.5 %
DIGITAL MICROWAVE RADIO	61	146	24.4 %
DACS	210	474	22.6 %
ISDN TERMINAL ADAPTER	57	304	52.8 %
LOCAL LOOP PRODUCT	400	776	18.0 %
SS #7 SYSTEM	135	320	24.1 %

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TAIWAN'S NEW MANUFACTURING FRONTIER

Dr. Ding-Yuan Yang
President
Winbond Electronics Corporation

Dr. Yang is President of Winbond Electronics Corporation. He founded Winbond in 1987 along with several other senior managers from ERSO. Prior to cofounding Winbond, he was General Director of Planning at Industry Technology Research Institute (ITRI). Earlier, he served as the Deputy Director of ERSO, in charge of R&D activities in computer systems. Before that, he worked at Harris Semiconductor, where he was a key project leader in the technology transfer program with RCA. Dr. Yang graduated from the National Taiwan University. He received a Ph.D. degree from Princeton University and a master of Management Science degree from Stanford University.

Dataquest Incorporated
ASIAN SEMICONDUCTOR AND ELECTRONICS TECHNOLOGY CONFERENCE
November 6-8, 1988
Seoul, Korea

SEMI21000 SMG 10/21/88 ASE

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TAIWAN'S NEW MANUFACTURING FRONTIER

Dr. Ding-Yuan Yang
President
Winbond Electronics Co.

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TAIWAN'S NEW MANUFACTURING FRONTIER

Dr. Ding – Yuan Yang

PRESIDENT

WINBOND ELECTRONICS CORP.

NOV. 7, 1988

TAIWAN 'S NEW MANUFACTURING FRONTIER

CONTENT

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I. ASSEMBLY COMPANIES

- ASSEMBLY OPERATIONS BEGAN IN 1967 IN EXPORT PROCESS ZONE WHEN LABOR WAS VERY INEXPENSIVE
- THERE ARE ABOUT 30 COMPANIES ENGAGED IN ASSEMBLY, OF WHICH 43% ARE FOREIGN – INVESTED COMPANIES
- PLASTIC DIP : 90%
  CERAMIC DIP : 10%
  SMALL OUTLINE AND PGA : LITTLE
- NEW FRONT END MANUFACTURING SPURS NEW INVESTMENT IN ASSEMBLY CAPACITY, PARTICULAR FOR HIGH PIN COUNT PACKAGES

TAIWAN'S NEW MANUFACTURING FRONTIER/
WINBOND ELECTRONICS CORP.

P. 2

I. ASSEMBLY COMPANIES

MAJOR INDEPENDENT ASSEMBLY COMPANIES

COMPANY	CAPACITY * M/MON	PACKAGE FORM
ADVANCED SEMICONDUCTOR ELECTRONICS	40	P - DIP,SOIC,PLCC,QFP
ORIENT SEMICONDUCTOR ELECTRONICS	15	P – DIP,SOIC,PLCC,PGA C – DIP,QFP,SIDE – BRAZE
SILICON WARE PRECISION INDUSTRY	7	P – DIP,SOIC,PLCC,QFP
LINGSEN PRECISION INDUSTRY	7	P – DIP,SOIC,PLCC,TO – 92
TALENT ELECTRONICS	4	P – DIP,SOIC,PLCC
CHINO - EXEL TECHNOLOGY	5	P – DIP,SOIC,PLCC

* 8 PIN EQUIVALENT

TAIWAN'S NEW MANUFACTURING FRONTIER/
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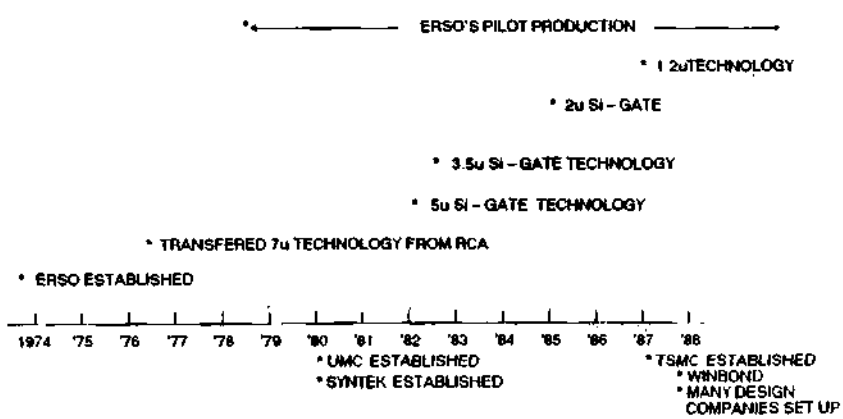
II. ERSO (ELECTRONICS RESEARCH & SERVICE ORGANIZATION)

- MAJOR DRIVING FORCE IN WAFER FABRICATION, IC DESIGN AND COMPUTER TECHNOLOGY DEVELOPMENT
- TOTAL NO. OF EMPLOYEE : ABOUT 1700 PERSONS
- ANNUAL BUDGET: NT$1,200 MILLION(ABOUT US$ 41.5M)
- PILOT PRODUCTION TERMINATED IN OCT.1988

TAIWAN'S NEW MANUFACTURING FRONTIER/ WINBOND ELECTRONICS CORP.

P. 4

II. ERSO



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II. ERSO

- MAJOR SPIN – OFF
  - UNITED MICROELECTRONICS CO. (UMC)
  - TAIWAN SEMICONDUCTOR MANUFACTURING CO. (TSMC)
  - SYNTEK DESIGN TECHNOLOGY
  - WINBOND ELECTRONICS CORP.
  - TAIWAN MASK CO. (DEC. 1988)
  - SILICON INTEGRATED SYSTEM (SIS)

TAIWAN'S NEW MANUFACTURING FRONTIER/
WINBOND ELECTRONICS CORP.

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III. FRONT END MANUFACTURING

- ERSO(STARTED IN 1977, TERMINATED IN 1988)
- UMC(STARTED IN JAN. 1982)
- TSMC(STARTED IN JULY 1987)
- HUALON MICROELECTRONICS CORP.(HMC) (STARTED IN JULY 1988)
- WINBOND ELECTRONICS CORP. (STARTED IN OCT. 1988)
- ADVANCED DEVICE TECHNOLOGY(ADT) (STARTED IN 1982)
- AMPI(STARTED IN AUG. 1988)

TAIWAN'S NEW MANUFACTURING FRONTIER/
WINBOND ELECTRONICS CORP.

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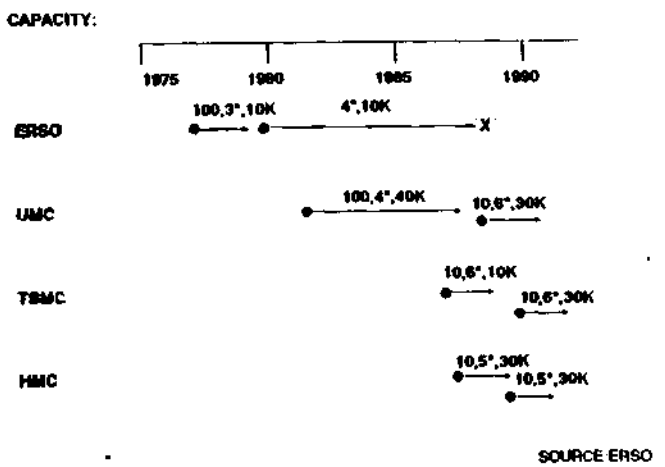
III. FRONT END MANUFACTURING



SOURCE ERSO

TAIWAN'S NEW MANUFACTURING FRONTIER/
WINBOND ELECTRONICS CORP.

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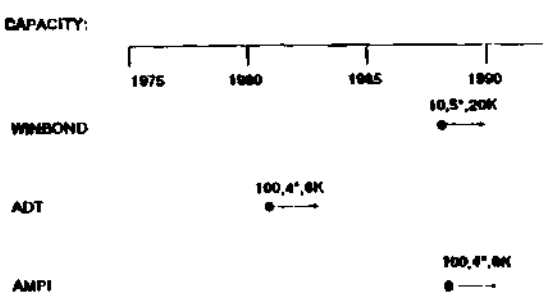
III. FRONT END MANUFACTURING



SOURCE ERSO

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III. FRONT END MANUFACTURING

PRODUCT LINE

	MICROCOMPUTER COMPONENT	TELECOMMU-NICATION	CONSUMER	MEMORY	FOUNDRY	CUSTOM-DESIGN	OTHERS
ERSO	X	X	X				
UMC	X	X	X	X	X		
TSMC					X		
HMC	X	X	X	X			
WINBOND	X	X	X	X	X	X	
ADT			X				POWER TRANSISTOR
AMPI			X		X		POWER IC

SOURCE: ERSO

TAIWAN'S NEW MANUFACTURING FRONTIER/ WINBOND ELECTRONICS CORP.

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III. FRONT END MANUFACTURING

REVENUE(US$ M)

	1987	1988*	1989*	1990*
ERSO	31.30	27.12	16.9	0
UMC	87.50	117.97	149.8	200
TSMC	4.00	34.00	83.0	124
HMC	–	–	62.0	100
WINBOND	–	–	52.0	80
ADT	N.A.	17.00	21.0	26
AMPI	–	–	13.6	17

*Forecast

SOURCE : ERSO

TAIWAN'S NEW MANUFACTURING FRONTIER/ WINBOND ELECTRONICS CORP.

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IV. DESIGN COMPANIES

- **THERE ARE ABOUT 50 COMPANIES ENGAGED IN IC DESIGN**
  - IC MANUFACTURING COMPANIES: WINBOND,UMC, HMC
  - DESIGN CENTERS SET UP BY SYSTEM COMPANIES: SERTEK, TATUNG, PROTON, ...ETC.
  - IC COMPANIES WITHOUT FAB.: SYNTEK, SIS, HOLTEK, ...ETC.
  - DESIGN CENTERS SET UP BY FOREIGN SEMICONDUCTOR COMPANIES(OR THEIR DISTRIBUTORS): TI, PHILIPS, HITACHI, ...ETC.

TAIWAN'S NEW MANUFACTURING FRONTIER/ WINBOND ELECTRONICS CORP.

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IV. DESIGN COMPANIES: IC COMPANIES WITHOUT FAB.

REVENUE(US$M)

	1987	1988*	1989*	1990*
SYNTEK	15.63	21.19	26.44	33.00
HOLTEK	8.44	11.46	14.24	18.00
SIS	0.12	20.34	30.00	37.00
OTHERS	–	10.37	16.00	20.00

*Forecast

SOURCE : ERSO

TAIWAN'S NEW MANUFACTURING FRONTIER/ WINBOND ELECTRONICS CORP.

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IV. DESIGN COMPANIES(con't)

ISSUES FACING THE DESIGN COMPANIES

- OVERLAP OF PRODUCT LINES
- EXPERTISE NOT OBVIOUS
- IS TSMC A RELIABLE SUPPLIER? IN TERMS OF PRIORITY, ALLOCATION, PRICING, ...ETC.
- NOT EAGER TO WORK WITH FRONT – END MANUFACTURERS BECAUSE OF OVERLAP OF PRODUCT LINES AND MARKET
- IS MINI – FAB A SOLUTION FOR FURTHER GROWTH?

To be continued....

TAIWAN'S NEW MANUFACTURING FRONTIER/ WINBOND ELECTRONICS CORP.

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V. SOME STATISTICS AND ESTIMATION

(MARKET SIZE AND IMPORT/EXPORT)

	1985 (1:40)	1986 (1:38)	1987 (1:32)
IMPORT	**481.6**	**789.1**	**1306.8**
CONSIGNMENT	167.8	211.7	285.9
COMSUMPTION	313.8	577.4	1020.9
PRODUCTION	**48.4**	**94.8**	**117.6**
DOMESTIC	25.4	61.2	57.9
EXPORT	23.0	33.6	59.7
CARRIED – IN	**37.6**	**70.9**	**119.8**
ESTIMATED IC DEMAND	**376.7**	**709.6**	**1198.6**
EXPORT	**718.5**	**562.9**	**774.5**

(UNIT : US$ M)

SOURCE: ROC CUSTOM OFFICE, ERSO

TAIWAN'S NEW MANUFACTURING FRONTIER/ WINBOND ELECTRONICS CORP.

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VI. SUMMARY & COMMENT

- THE GROWTH OF ELECTRONIC/INFORMATION INDUSTRY INDUCES HIGH MARKET DEMAND
- FRONT END MANUFACTURING CAPACITY WILL TRIPLE FROM 1987 TO 1990
- COMPANIES EXPRESSLY EMPHASIZE IN PRODUCT DEVELOPMENT AS MAJOR STRATEGY
- COMPETITION WILL BE VERY KEEN AS COMPANIES LOOK AT THE SAME PRODUCTS AND MARKET FOR THE NEXT 3 YEARS

To be continued....

TAIWAN'S NEW MANUFACTURING FRONTIER/ WINBOND ELECTRONICS CORP.

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VI. SUMMARY & COMMENT(con't)

- THE SUCCESS OF NEW COMPANIES MAY ENCOURAGE MORE INVESTMENT IN SEMICONDUCTOR MANUFACTURING
- DESIGN COMPANIES FACE GREAT UNCERTAINTY AS COMPETITION INCREASES AND FOUNDRY CAPACITY BECOMES LIMITED
- OPEN QUESTION:
  WHEN WILL TAIWAN PRODUCE DRAM?

TAIWAN'S NEW MANUFACTURING FRONTIER/ WINBOND ELECTRONICS CORP.

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Dr. Chang is the executive managing director of Daewoo Telecom Company. He is responsible for Daewoo's semiconductor operation. He received B.S. degree from Seoul National University and M.S. and Ph.D. from the Ohio State University in Columbus, Ohio in the United States, all degrees in elecctronics engineering. Before he joined Daewoo he worked for IBM in the States for several years in the semiconductor field.

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Approaching
the Asian Age

ENTERING THE ASIC MARKET

Dr. Hong Jo Chang
Executive Managing Director
Daewoo Telecom Co. Ltd.

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Entering the ASIC Market

Hong Jo Chang
Executive Managing Director
Daewoo Telecom Co., Ltd.

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ASIC STATUS IN KOREA

OVERVIEW

Users' interest rapidly growing

Design centers booming

ASSP market growing fast

CAD S/W R&D active in institutes

Government's support to industries

ASIC COMPANIES IN KOREA

COMPANY	ASIC START YEAR	PRODUCT				DESIGN-ERS	LOCAL FAB	AFFIL. COMPAN
		GATE ARRAY	STD CELL	PLD	MCU			
ANAM	87	*	*			5		VTI
DAEWOO	86		*		*	35	*	ZyMOS
GOLD STAR	84	*	*		*	N/A	*	LSI LOGIC
HYUNDAI	86	*		*		N/A	*	LSI LOGIC
MJL	87			*		2		ALTERA
SAMSUNG	84	*	*	*		40	*	

SOURCE : ELECTRONIC PARTS AND COMPONENTS MONTHLY

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ASIC COMPANIES IN KOREA

COMPANY	ASIC START YEAR	PRODUCT				DESIGN-ERS	LOCAL FAB	AFFIL. COMPANY
		GATE ARRAY	STD CELL	PLD	MCU			
AMD	N/A	*		*	*	N/A		
INTEL	86				*	N/A		
LSI LOGIC	87	*	*			7		
MOTOROLA	85	*	*		*	3		
NS	86	*	*		*	5		
TI	87	*	*		*	10		
TOSHIBA	N/A	*	*			N/A		

SOURCE : ELECTRONIC PARTS AND COMPONENTS MONTHLY

OBSTACLES IN ASIC BUSINESS

Poor users' understanding

Low cost, small volume requirement

Continuous investment and upgrading of technology

Lack of design engineers

Lack of system design knowledge

No commercial mask house

Most market by big corporatons

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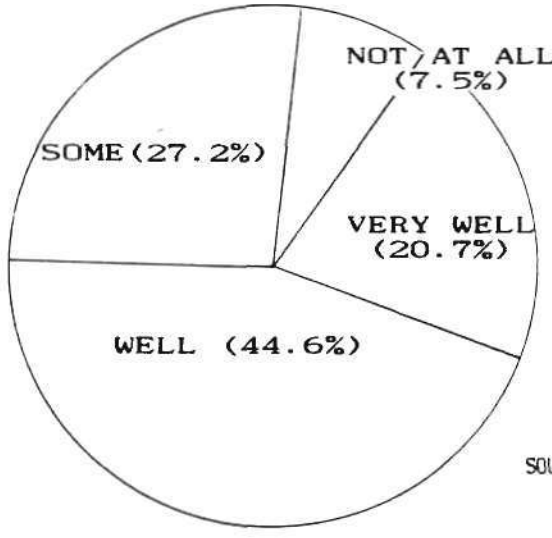
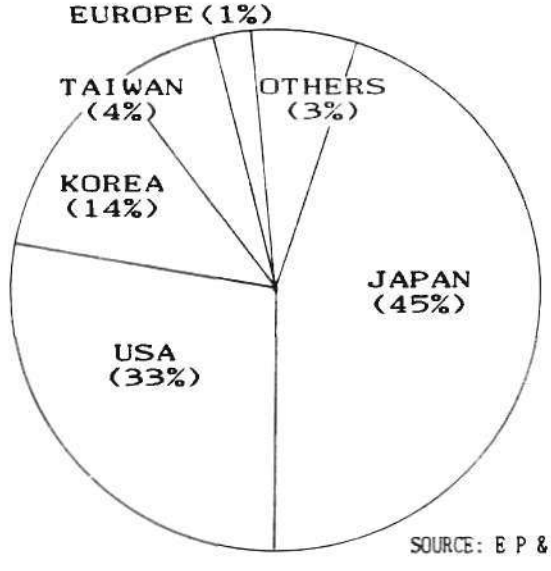
USER UNDERSTANDING



SOURCE: E P & C MONTHLY

ASIC SUPPLIER BY COUNTRY



SOURCE: E P & C MONTHLY

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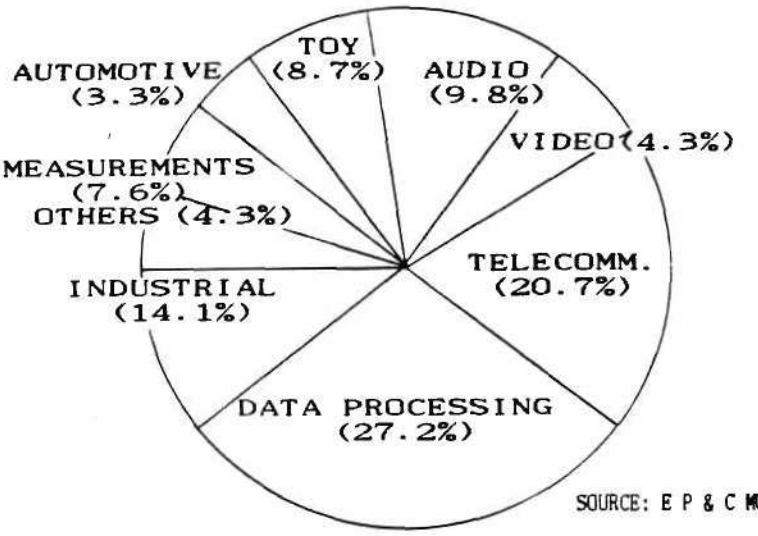
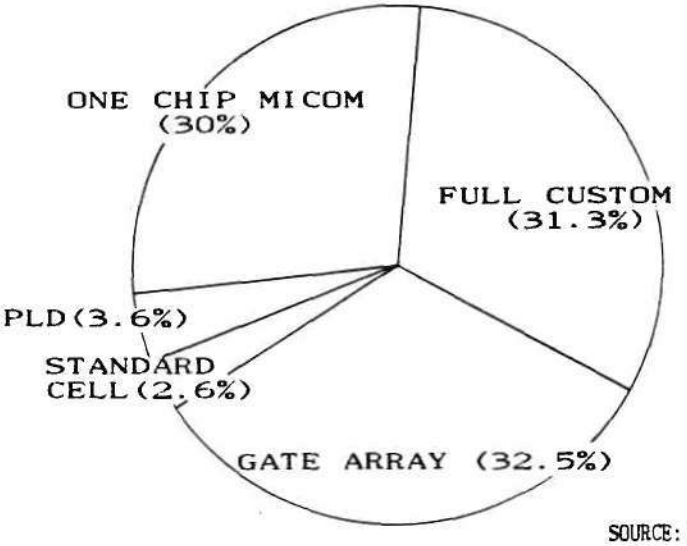
APPLICATION FIELD



SOURCE: E P & C MONTHLY

PRODUCT CLASSIFICATION



SOURCE: E P & C MONTHLY

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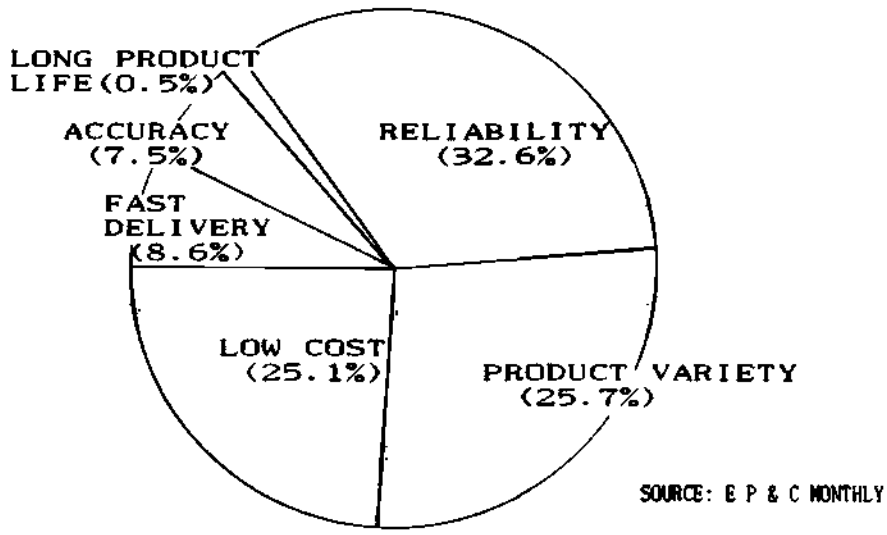
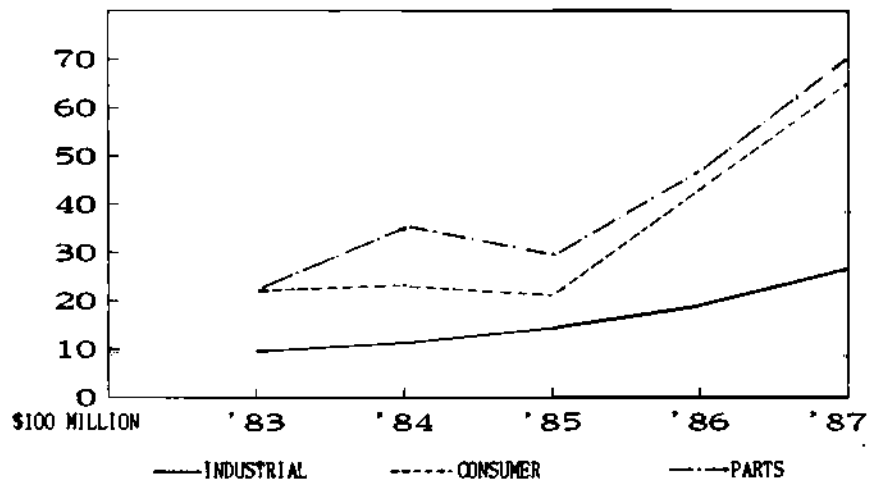
CUSTOMERS REQUIREMENT



SOURCE: E P & C MONTHLY

ELECTRONICS PRODUCTION IN KOREA



SOURCE: KOREAN GOVERNMENT

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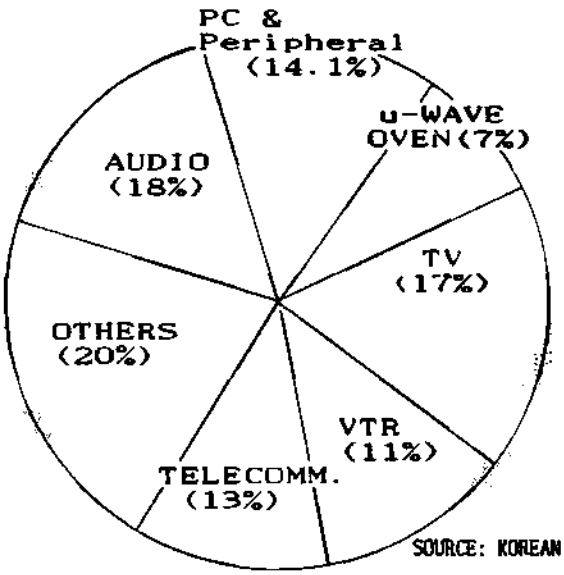
KOREA'S ELECTRONICS PRODUCTION('87)

TOTAL 10 BILLION US$



SOURCE: KOREAN GOVERNMENT

INTRODUCTION OF DAEWOO'S ASIC BUSINESS

OVERVIEW

Company : Daewoo Telecom Co., Ltd.

Plant location : Guro Industrial Park,
Seoul, Korea

Facilities : 2 Fabs, test, ass'y, CAD

No. of employees in semiconductor: 300

No. of designers : 35

Major product : CMOS and Bipolar ASIC

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THE REASONS DAEWOO ENTERED ASIC BUSINESS

Large internal semiconductor consumption
- Over 100 Million US$ in '88
- 90% imported

Various applications within Daewoo Group
- PC's
- Telecommunications
- Home electronics and appliances
- Automobiles
- Heavy industries

Heavy dependence on foreign makers
- Delivery
- Cost
- Volume

TECHNOLOGY/PRODUCT

Present
- Semicustom std. cell
- Full custom CMOS
- Bipolar Linear

Future
- Gate Array
- Silicon Compiler
- BICMOS

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DAEWOO'S APPROACH FOR ASIC

Emphasis on internal requirements

Close cooperation with system houses

Low cost manufacturing

Increase of product variety

Keep up with advanced CAD S/W technology

DAEWOO - ZyMOS

Daewoo

Low labor cost
Manufacturing facilities
Financing capability

ZyMOS

ASIC business experience
Manufacturing experience
Highly-skilled manpower

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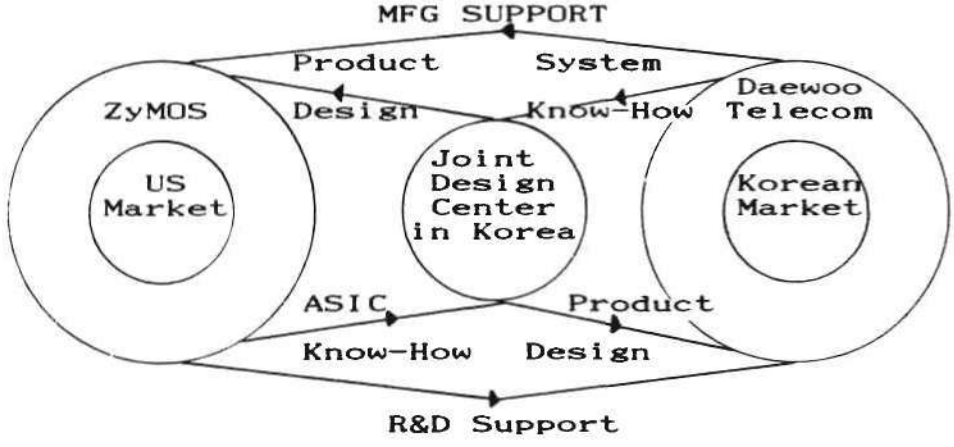
COOPERATION OF DAEWOO AND ZyMOS



SUMMARY

Korea's ASIC market is infant but growing fast

System knowledge is essential for success

Most market within big corporations

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DEVELOPING SMALL ELECTRONICS BUSINESS IN SOUTH KOREA

Dr. Kwang O. Park
Senior Vice President
Hyundai Electronics Industries Co.

Dr. Park is Senior Vice President in charge of research and development at Hyundai Electronics Industries Co. He is actively involved in the development of high-density memory products, logic products, ASICs, product planning, and development. Prior to becoming Senior Vice President, he was Managing Director of manufacturing and supervised the construction of the 6-inch wafer fab. Previously, he worked at Intel as a Senior Staff Engineer and as Engineering Manager. While there, he worked on Intel 448 technology area of process development. Prior to working at Intel, he was a Senior Member of the Technical Staff at GTE Laboratories. Dr. Park also spent two years at National Micronetic as a Senior Process Development Engineer in the area of thin-film technology. Dr. Park received a B.S. degree from the Seoul National University and a Ph.D. from the University of Minnesota.

Dataquest Incorporated
ASIAN SEMICONDUCTOR AND ELECTRONICS TECHNOLOGY CONFERENCE
November 6-8, 1988
Seoul, Korea

S2821011 IMG 10/21/88 ASE

Approaching
the Asian Age

DEVELOPING SMALL ELECTRONICS BUSINESS IN SOUTH KOREA

Dr. K.O. Park

Senior Vice President
Hyundai Electronics Industries Co.

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WE ALREADY JUMPED IN A SEMICONDUCTOR WAGON.

WHAT DO WE NEED TO DO TO DRIVE THE WAGON FAST AND WIN THE RACE?

WE NEED MORE AND MORE PASSENGERS TO JOIN US IN THE WAGON

WHY DOES KOREA NEED MORE(SMALL AND MEDIUM SIZED) SEMICONDUCTOR-RELATED BUSINESS?

- TO PROVIDE SEEDBED OF GROWTH FOR THE PERIPHERAL BUSINESS
- TO SPUR AND ATTAIN COMPETITIVE POSITION IN THE WORLD SEMICONDUCTOR RACE
- TO ACHIEVE TECHNICAL INDEPENDENCE AND EXCELLENCE THROUGH BALANCED TECHNOLOGY EXCHANGES AND TRADES
- TO EVENTUALLY FLOURISH IN THIS AGE OF TOUGH GLOBAL COMPETITIONS

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WHAT CAN WE DO TO SPUR AND ATTAIN MORE COMPETITIVE POSITION IN THE RACE AND ACHIEVE TECHNICAL INDEPENDENCE AND EXCELLENCE?

- PUT BETTER INFRASTRUCFURES IN PLACE
- ATTRACT AND BUILD UP FAST MORE SEMICONDUCTOR RELATED BUSINESSES
- INDUCE BALANCED DEVELOPMENT IN THE ALL AREAS OF TECHNOLOGY
- ENCOURAGE AND FACILITATE INDIVIDUAL ENTREPRENEURISM, PROFIT SHARINGS, ETC.
- ENCOURAGE AGGRESIVE EXPANSION OF R&D PROGRAMS
- IMPROVE THE QUALITY OF OVERALL EDUCATIONAL PROGRAMS AND/OR PROFESSIONAL TRAINING PROGRAMS
- INCREASE SUPPORT FOR UNIVERSITY AND JOINT PRIVATE SECTOR R&D EFFORTS

WHAT KINDS OF SEMICONDUCTOR RELATED BUSINESSES ARE WE TALKING ABOUT?

- WAFER PROCESS EQUIPMENT MANUFACTURING
- MATERIALS, CHEMICALS, AND GASES SUPPLIES
- FACILITY SUPPLIES
- MASK SHOPS
- CAD/CAM
- COMPUTERS
- INDEPENDENT DESIGN CENTERS

AND MORE AND MORE SEMICONDUCTOR MANUFACTURING COMPANIES TO SUSTAIN THEM.

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LOW COST LABOR ALONE IN MANUFACTURING IS NOT A SUFFICIENT ENOUGH FACTOR TO GIVE US A COMPETITIVE EDGE IN THE GLOBAL COMPETITIONS

BREAKDOWN OF TYPICAL WAFER FABRICATION COSTS

MATERIALS	30%
FACILITY AND EQUIPMENT DREPREICATION	40%
UTILITY	5%
G&A	13%
LABOR	12%
	100%

EFFECTIVE PURCHASING PRICE COMPARISON OF TYPICAL SEMICONDUCTOR EQUIPMENT

	US	KOREA
EQUIPMENT PRICE	100	100
COMMISSION, TRAINING		12%
INSURANCE		0.54%
AIR FREIGHT CHARGE(OVERSEA)		1%
CUSTOM DUTY		6.75%
TAXES		1.21%
TOTAL	100	124

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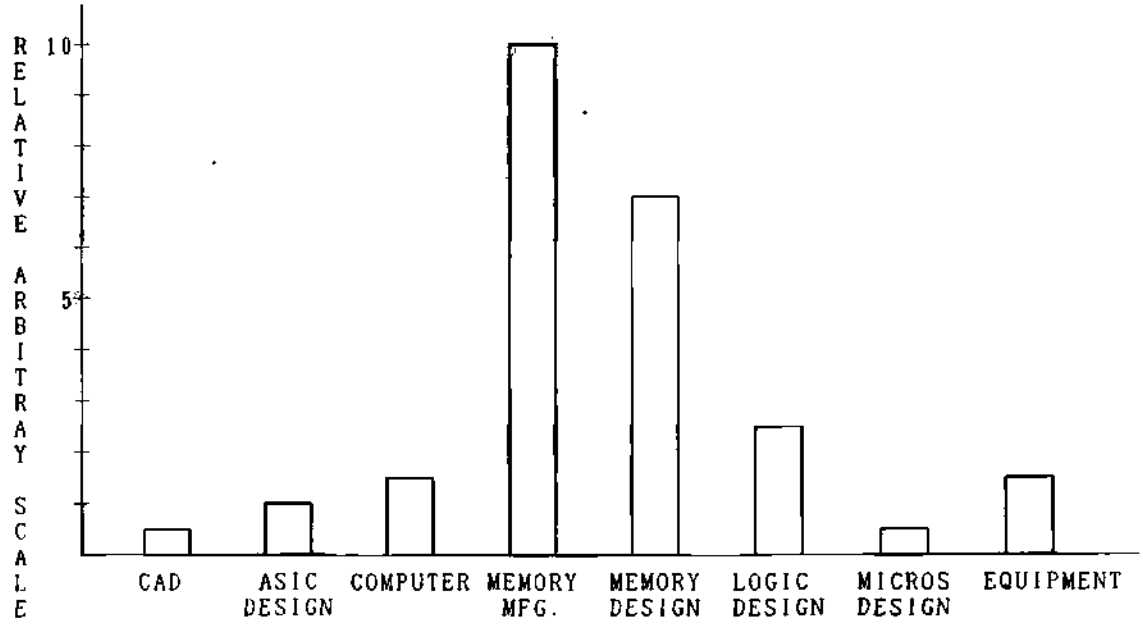
IT IS TIME TO INDUCE BETTER BALANCED DEVELOPMENT ACTIVITY IN ALL AREAS OF TECHNOLOGY

GRAPHIC ILLUSTRATION OF THE UNBALANCED TECHNOLOGY DEVELOPMENT ACTIVITY



ARE THE PRESENT KOREAN SEMICONDUCTOR BUSINESS SUFFICENTLY BIG ENOUGH TO ATTRACT AND SUSTAIN THE PERIPHERAL BUSINESS ACTIVITY DOMESTICALLY?

- o. IT NOT HAS BEEN SO FAR.
- o. BUT THE OPPORTUNITY IS RIPENING

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EXAMPLE

KIND OF BUSINESS	ESTIMATION OF ANNUAL REQUIRED SALES TO SUSTAIN MINIMUM BUSINESS ACTIVITY IN KOREA
o. PHOTO RESIST/CHEMICAL	$ 5- 10M
o. STEPPER	$80-100M
o. ETCH EQUIPMENT	$30- 40M
o. MASK SHOP	$10- 20M

ESTIMATION OF CAPITAL SPENDING BY THE MAJOR SEMICONDUCTOR COMPANIES IN KOREA (IN MILLION US DOLLARS)

	86	87	88	89	90	CAGR
SAMSUNG	127	187	280	350	400	43.8%
GOLDSTAR	90	133	198	300	350	65.3%
HYUNDAI	100	80	70	350	400	62.5%

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WHY SMALL AND MEDIUM SIZED COMPANIES ARE DESIRED OVER BIG COMPANIES?

BECAUSE THEY ARE:

- MORE DYNAMIC AND COMPETITIVE
- MORE QUICKLY RESPOND TO CHANGING MARKET SITUATIONS
- MORE INNOVATIVE AND CREATIVE
- MORE SPECIALIZED AND DIVERSIFIED
- MORE ATTRACTIVE TO ENTREPRENEURS

QUESTIONS AND CONCERNS THAT NEEDS TO BE ADDRESSED TO INVESTORS FOR SMALL AND MEDIUM SIZED BUSINESS?

- IS BUSINESS OPPORTUNITY MATURE?
- IS BUSINESS CLIMATE RIGHT?
- ARE THERE GOOD GOVERNMENTAL INCENTIVES AND POLICIES IN PLACE TO ATTRACT SMALL INVESTMENTS?
- WHAT ABOUT THE RATE OF RETURN ON INVESTMENT AND PAY BACK PERIOD?
- ARE THERE ENOUGH EXPERIENCED AND SKILLED LABOR FORCES?
- CAN THE MARKET BE DEVELOPED EASELY?
- IS LOCAL FINANCING READILY AVAILABLE?
- WILL ECONOMIC AND POLITICAL SITUATIONS BE STABLE IN A LONG RUN?
- CAN OTHER ASIAN TERRITORY BE COVERED FROM KOREA?
- IS RISK-TAKING TOO HIGH?

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WHAT ARE THE MAJOR CONCERNS AND ISSUES OF SMALL AND MEDIUM SIZED COMPANIES CURRENTLY DOING BUSINESS IN KOREA?

- STEADY PRICE HIKES OF IMPORTED RAW MATERIALS AND COMPONENTS
- JIT DELIVERY OF RAW MATERIALS AND COMPONENTS
- COMPLEX GOVERNMENT APPROVAL PROCEDURES FOR IMPORT AND EXPORT
- DIFFICULT LOCAL BANK FINANCING
- COMPLEX AND BURDENSOME TAX SYSTEM
- SHORTAGE IN SKILLED AND EXPERIENCED MANPOWER
- DIFFUCULTY IN DEVELOPING AND PENETRATING NEW MARKET

- LACK OF RESOURCES TO DEVELOP COMPETITIVE NEW TECHNOLOGY
- ESCAPE FROM LABOUR INTENSIVE BUSINESS
- FREQUENT DELAYED PAYMENTS FROM RECEIVABLE ACCOUNTS
- LABOR UNION MOVEMENT
- TRADE FRICTIONS
- INTELLECTUAL PROPERTY RIGHT AND PROTECTION
- LACK OF TIMELY MARKETING AND NEW TECHNOLOGY INFORMATION
- MAINTAINING INDEPENDENCE FROM BIG GUYS ATTACKS

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SURVEY OF SMALL AND MEDIUM SIZED ELECTRONIC COMPANIES ON THEIR OPERATIONAL ISSUES

SIZE / ITEM	1-29	30-49	50-99	100-199	200-299	OVER 300	NO OF COMPANIES SURVEYED
MATERIALS							
.PRICE HIKE	4	4	7	9	1	6	31
.AVAILABILITY							
MANPOWER SHORTAGE							
.SHORTAGE IN PROF ENGINEER	2	8	7	9	5	7	38
SHORTAGE IN SKILLED LABOR	3	5	6	6	2	3	25
MARKETING AND SALES							
. LACK OF MARKETING EXPERIENCE	3	1	10	5	5	5	29
DIFFICULTY IN PENETRATING NEW MARKET							
BANK FINANCING							
.LACK OF COLLATERALS	7	3	8	5	3	5	31
.LIMITED AMOUNT OF LOAN	-	7	4	5	5	4	25
FUNDING SHORTAGE	5	7	9	7	3	1	32
LACK OF TECHNICAL INFORMATION	1	2	5	1	1	1	11
TAX EXAMINATION	2	2	5	3	2	1	15

Source:

SURVEY OF SMALL AND MEDIUM SIZED CMPANIES ON THE CONCERNS AND ISSUES ABOUT THE TAX SYSTEM

(NO OF COMPANIES AND %)

SIZE / ITEM	1-29	30-49	50-99	100-199	200-299	OVER 300	NO OF COMPSNID SURVEYED
FREQUENT TAX EXAMINATIONS	6 (16.7)	10 (18.9)	23 (29.5)	8 (13.8)	14 (40.0)	3 (11.5)	64 (22.4)
UNFAIR TAX IMPOSITION	4 (11.1)	9 (17.0)	10 (12.8)	8 (13.8)	-	1 (3.8)	32 (11.2)
TOO MANY DIFFERENT FORMS ON TAS REPORTS	8 (22.2)	14 (26.4)	21 (26.9)	21 (36.2)	10 (28.6)	5 (19.2	79 (27.6)
TOO FREQUENT DEMAND ON TAX REPORT	3 (8.3)	3 (5.7)	9 (11.5)	6 (10.3)	8 (22.9)	13 (50.0)	42 (14.7)
BOOK KEEPING	14 (38.9)	11 (20.8)	9 (11.5)	6 (10.3)	1 (2.9)	2 (7.7)	43 (15.0)
CLOSING FINANCIAL REPORT	1 (2.8)	4 (7.5)	4 (5.1)	8 (13.8)	2 (5.7)	2 (7.7)	21 (7.3)
OTHERS	-	2 (3.8)	2 (2.6)	1 (1.7)	-	-	5 (1.7)
TOTAL	36 (12.6)	53 (18.5)	78 (27.3)	58 (20.3)	35 (12.2)	26 (9.1)	286 (100.0)

Source:

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COMPOSITINAL COMPARISION OF SMALL AND MEDIUM SIZED BUSINESS

	'70		'80		'85		'86	
	TOTAL	SMB	TOTAL	SMB	TOTAL	SMB	TOTAL	SMB
NO. OF TOTAL BUSINESS	25,816	25,072	32,560	31,466	45,933	44,803	52,011	50,787
COMPOSITION (%)		97.0		96.6		97.5		97.6
TOTAL NO OF EMPLOYEES	938	452	2,099	1,036	2,529	1,413	2,833	1,626
COMPOSITION (%)		48.2		49.4		55.9		57.4
TOTAL OUTPUT (BILLION WON)	1,388	416	38,817	11,763	78,076	27,777	93,132	35,288
COMPOSITION (%)		29.9		32.0		35.6		37.9
ADDED VALUES (BILLION WON)	588	165	12,233	4,292	27,496	10,372	33,746	13,185
COMPOSITION (%)		28.0		35.1		37.7		39.1

Source:

SURVEY OF S&M COMPANIES ON STRATEGIC POLICY RECOMMENDATIONS BY INDUSTRY TO IMPROVE COMPETETIVENESS IN THE INTERNATIONAL TRADES

BUSINESS / ITEM	TEXTITE	GARMENT	MACHINERY	ELECTRONICS	TRANSPORTATION	TOTAL
GUARANTEE OF FREE COMPETITION AMONG CORPORATES	3 (5.0)	2 (8.3)	1 (1.0)	1 (1.2)	4 (6.7)	11 (3.4)
EXPANDED BANKING AND FINANCING ASSISTANCE	22 (36.7)	12 (50.0)	30 (29.7)	34 (41.5)	21 (35.0)	119 (36.4)
PROMOTIONAL TRADE DIPLOMACY	1 (1.7)	1 (4.2)	3 (3.0)	2 (2.4)	1 (1.7)	8 (2.4)
COODINATION OF EXCESSIVE COMPETITION	7 (11.7)	1 (4.2)	9 (8.9)	10 (12.2)	4 (6.7)	31 (9.5)
SIMPLIFICATION OF IMPORT AND EXPORT RELATED PROCEDURES AND FINANCING	15 (25.0)	6 (25.0)	6 (5.9)	5 (6.1)	6 (10.0)	38 (11.6)
GOVERNMENTAL SUPPORT FOR R&D	9 (15.0)	2 (8.3)	39 (38.6)	26 (31.7)	21 (35.0)	97 (29.7)
GATHERING OF OVERSEA MARKETING AND TECHNICAL INFORMATION	3 (5.0)	-	12 (11.9)	4 (4.9)	2 (3.3)	21 (6.4)
OTHERS	-	-	1 (1.0)	-	1 (1.7)	2 (0.6)
TOTAL	60 (18.3)	24 (7.3)	101 (30.9)	82 (25.1)	60 (18.3)	327 (100.0)

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MAJOR PROBLEMS IN THE MARKETING AND SALES AREA BY INDUSTRY

BUSINESS / ITEM	TEXTILE	GARMENT	MACHINERY	ELECTRO-NICS	TRANSPOR-TATION	TOTAL
LACK OF EXPERIENCED MANPOWER	13 (26.5)	6 (26.1)	29 (26.9)	23 (29.5)	20 (20.8)	91 (29.6)
MAKT' ING INFORMATION	7 (14.3)	4 (17.4)	17 (15.7)	11 (14.1)	7 (14.3)	46 (15.0)
DIFF. IN NEW MARKET & SALES DEVELOPMENT	14 (28.6)	3 (13.0)	36 (33.3)	29 (37.2)	13 (26.5)	95 (30.9)
ADVERTIZEMENT AND SALES PROMOTION	1 (2.0)	1 (4.3)	6 (5.6)	2 (2.6)	1 (2.0)	11 (3.6)
PROVIDING FUNDS FOR MKT AND SALES	6 (12.0)	3 (13.0)	13 (12.0)	8 (10.3)	4 (8.20)	34 (11.1)
EXCESSIVE GOVERNMENT REGULATIONS AND TAX BURDENS	-	1 (4.3)	4 (3.7)	1 (1.3)	1 (2.0)	7 (2.3)
QUALITY PROBLEM	1 (2.0)	-	3 (2.8)	1 (1.3)	2 (4.1)	7 (2.3)
TRADE QUOTAS	4 (8.2)	5 (21.7)	-	3 (3.8)	1 (2.0)	13 (4.2)
OTHERS	3 (6.1)	-	-	-	-	3 (10.0)
TOTAL	49 (16.0)	23 (7.5)	108 (35.2)	78 (25.4)	49 (16.0)	307 (100.0)

MAJOR CAUSES FOR INSUFFICENT MFG FACILITY AND EQUIPMENT BY INDUSTRY

BUSINESS / ITEM	TEXTILE	GARMENT	MACHINERY	ELECTRO-NICS	TRANSPOR-TATION	TOTAL
INSUFFICENT FUND	21 (58.3)	10 (66.7)	65 (67.0)	48 (81.4)	29 (61.7)	173 (68.1)
SHORTAGE IN SKILLED OPERATIONAL MANPOWER	8 (22.2)	4 (26.7)	16 (16.5)	7 (11.9)	8 (17.0)	43 (16.9)
LACK OF INFORMATION ABOUT MFG EQUIPMENT AND FACILITY	1 (2.8)	1 (6.7)	13 (13.4)	2 (3.4)	5 (10.6)	22 (8.7)
OTHERS	6 (16.7)	-	3 (3.1)	2 (3.4)	5 (10.6)	16 (6.3)
TOTAL	36 (14.2)	15 (5.9)	97 (23.2)	59 (38.2)	47 (18.5)	254 (100.0)

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WHAT NEEDS TO BE DONE TO ATTRACT AND BUILD UP MORE SMALL AND MEDIUM SIEZED BUSINESS(SMB)?

- EXPAND THE BASES FOR SMB TO INCREASE COMPETITIVENESS
- SIMPLIFY THE REGISTRATION PROCEDURES FOR NEW INVESTMENTS AND BUSINESS FORMATION
- FACILITATE LOCAL BANK FINANCING PROCEDURES AND INCREASE RESERVES FOR EXPANDED FINANCING ASSISTANCE
- SUPPORT PRIVATE SECTOR R&D AND EXPAND JOINT R&D PROJECT BETWEEN SIMILAR BUSINESS
- EXPAND EDUCATIONAL AND TRAINING PROGRAM ASSISTANCE TO PROVIDE ABUNDANT SKILLED LABOR FORCE AND IMPROVE PRODUCTIVITY

- BROADEN TAX INCENTIVES FOR THE ENCOURAGEMENT OF INVESTMENTS
- PROVIDE TAX INCENTIVES ON R&D
- ACCELERATE AND EXPEDITE FACTORY AUTOMATION
- SIMPLIFY THE TAX SYSTEM
- SIMPLIFY THE CUSTOM CLEARANCE PROCEDURES AND REDUCE CUSTOM DUTIES
- PROVIDE FURTHER TAX EXEMPTION OR REDUCTION ON ROYALTIES
- INSTALL A SYSTEM TO PROTECT SMALL GUYS FROM BIG ONES

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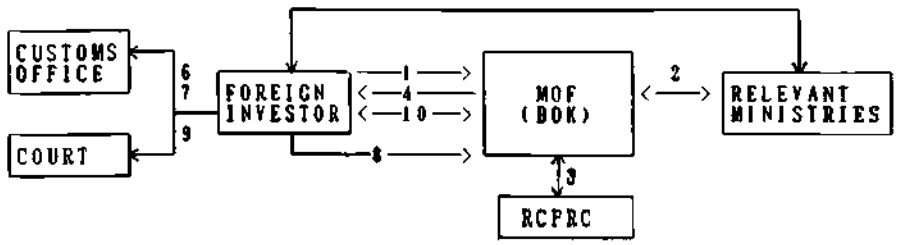
FOREIGN INVESTMENT PROCEDURES



1. APPLICATION FOR AUTHORIZATION
2. REVIEW OF APPLICATION
3. DELIBERATION AND APPROVAL BY THE FCPRC
4. AUTHORIZATION
5. APPLICATION FOR REVIEW AND CONFIRMATION OF SPECIFICATION OF CAPITAL GOODS TO BE IMPORTED
6. IMPORT DECLARATION
7. APPLICATION FOR EXEMPTION OR REDUCTON OF CUSTOMS DUTY, ETC.
8. REPORT OF FOREIGN CAPITAL INDUCEMENT
9. INCORPORATION
10. REGISTRATION OF FOREIGN-INVESTED ENTERPRISE

*NOTE: PROCEDURES 2 AND 3 ARE OMITTED IN THE CASE OF PROJECTS ELIGIBLE FOR AUTOMATIC APPROVAL.

FOREIGN INVESTMENT CONDITIONS

PROJECTS	NECESSARY CONDITIONS
1) PROJECTS ACCOMPANIED BY ADVANCED TECHNOLOGY	- THE PROJECT SHOULD BE ACCOMPANIED BY THE TECHNOLOGY THAT MEETS ALL THE FOLLOWING CONDITIONS DOMESTIC SELF-DEVELOPMENT IS CONSIDERED DIFFICULT . USED IN TECHNOLOGY INTENSIVE OR HIGHTECH INDUSTRIES ANNOUNCED BY MOF . RECOGNIZED AS HAVING REMARKABLE ECONOMIC OR TECHNOLOGICAL BENEFIT BY THE MINISTER OF FINANCE AFTER CONSULTING WITH RELEVANT MINISTERS AND THE MINISTER OF SCIENCE AND TECHNOLOGY
2) PROJECTS INVESTED IN BY NON-RESIDENT KOREAN NATIONALS	- ONLY IN MANUFACTURING INDUSTRIES
3) PROJECTS LOCATED IN FREE EXPORT ZONES	
4) OTHER PROJECTS	- THE PROJECT SHOULD BE SMALL AND MEDIUM SIZED AND SHOULD FALL IN THE LIST OF "INDUSTRIES FOR PREFERRED FOSTERING AS A SMALL AND MEDIUM-LIZED ENTERPRISE WITH TAX EXEMPTABLE STATUS" - ITS FOREIGN INVESTMENT RATIO SHOULD BE LESS THAN 50%

(MINISTRY OF FINANCE NOTIFICATION, NO 87-10, 87.7.1).

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Dataquest

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A NEW PLAYER IN ASIAN SEMICONDUCTOR GAME - INDIA

Rahul Sud
Vice President of Marketing
Microchip Technology Inc.

Mr. Sud is Vice President of Marketing at Microchip Technology Incorporated, a $100M manufacturer of VLSI integrated circuits. Mr. Sud founded Lattice Semiconductor Corporation in 1983 and served as President and Chief Executive Officer for four years. Lattice's Generic Array Logic (GAL ™) family of 0.9 Micron E^2 CMOS ™ PLD's have set a new industry standard in the $750M PLD marketplace. During his 15 years in microelectronics, Mr. Sud has held management positions encompassing marketing, development, manufacturing and corporate and general management, having worked at Intel, Inmos, Signetics and Harris Semiconductor. Mr. Sud was Electronics Man of the Year, Semiconductor Memories in 1980 and received the TOBIE award in London for the development of Inmos' pioneering family of IMS 1400 fast static RAMS which achieved $100 million in sales in 1984.

Mr. Sud graduated as top ranked graduate from St. Stephens College, University of Delhi. He holds two masters degrees, one in Solid State Physics from the Florida Institute of Technology and one in Electrical Engineering from the University of California, Berkeley. He achieved Ph.D candidacy at Stanford University before joining the industry.

Dataquest Incorporated
ASIAN SEMICONDUCTOR AND
ELECTRONICS TECHNOLOGY CONFERENCE
November 6-8, 1988
Seoul, Korea

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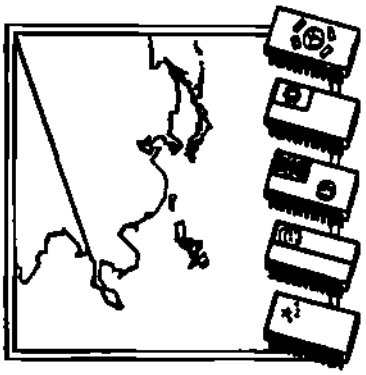

Approaching
the Asian Age

A NEW PLAYER IN ASIAN SEMICONDUCTOR GAME -- INDIA

Rahul Sud

Vice President, Marketing
Microchip Technology Inc.

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DISINCENTIVES TO BUSINESS

- **INDIAN BUREAUCRACY:** PERVASIVE, COMPARTMENTALIZED, OVERREGULATORY AND LARGELY INEFFICIENT

- **PHYSICAL INFRASTRUCTURE:** POWER, TRANSPORTATION, AND COMMUNICATIONS STILL NOT MATURE

GDP GROWTH RATE COMPARISON (PERCENT)

COUNTRY	1985	1986	1987
INDIA	4.2	4.5	4.5
KOREA	5.2	10.5	6.7
TAIWAN	4.1	9.8	6.5-7.5
CHINA	12.5	7.0	5.5-6.5
JAPAN	4.5	2.3	3.5-4.5
UNITED KINGDOM	3.7	2.4	3.0
UNITED STATES	3.0	2.7	2.7

SOURCE: SRI INTERNATIONAL

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INDIA'S MIDDLE CLASS

THE DRIVING FORCE

- 12.5% OF POPULATION: – 100 MILLION PEOPLE
- GREATER THAN THE ENTIRE POPULATION OF GREAT BRITAIN OR FRANCE
- ENTREPRENEURIAL

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INDIAN EDUCATIONAL INSTITUTIONS

TYPE	NUMBER
COLLEGE/UNIVERSITIES	125
SPECIALIZED INSTITUTES	15
INDIAN INSTITUTES OF TECHNOLOGY	5
ENGINEERING COLLEGES	164
POLYTECHNICS	331
REGIONAL ENGINEERING COLLEGES	5
TOTAL	645

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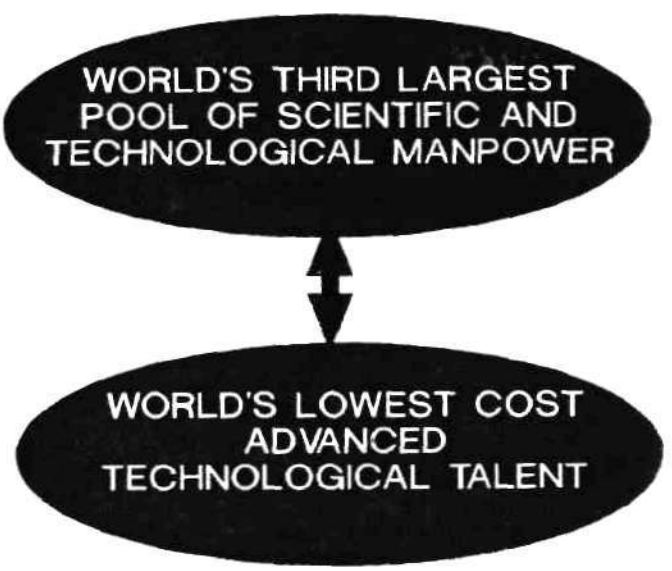
MAJOR SCIENTIFIC AGENCIES IN INDIA

AGENCY	EXPENDITURE (MILLIONS OF Rs)
• DEPARTMENT OF ATOMIC ENERGY	1780.66
• DEPARTMENT OF SPACE	1450.28
• DEPARTMENT OF ELECTRONICS	60.60
• DEPARTMENT OF SCIENCE & TECHNOLOGY	850.18
• DEPARTMENT OF OCEAN DEVELOPMENT	220.71
• DEPARTMENT OF ENVIRONMENT	180.93
• DEPARTMENT OF NON-CONVENTIONAL ENERGY SOURCES	140.45
• INDIAN COUNCIL OF AGRICULTURAL RESEARCH	1310.00
• DEFENCE RESEARCH AND DEVELOPMENT ORGANIZATION	2040.00
• INDIAN COUNCIL OF MEDICAL RESEARCH	190.00
• COUNCIL OF SCIENTIFIC AND INDUSTRIAL RESEARCH	1210.00
• NATIONAL BIOTECHNOLOGY BOARD	---
• NATIONAL SCIENCE AND TECHNOLOGY ENTREPRENEURSHIP	---
• DEVELOPMENT BOARD	---

INDIA HAS OVER 130 SPECIALIZED LABORATORIES AND INSTITUTIONS

INDIA



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WAGE RATE COMPARISON FOR SKILLED ELECTRONICS EQUIPMENT OPERATORS

INDIA	$0.60/Hr.
SOUTH KOREA	$2.50/Hr.
TAIWAN	$2.00/Hr.
THAILAND	$1.15/Hr.

LEVERAGING INDIA'S NATIONAL ASSET

SKILLED TECHNOLOGICAL AND SCIENTIFIC MANPOWER

- VLSI DESIGN
- SOFTWARE DESIGN
- SYSTEMS DESIGN
- OTHER KNOWLEDGE INTENSIVE PRODUCTS

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GROSS SAVINGS AS A PROPORTION OF GDP 1965 - 1983

(PERCENT)

	1965-70	1970-75	1980-83
HOUSEHOLDS	11.6	13.5	15.7
PUBLIC SECTOR	1.4	1.8	1.9
PRIVATE CORPORATE	2.6	3.2	5.2
TOTAL DOMESTIC SAVINGS	15.6	18.4	22.6

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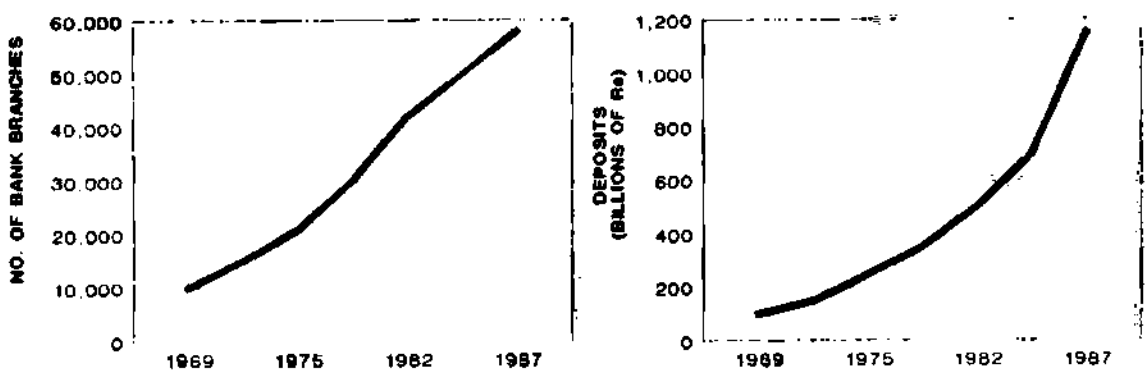
EXPANSION OF COMMERCIAL BANKING



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SOURCE: RESERVE BANK OF INDIA

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SAVINGS RATES

INDIA	23%
JAPAN	17%
SWITZERLAND	17%

BANK DEPOSITS HAVE GROWN 22 FOLD SINCE 1970 TO OVER RS 1 TRILLION IN 1987

INDIAN STOCK MARKET

	1982	1986	1990
NUMBER OF INVESTORS (MILLIONS)	2 M	7 M	15 M

VALUE OF CAPITAL ISSUES APPROVED INCREASED 84% IN 1986, TOTALLING RS 37 MILLION

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INDIA

- WORLD'S SECOND LARGEST POPULATION ----- 800 MILLION
- WORLD'S LARGEST NUMBER OF COLLEGE STUDENTS
- WORLD'S THIRD LARGEST POOL OF SCIENTIFIC & ENGINEERING MANPOWER
- WORLD'S 10th LARGEST INDUSTRIALIZED NATION
- WORLD'S HIGHEST SAVINGS RATE - 23%

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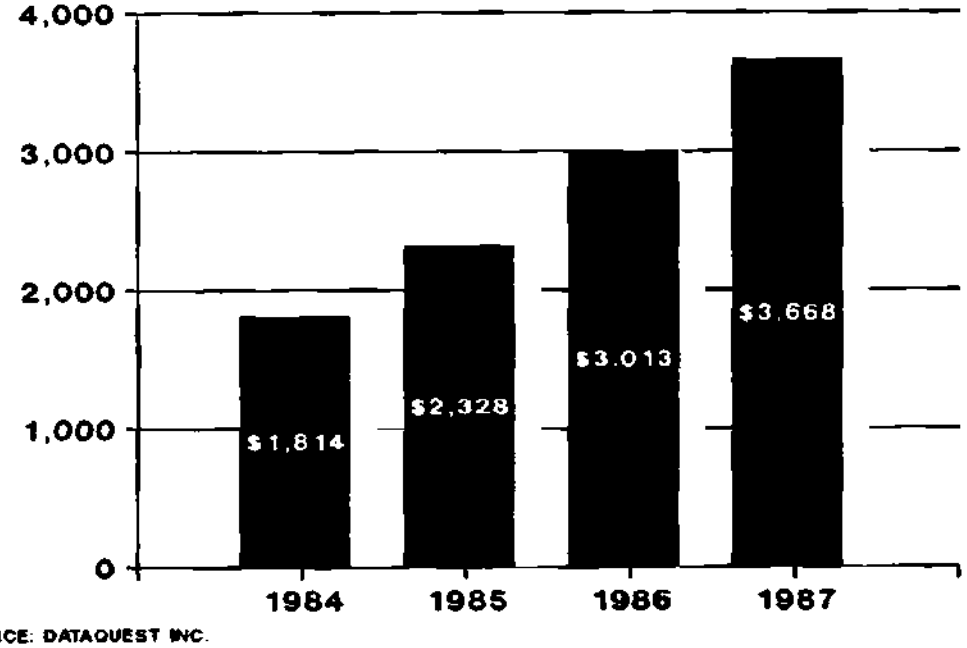
INDIA'S ELECTRONICS PRODUCTION ($ MILLIONS)



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SOURCE: DATAQUEST INC.

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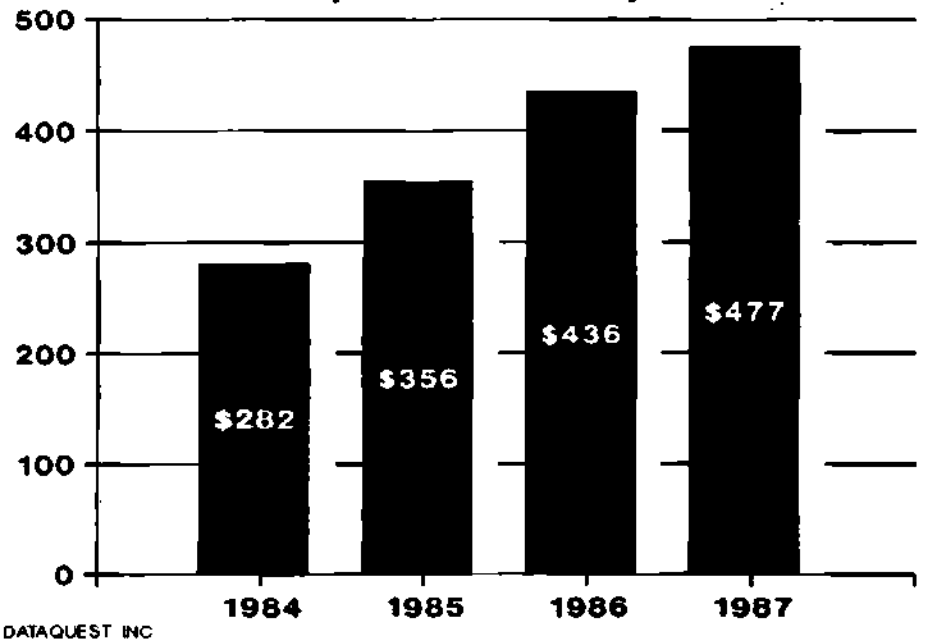
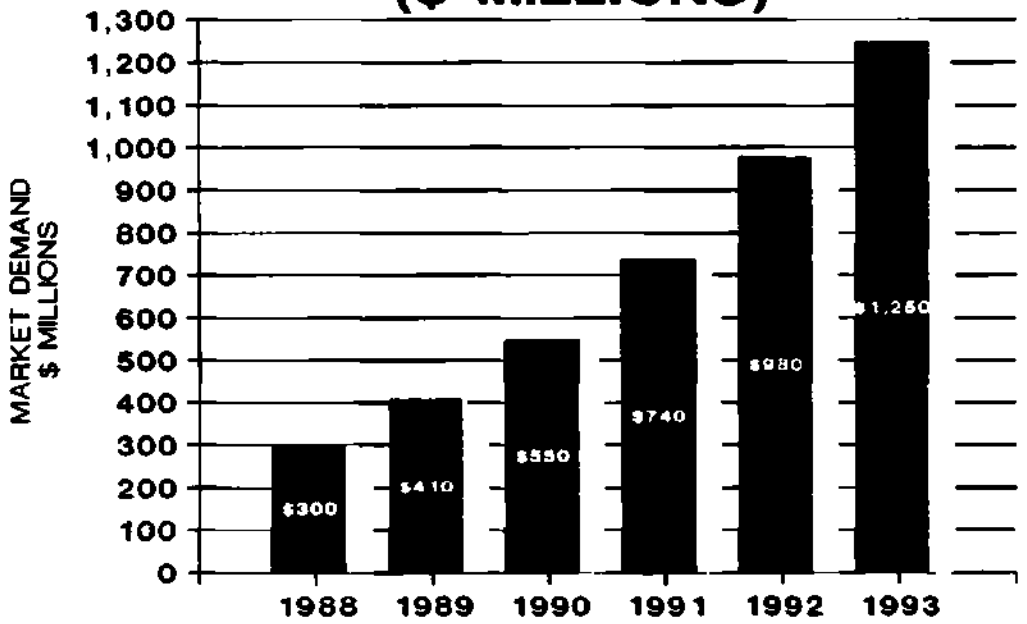
INDIA'S COMPONENT PRODUCTION ($ MILLIONS)



SOURCE DATAQUEST INC

INDIAN SEMICONDUCTOR DEMAND ($ MILLIONS)



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INDIAN SEMICONDUCTOR INDUSTRY

COMMERCIAL

- BHARAT ELECTRONICS LTD.
- SEMICONDUCTORS LTD.
- CONTINENTAL DEVICES INDIA LTD.
- SEMICONDUCTOR COMPLEX LTD.
- INDIAN TELEPHONE INDUSTRIES

RESEARCH

- TATA INSTITUTE OF FUNDAMENTAL RESEARCH
- CENTRAL ELECTRONICS ENGINEERING AND RESEARCH INSTITUTE

SEMICONDUCTOR COMPLEX LIMITED

A $50 MILLION NATIONAL MICROFABRICATION CENTER

- 1.5 MICRON CMOS
- CAD
- ASSEMBLY/TEST
- ASIC

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INDIAN GOVERNMENT COMMITMENT TO VLSI

- 11 NEW NATIONAL DESIGN CENTERS
- LIBERALIZED POLICY ON IMPORT OF HARDWARE AND SOFTWARE
- NEW WAFER FAB PLANNED BY INDIAN TELEPHONE INDUSTRIES

SUCCESSFUL FOREIGN DESIGN/SOFTWARE ENTERPRISES IN INDIA

- TEXAS INSTRUMENTS
- TATA – BURROUGHS
- OTHER

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FOREIGN COMPANIES IN INDIA

- AT&T PHILLIPS TELECOM
- CII – HONEYWELL BULL
- CONTROL DATA CORP.
- ELXSI & TRILOGY SYSTEMS
- ICL
- NORSK DATA
- N.V. PHILLIPS
- SIEMENS
- OKI ELECTRIC INDUSTRY
- TANDON CORP.
- MONSANTO
- RANK XEROX LTD.

GOVERNMENT INCENTIVES

INDIA'S EXPORT PROCESSING FREE TRADE ZONES

- UP TO 100% FOREIGN OWNERSHIP
- EXEMPTION FROM IMPORT DUTIES ON CAPITAL EQUIPMENT AND RAW MATERIALS
- LOW INTEREST FINANCING
- 5 YEAR TAX HOLIDAY
- LOW COST LAND
- MAY SELL 25% OF OUTPUT TO DOMESTIC MARKET

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INDIA'S UNIQUE POSITION

- POSITIONED TO CATAPULT INTO ONE OF THE PREMIER CENTERS OF INDUSTRIAL R&D
- IDEAL FOR PRODUCTION OF KNOWLEDGE INTENSIVE PRODUCTS

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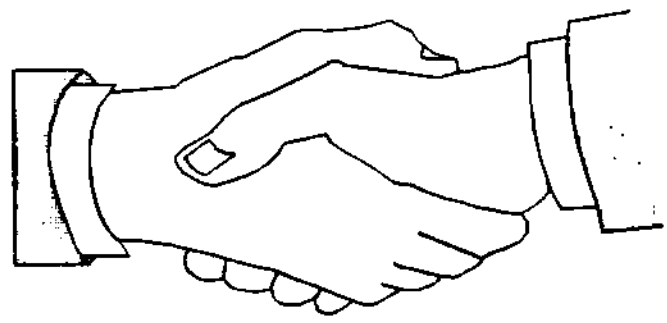
INDIA INVITES

YOU



TO FORM A PARTNERSHIP Microchip

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PARTNERSHIP MODEL

INDIA	FOREIGN PARTNER
• VLSI DESIGN	• STRATEGIC MARKETING
• SOFTWARE TOOL DESIGN	• APPLICATIONS
• HARDWARE TOOL DESIGN	• WAFER FABRICATION
• DEBUG	• WORLD-WIDE SALES AND DISTRIBUTION
• ASSEMBLY	
• TEST	

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INDIA'S
COMPETITIVE ADVANTAGE

- ONE OF THE MOST EXTENSIVE COLLEGE, UNIVERSITY AND GOVERNMENT LABORATORY NETWORKS
- ENORMOUS POOL OF TECHNICAL AND MANAGERIAL PERSONNEL – WORLD'S 3rd LARGEST
- ABUNDANT CAPITAL AVAILABILITY DUE TO HIGH SAVINGS RATES
- A LARGE AND GROWING INTERNAL MARKET

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INDIA

A PASSAGE TO SEMICONDUCTORS

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ABOUT THE AUTHOR

Xu Juyan is the chief engineer of Wuxi Microelectronics Corporation, China. Since 1957, he has been in the semiconductors area, mainly specializing in R&D work of microelectronics process technology, devices and circuits fabrication, circuit design, CAD and semiconductor equipment. In addition to technological management, he has been studying development strategies of the electronics industry in recent years. At present, besides the professor-grade senior engineer at WMC, he is holding concurrently the following key posts, a professor both at the Microelectronics Institute of Southeast University and the Economics Administration Department of Zhejiang University, a member of the Academic Committee, Education Committee and Semiconductor ICs Committee of CIE, a member of China's Electronics Industry Science and Technology Committee, and an examiner of the National Foundation of Natural Science.

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Approaching
the Asian Age

THE RISE OF CHINA'S SEMICONDUCTOR INDUSTRY

Xu Juyan
Chief Engineer
Wuxi Microelectronics Complex

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THE RISE OF CHINA'S SEMICONDUCTOR INDUSTRY

XU JUYAN

Chief Engineer
Wuxi Microelectronics Corporation, China

OVERVIEW

China's research and development in semiconductor can be traced back to as early as 1950s.

China developed its first germanium transistor in 1957 and was able to produce seven types of such devices with an annual output of 60,000 pieces in 1958. In the early 1960s, Hebei Semiconductor Institute developed the planar technology, with which it developed both the planar small signal transistor and the high-frequency high power transistor. Thereafter, it began to manufacture silicon semiconductor devices on 1.5 inches imported wafer fabrication equipment. In 1965, Hebei Institute began to manufacture its first series of integrated circuits (DTL), thus bringing China's semiconductor industry into a new era. One year after, China developed two kinds of linear ICs (amplifiers). About the same time, both microwave and optoelectronic devices developed rapidly in China. The late 1960s witnessed emergence of Sichuan Solid State Circuits Research Institute and Nanjing Solid State Devices Research Institute, with the latter specializing in research and development of microwave and optoelectronics technology. (Table 1 lists a chronology of events in China's semiconductor industry.)

Thereafter, the turmoil of the notorious "great cultural revolution" began to affect the development of China's semiconductor industry. In 1970, about 150 millions of discrete devices and 1.2 millions of ICs were produced in China. Since then, China's semiconductor production was on decline year after year until 1974-75, which saw the annual output resuming to the level of 1970 (see Table 2).

The year of 1977, only one year after 1976 with the downfall of the "gang of four", experienced a sharp increase in ICs production with a total output five times more than that of 1975. This sharp

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rebound, however, did not remain longer due to the basic guideline influenced by the "gang of four". So soon after the conspirational clique of the "gang of four" was cracked down, China's semiconductor industry actually entered a ten-year period (1976-1986) of recovery and readjustment. The readjustment included rearrangement of the ratio between military and civic, capital and consumer applications, better combination of central planning and marketing control on the macroeconomic management and a new development strategy (emphasis on applied purposes rather than blind pursuit of the world most advanced level). Therefore, the manufacture of semiconductor devices developed moderately in China between 1976 and 1986.

Last year, China's semiconductor industry began to show its prowess after a ten-year readjustment and jumped out the moderate growth. The ICs output of 1987 increased 50% against that of 1986 in China. More significantly, the Chinese government has laid out a new guideline for its electronics industry, i.e., to develop a new powerful electronics industry with microelectronics technology as its cornerstone and both computers and communications as its frame to closely serve the national economy, speed up the progam of the "four modernizations", and to raise the living standard of the whole society. Under such guideline, China's electronics industry has been playing a more important role in the national economy and its oupput value has grown steadily in the past few years (See Table 3). The use of semiconductor products has escalated rapidly as a result of sharp growth in the consumer industry (see the communications and broadcasting column of Table 4). Such fast growth in return has added an impetus to the development of semiconductor industry. Therefore, it is widely acknowledged that the global semiconductor field will see a competitive player from China.

THE INDUSTRY STRUCTURE AND SCALE

There are some hundreds of semiconductor manufacturing and research organizations in China. The majority of them is under the administration of the Ministry of Machine-building and Electronics Industry, and the rest is respectively under the Academia Sinica, the Ministry of Space and Aviation Industry, the Ministry of Postal and Telecommunications and the State Education Commission. These manufacturers and research institutes are scattered all over the country(see Table 5), but mainly in the provinces of Jiangsu, Liaoning, Shandong and

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Sichuan and cities of Shanghai, Beijing and Tienjin. According to the statistics shown in Table 6, more than 200,000 people were engaged in the manufacture and research of China's semiconductor industry in 1986, with the majority in the line of discrete devices and over 40,000 in ICs, among whom more than 5,000 were reseach and technical people. Most of these technical people now are working in the Academia Sinica and major research organizations in industrial fields. They account for 40% of the total employment there.

Most Chinese semiconductor manufacturers are under the Ministry of Machine-building and Electronics Industry. Their output, output value and productivity in the past three years are presented in Table 7. A principal portion of such devices are commercially produced by only a few larger corporations. Up to now, the value of Chinese semiconductor devices consitutes a rather small portion of that of the electonics industry, far from satisfying the needs of the country's industrialization.

Comparatively speaking, China's research and development in semiconductor technology advances more rapidly than its manufacture. A variety of high density 64k-bit DRAM and 16-bit microprocessors have been developed on the 3 inches equipment. Nearly one thousand of new types of products developed in 1985 by organizations under the Ministry of Electronics Industry are shown in Table 8. A part of them developed by research institutes during the sixth five-year period (1981-1985) are listed in Table 9. Table 10 is a list of some major seciconductor research insititutes in China.

At present, the manufacture technology in China is 3-5 micron and the research and development is 1-2 micron. The products made in China cover all kinds of silicon and compound semiconductor devices, mainly for consumer applications with 3-4 inches wafers.

China's semiconductor industry boasts a fair comprehensive system comprising design, wafer fabrication, mask making, assembly & packaging, and testing with wafer fabrication in dominance over the other four.

INTERNATIONAL COOPERATION

Over the last several years, China's semiconductor industry has

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been under remoulding in light of the opening policy. The remoulding has been carried out in the forms of license agreement, compensation trade, processing with supplied materials and joint ventures. Only within the past few years have US$100 million and US$150 million worth equipment and technology been imported respectively regarding discrete devices and ICs. Such imported projects are shown in Table 11. Table 12 lists a number of major imported projects which were completed and went into commercial production in 1985.

Having gained more experiences, China's semiconductor industry is cooperating with foreign companies in more comprehensive ways. It is introducing a complete package of technology from them and attracting them to establish partially-owned and wholly-owned plants in China.

Meanwhile, Chinese semiconductor scholars have established wide connections with their counterparts all over the world, often comparing notes with them on many subjects.

Besides above international exchange, China has also imported semiconductor devices extensively in the past years. The imported ICs are three times as many as domestically produced devices. However, the exports of the same period are only a few percentage of the total output value.

DEVELOPMENT AND OUTLOOK

Although the semiconductor market in China is still in its infancy compared with that of U.S., Japan or Europe, it is expected to grow rapidly in the near future.

During the period of the sixth five-years (1981-1985), the output value of China's semiconductor devices industry was at a compound annual growth rate of 26-33 percent. If at such a rate, it will increase three to four times by the end of 1990. Discrete devices will increase to RMB¥ 10 billion and ICs to RMB¥2-3 billion mark. Positively affected by the ten-year readjustment, the better guideline and the opening policy, the actual future growth rate of China's semiconductor devices industry could be greater than that of the sixth five-year period. It is, however, still uncertain if the supply of such devices can

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meet the demand of a one-billion-population market. Between 1981 and 1985, China imported over 50 production lines for major parts of color TV sets with a capacity of producing 8-9 million sets per year. Nine of ten planners and experts predicted then that it was more than enough to satisfy the Chinese market. It turned out this is much underestimated. According to the public statistics, presently about 1000 families are sharing a VCR, 1000 people are sharing eight telephones and 25,000 people are sharing a car in China. When someday the Chinese market grows to be even half in size of the U.S. or Japanese market, just guess how many semiconductor devices will be needed for all electronics systems.

The world history shows that the centre of human civilization has been moving from one place to another as time goes by. The Chinese civilization has been completing a journey around the earth. It started from the Chinese ancient capital Xi'an seven centuries ago, moved to Rome through the "Silk Road" and was brough to the easten coast of North America by the eighteen century Industrial Revolution following the Renaissance and the Bourgeois Revolution. In 1950s, one of the transistor inventors Dr. Shockley spread the seed of silicon civilization, from east to west, to the silicon valley. In late 1970s, the seed was brought across the Pacific Ocean to Japan. In 1980s, it crossed the Sea of Japan and came to South Korea. This civilization, touring along thirty-five degrees latitude(see figure 1), is expected to return to China. If the return comes true, it must a sublimation, bringing another round of prosperity to the human beings. At that time, China will possibly rise to be the largest market of manufacturing and consuming semiconductor devices in the world.

US $ 1.00=RMB¥3.72

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Table 1 A Chronology of Events in China's Semiconductor Industry

YEAR	EVENTS
1956	Semiconductor technology was listed as one of the priorities in " Twelve-year Science & Technology Development Program " prepared by the late Premier Zhou Enlei with other planners
1957	The first germanium transistor was developed in China
1960	o Emergence of the semiconductor research institute under the Academia Sinica o Emergence of Hebei Semiconductor Research Institute under the Ministry of Industries
1963	Emergence of No.Four Machine-building Ministry(late called the Ministry of Electronics Industry)
1965	o Hebei Institute developed and began to manufacture its first series of ICs(DTL) o The output of semiconductor devices and transistor radios exceeded that of electron tubes and electron tubes radios
1966	The first linear IC was developed and development of MOS IC started in China
1968	Preparations were started to establish Sichun Solid State Circuits Research Institute
1974	The State Planning Commission held the national key-task conference on LSI and its basic materials
1976	1k DRAM was developed at Beijing University
1978	4k DRAM was developed at the semiconductor research institute under the Academia Sinica and Sichun Solid State Devices Research Institute respectively
1980	16k DRAM was developed at Sichun Solid State Devices Research Institute and the semiconductor research institute under the Academia Sinica respectively

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1982
- o A leading group and its office were establised under the State Council to enforce the development of computers and ICs industry in China (late called China's Electronics Industry Vitalization Leading Group)
- o The third national key-task conference on LSI was held and it decided to build two microelectronics bases in China, with one in the southern part and the other in the northern part of the country

1983
The State Planning Commission approved to establish Wuxi LSI Research&Production Corporation under the Ministry of Electronics Industry (late called Wuxi Microelectronics Corporation)

1985
- o 16k SRAM was developed at Qinghua University
- o 64k DRAM was developed at Wuxi Microelectronics Corp.

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Table 2 OUTPUT OF SEMICONDUCTOR DEVICES MADE IN CHINA
(In Thousands)

YEAR	DISCRETE DEVICES	ICs	YEAR	DISCRETE DEVICES	ICs
1958	59.8		1974	223,346.3	3,878.2
1960	3,086.0		1976	353,034.7	21,582.6
1962	954.6		1978	411,819.3	30,410.9
1964	3,554.6		1980	677,061.8	16,840.6
1966	27,649.5	1.7	1982	633,567.0	13,520.0
1968	37,416.4	78.6	1984	1,053,653.0	39,278.9
1970	150,523.1	4,225	1986	989,903.2	45,721.4
1972	191,669.8	2638.2			

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Table 3 PERCENTAGE OF CHINA'S ELECTRONICS INDUSTRY OUTPUT VALUE IN THE NATIONAL INDUSTRIAL VALUE

YEAR	OUTPUT (¥ B)	PERCENT (%)
1982	11.01	2.0
1983	14.32	2.3
1984	21.45	3.1
1985	28.64	3.5
1986	30.02	3.3

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Table 4 SALES OF ELECTRONICS PRODUCTS IN DIFFERENT AREAS
(IN BILLIONS RMB¥)

YEAR	RADARS	COMMUNICATIONS & BROADCASTING	COMPUTERS	COMPONENTS	TOTAL
1982	4.1	37.5	4.3	35.5	81.4
1983	5.5	53.1	6.5	45.9	111.0
1984	6.3	80.0	14.6	60.2	161.1
1985	10.3	132.5	11.4	78.9	233.1
1986	12.3	134.3	14.4	80.3	241.2

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TABLE 5 LOCATION OF SEMICONDUCTORS DEVICES MANUFACTURERS IN 1986

	Manufacturers	Institutes
Northern China, Northeast	138	3
Eastern China, Southern China	265	4
Southwest, Northwest	24	1

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TABLE 6 THE TOTAL EMPLOYMEN IN CHINA'S SEMICONDUCTOR INDUSTRY IN 1986

	TECHNICAL PEOPLE	WORKERS	TOTAL
The Ministry of Electronics Industry	22. 389	126. 075	206. 106
The Ministry of Space Industry	1. 200		3500
The Ministry of Postal and Telecommunications	63	203	266
The Academia Sinica	1246	1422	2793

*Managerial people are not included

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TABLE 7 OUTPUT, OUTPUT VALUE AND PRODUCTIVITY OF SEMICONDUCTOR DEVICES

		1984	1985	1986
OUTPUT(MILLION PIECES)	DD	1053.7	1303.8	989.9
	IC	39.3	53.1	45.7
OUTPUT(MOLLION RMB ¥)	DD	2156.8	2757.2	2086.7
	IC	431.0	471.3	388.9
PYODUCTIVITY (RMB¥ man)	DD	14, 192	18,857	13,141
	IC	15, 827	17,502	13,316

*D.D. = Discrete Devices

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TABLE 8
NEW PRODUCTS DEVELOPED BY ORGANIZATIONS UNDER M.E.I. IN 1985

DESIGN VERIFICATION	347
PRODUCTION FINALS	12
TECHNICAL VERIFICATION	92
PROTOTYPES	369
TOTAL	820

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TABLE 9
ACHIEVEMENTS MADE BY SOME MAJOR INSTITUTES DURING THE SIXTH FIVE-YEAR (1981-1985)

	TECHNOLOGY	PRODUCTS	INVOVATIONS	TOTAL
Hebei Semiconductor Institute	104	101	3	208
Nanjing Electronics Devices R.I.	59	131	1	191
Sichun Solid State Circuits R.I.	.	131	.	131
Beijing Semiconductor Devices R.I.	28	41		69
Liaohe Lab & Institute	40	9	.	49
Shanghai Semiconductor Devices R.I.	.	39	.	39
Jinan Semiconductor Institute	12	36	.	48

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TABLE 10
MAJOR SEMICONDUCTOR RESEACH INSTITUTES IN CHINA

Sichun Solid State Circuits R.I.

Nanjing Electronics Devices R.I.

Hebei Semiconductor R.I.

The Semiconductor R.I. under the Academia Sinica

Shanghai Metallurgical Institute

Lishan Microelectronics R.I.

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TABLE 11 IMPORTED PROJECTS BETWEEN 1981 and 1985

	1981	1982	1983	1984	1985
DISCRETES	4	10	21	55	14
ICs	2	3	10	23	7

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TABLE 12
IMPORTED AND TECHNICALLY REMOULDED PROJECTS IN 1985

ITEMS	CAPACITY
LEAD FRAMESMAKING	200 million ps/year
GLASS PASSIVATION DIODES	10 million ps/year
ICs FOR COLOR TV	26.48 million ps/year
LOW-NOISE TRANSISTORS	10 million ps/year
VARACTORS	30 million ps/year
SILICON RECTIFIERS	15 million ps/year

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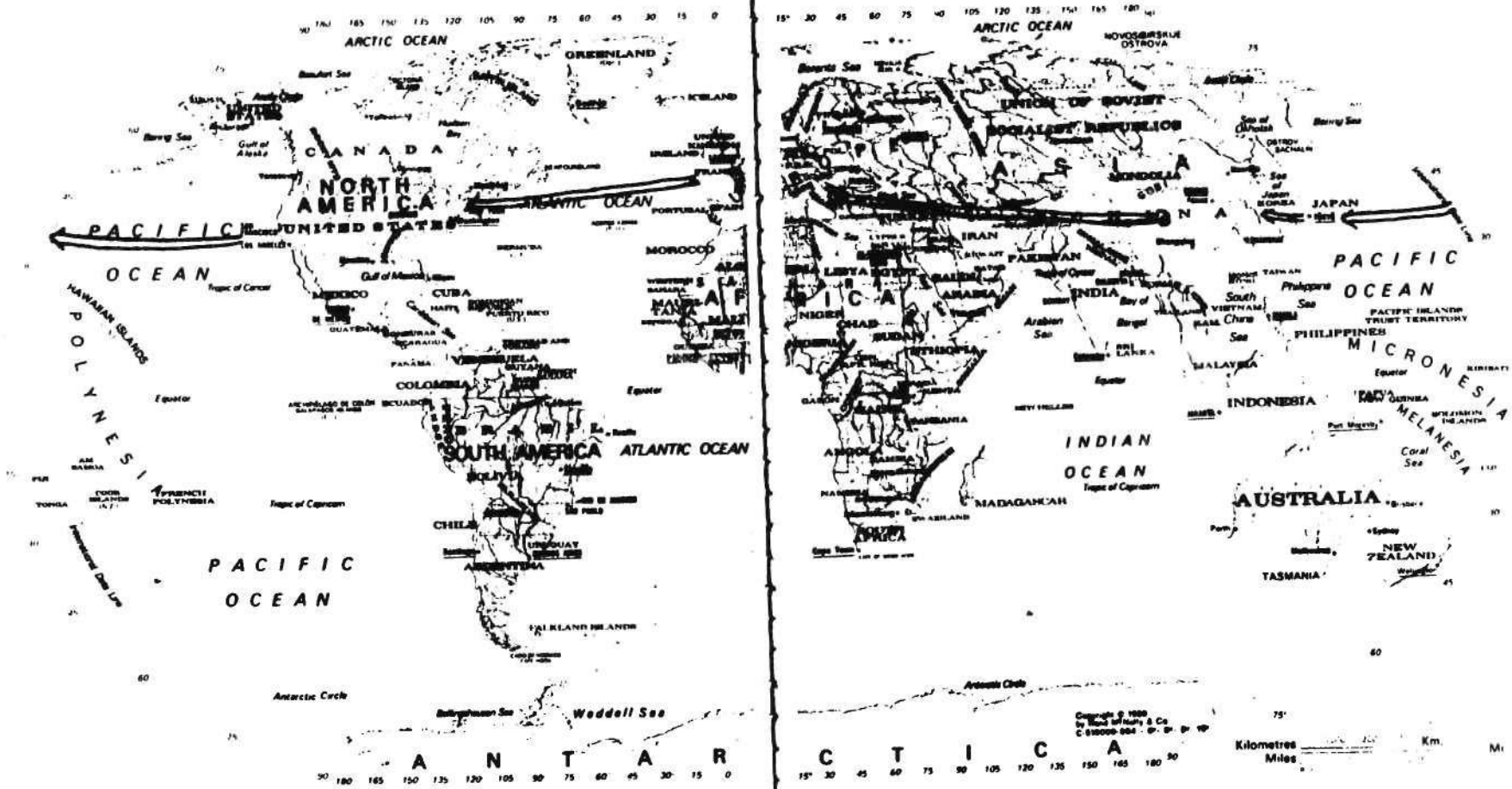

FIGURE 1. THE CENTRE OF HUMAN CIVILIZATION KEEPS MOVING

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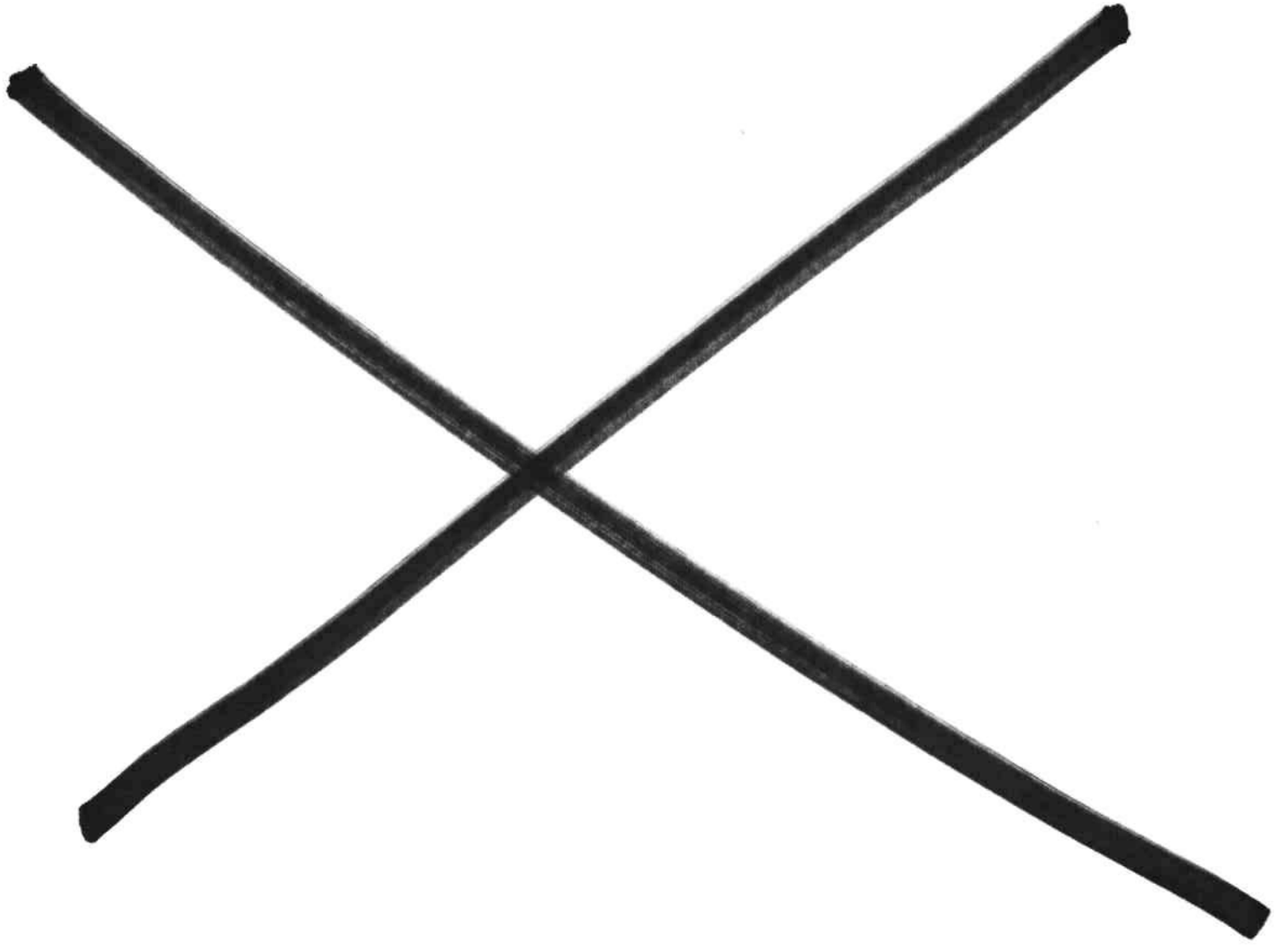

Approaching
the Asian Age

APPROACHING THE ASIAN AGE

J.H. Son

Senior Industry Analyst
Asian Components Group
Dataquest Incorporated

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AMERICA AFTER THE ELECTION--A NEW DIRECTION?

John Wilson
Vice President, Business and Technology Analysis
Dataquest Incorporated

Mr. Wilson is Vice President for Business and Technology Analysis in Dataquest's Research Operations Division. He is responsible for analysis of business, political, and economic trends affecting high-technology industries, and also edits Strategic Issues, a monthly newsletter commenting on these trends. Before joining Dataquest, Mr. Wilson was a Senior Writer for Business Week, where he specialized in coverage of technology, international competitiveness, and entrepreneurship. Prior to that assignment, he served as the magazine's bureau chief in West Germany and in San Francisco, where he helped strengthen technology coverage. He is the author of The New Venturers: Inside the High-Stakes World of Venture Capital, the first general-interest book on the venture capital industry. Mr. Wilson is a graduate of the University of Oregon and holds a master's degree in Communication from Stanford University. He is a member of the Society of Professional Journalists.

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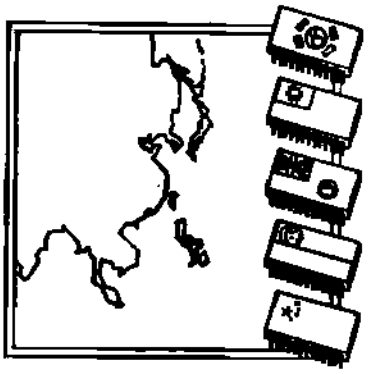
ASIAN SEMICONDUCTOR AND ELECTRONICS TECHNOLOGY CONFERENCE
November 6-8, 1988
Seoul, Korea



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AMERICA AFTER THE ELECTION -- A NEW DIRECTION?

John W. Wilson

Vice President
Business and Technology Analysis
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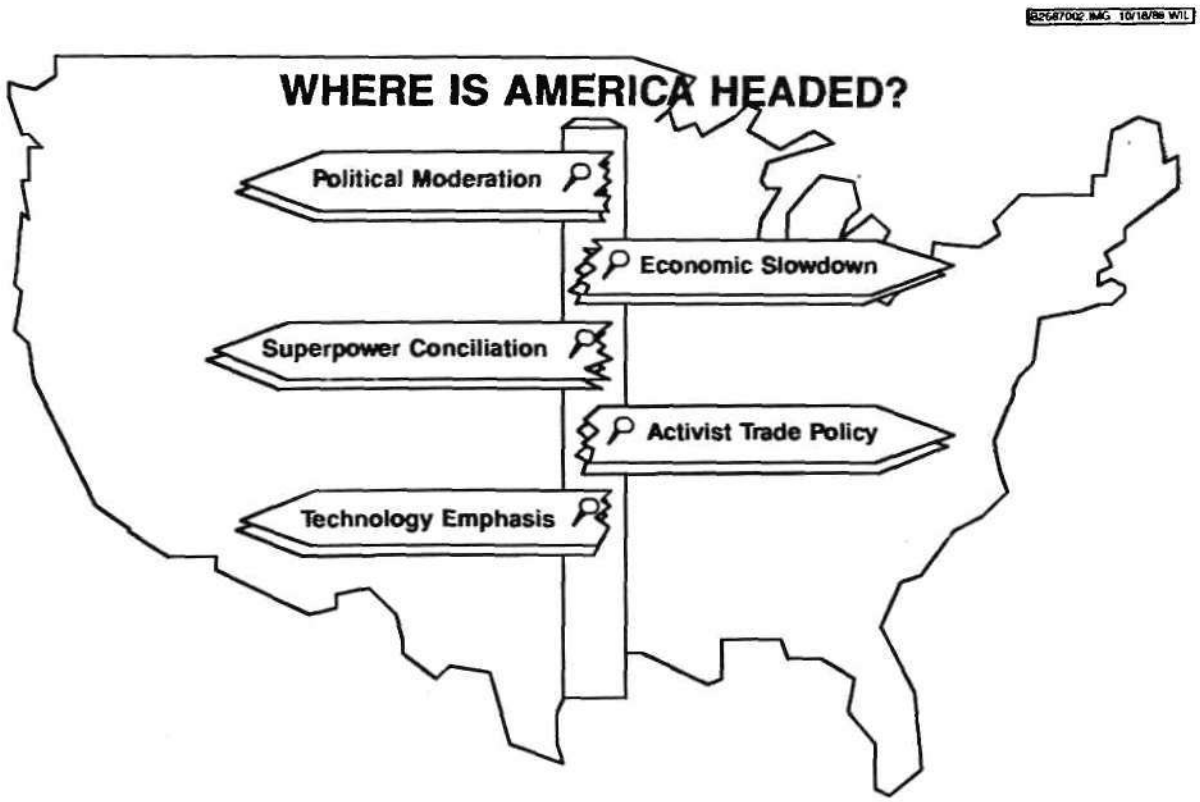

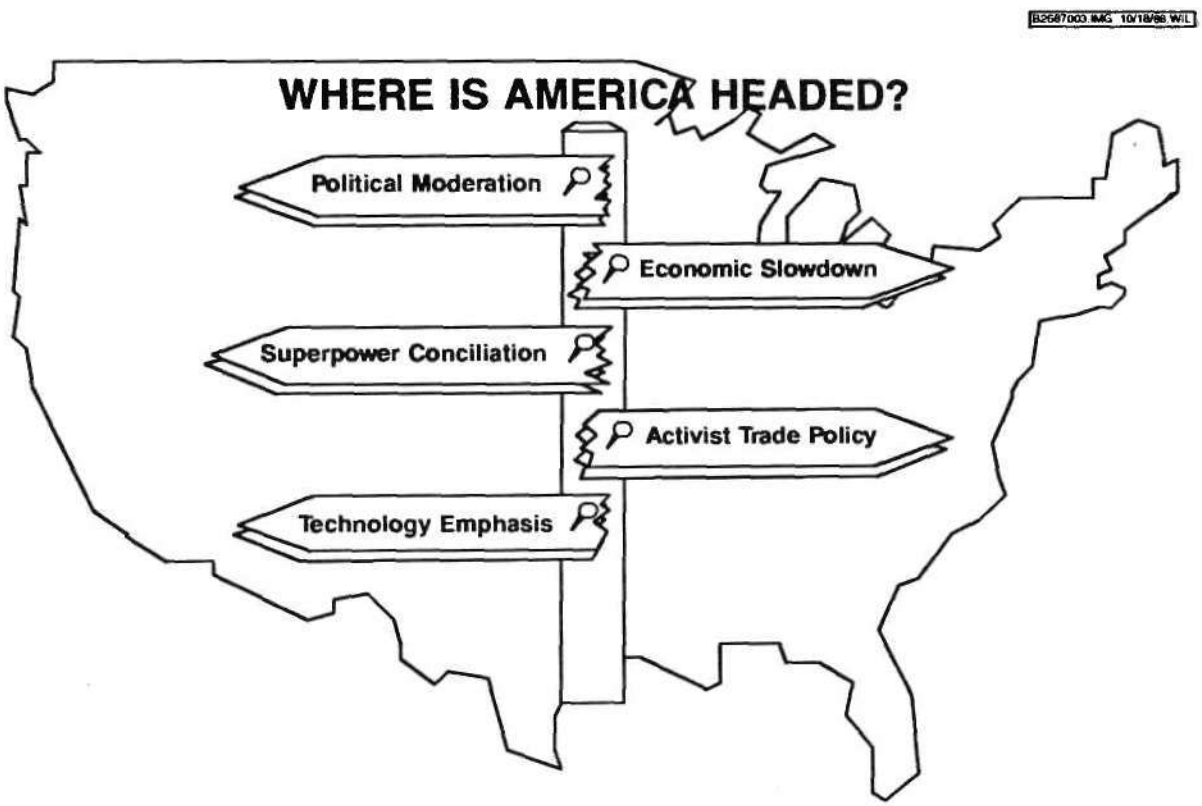

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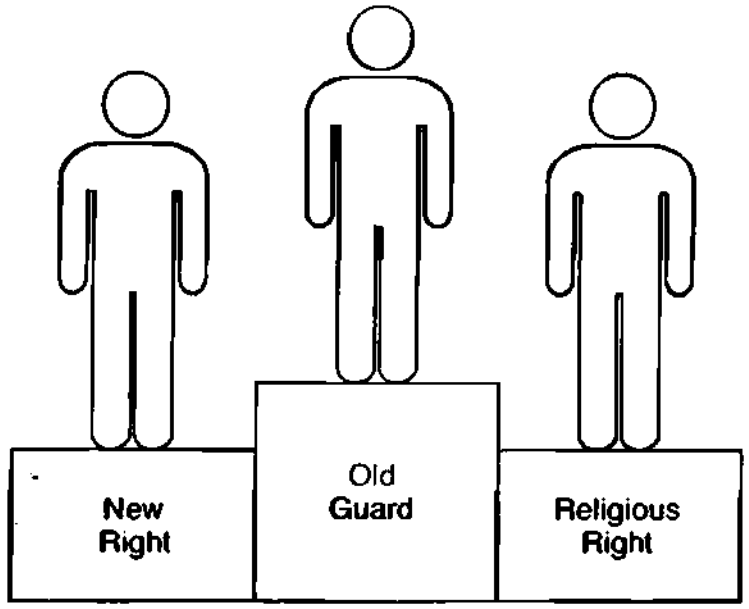
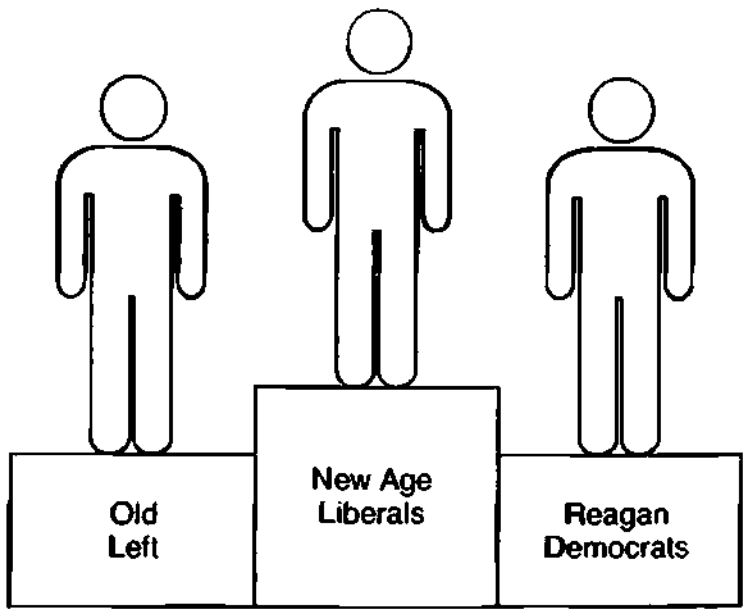
U.S. POLITICAL OLYMPICS

Republicans



U.S. POLITICAL OLYMPICS

Democrats



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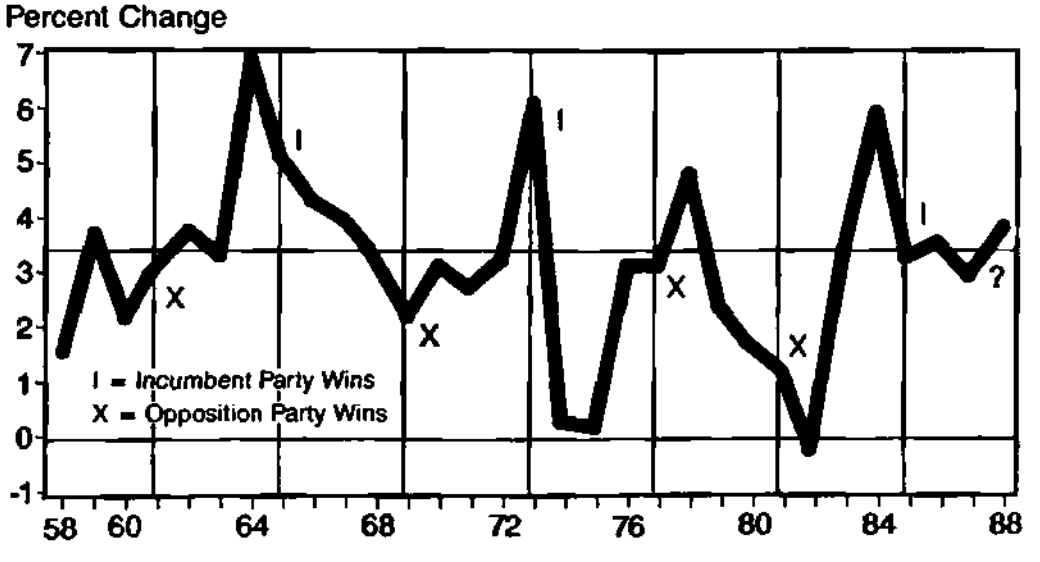
WHERE THEY STAND

	George Bush	Michael Dukakis
On the deficit	For "Flexible Freeze" on government spending	For tougher tax enforcement
On defense	For deploying "Star Wars"	For better conventional forces
On trade	Against protectionism	For "temporary" protection
On industrial policy	Against government intervention	For helping depressed regions
On savings and investment	For cutting capital gains tax	Against cutting capital gains tax

Source: Dataquest

REAL DISPOSABLE INCOME GROWTH AND THE PRESIDENTIAL ELECTION



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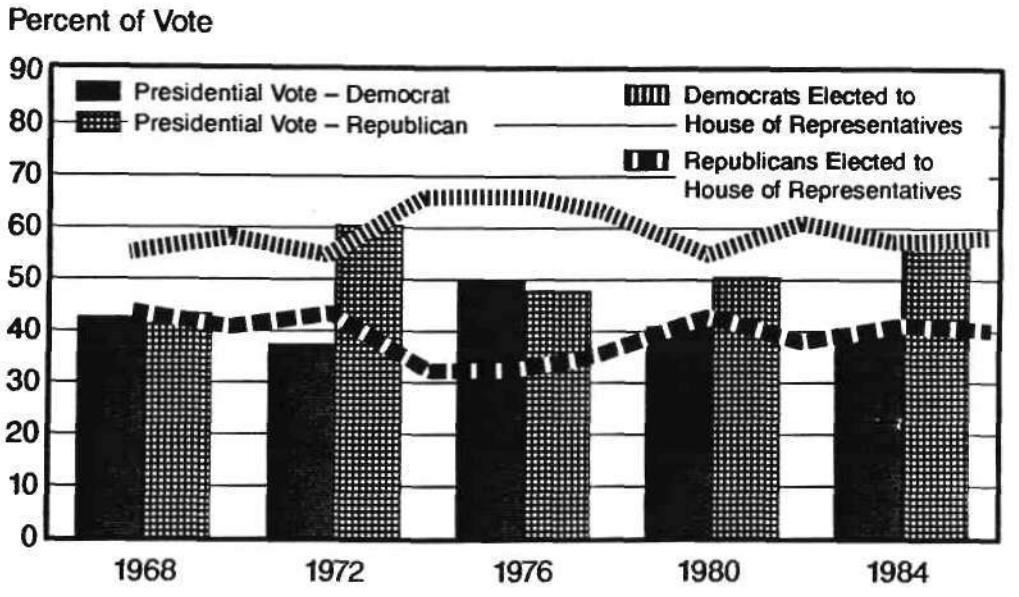
A PARTY SCORECARD



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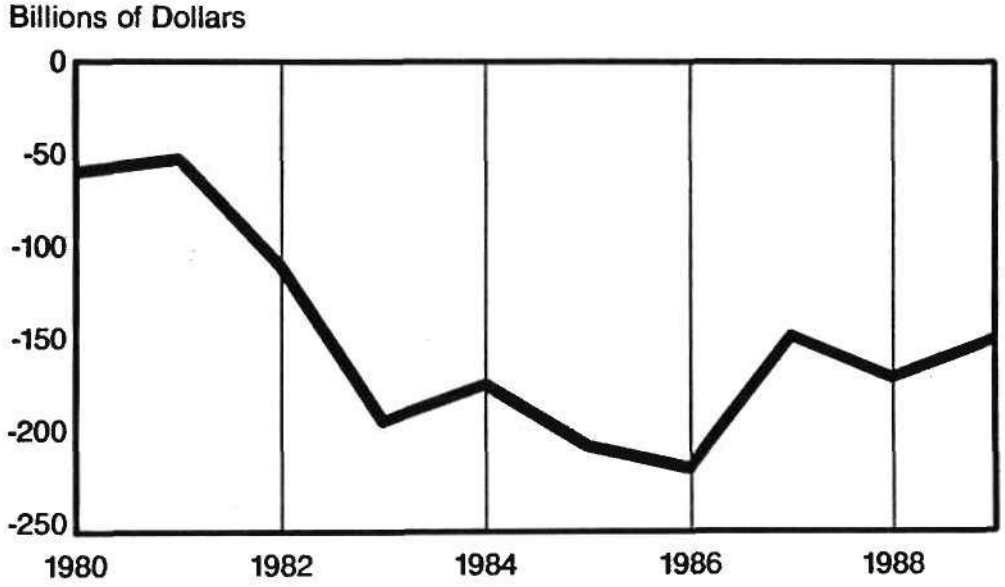
FEDERAL BUDGET DEFICIT



Source: Dun & Bradstreet

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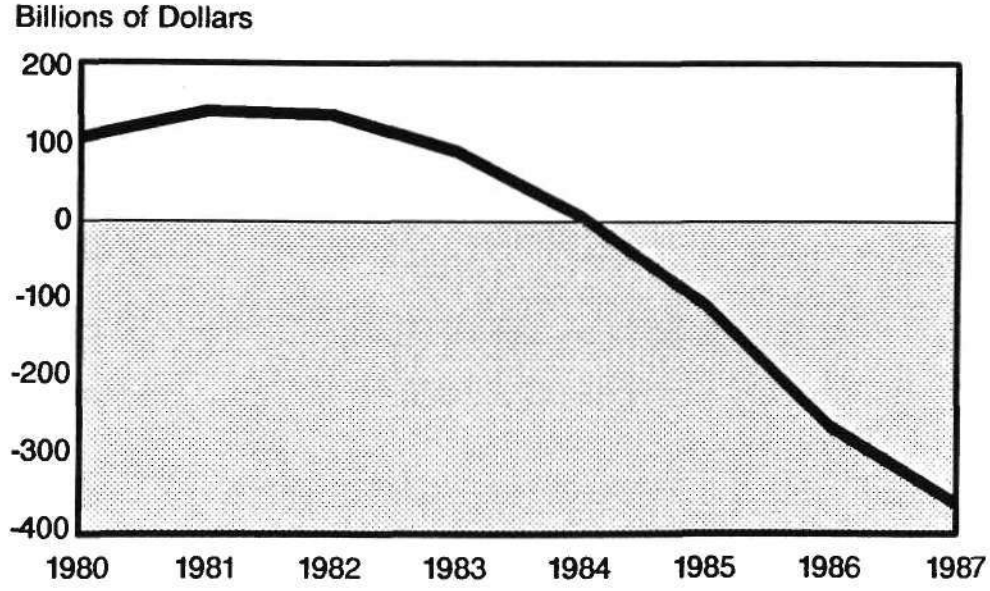
U.S. INTERNATIONAL INVESTMENT POSITION



Source: U.S. Department of Commerce

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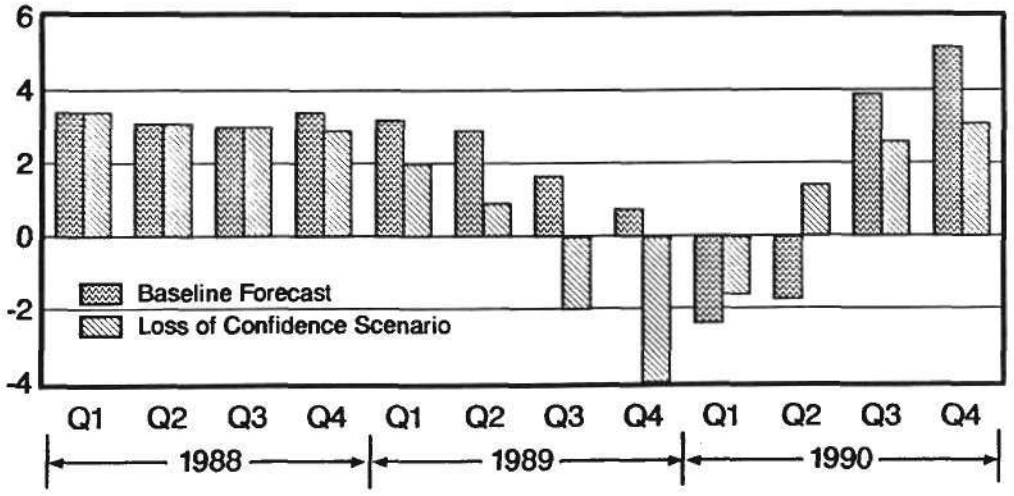
GNP GROWTH

(1982 Dollars)

Percent Change (Annual Rate)



Source: Dun & Bradstreet

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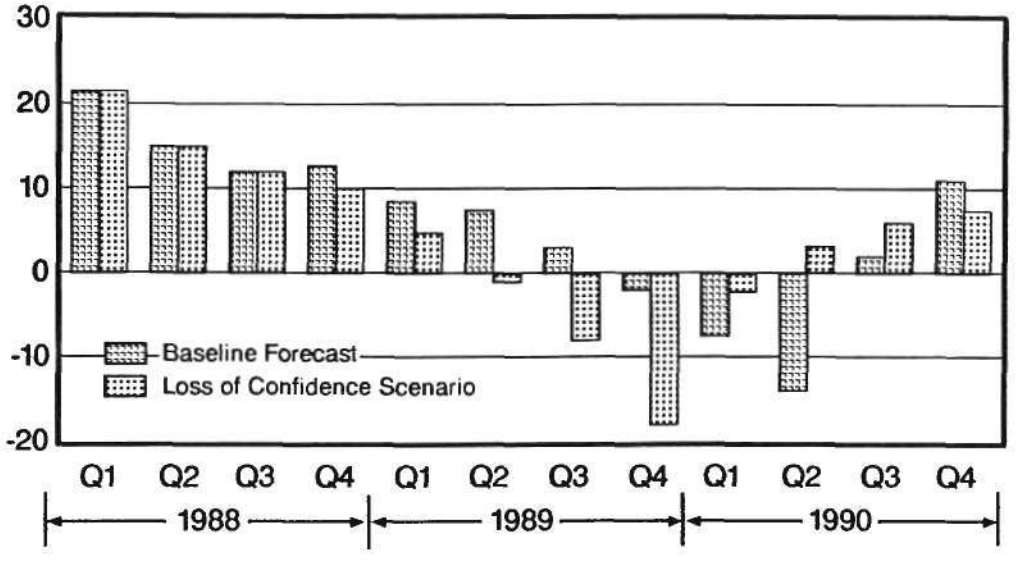
EQUIPMENT INVESTMENT

Percent Change (Annual Rate)



Source: Dun & Bradstreet

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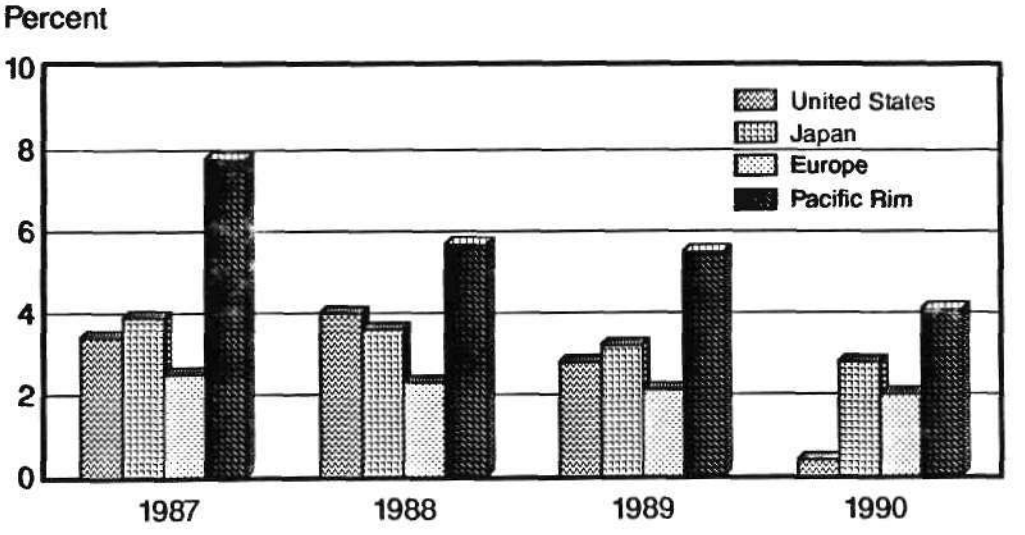
WORLDWIDE GROWTH PROSPECTS

Real GNP Growth



Source: Dun & Bradstreet
WEFA Group

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WHAT IS THE DOLLAR WORTH?

	Yen	DM
Purchasing Power Parity	203	2.58
Fundamental Equilibrium	150	1.75
Sustainable Equilibrium	135	1.65

Source: U.S. International Trade Commission

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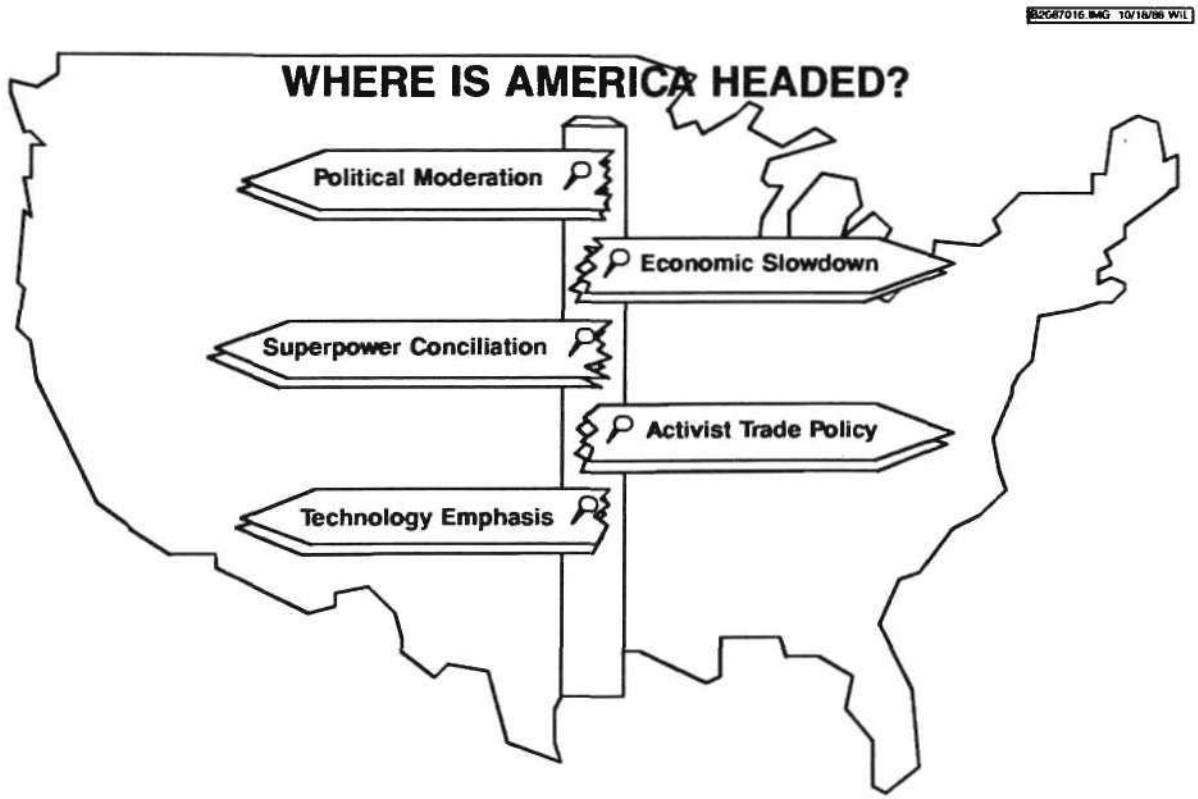

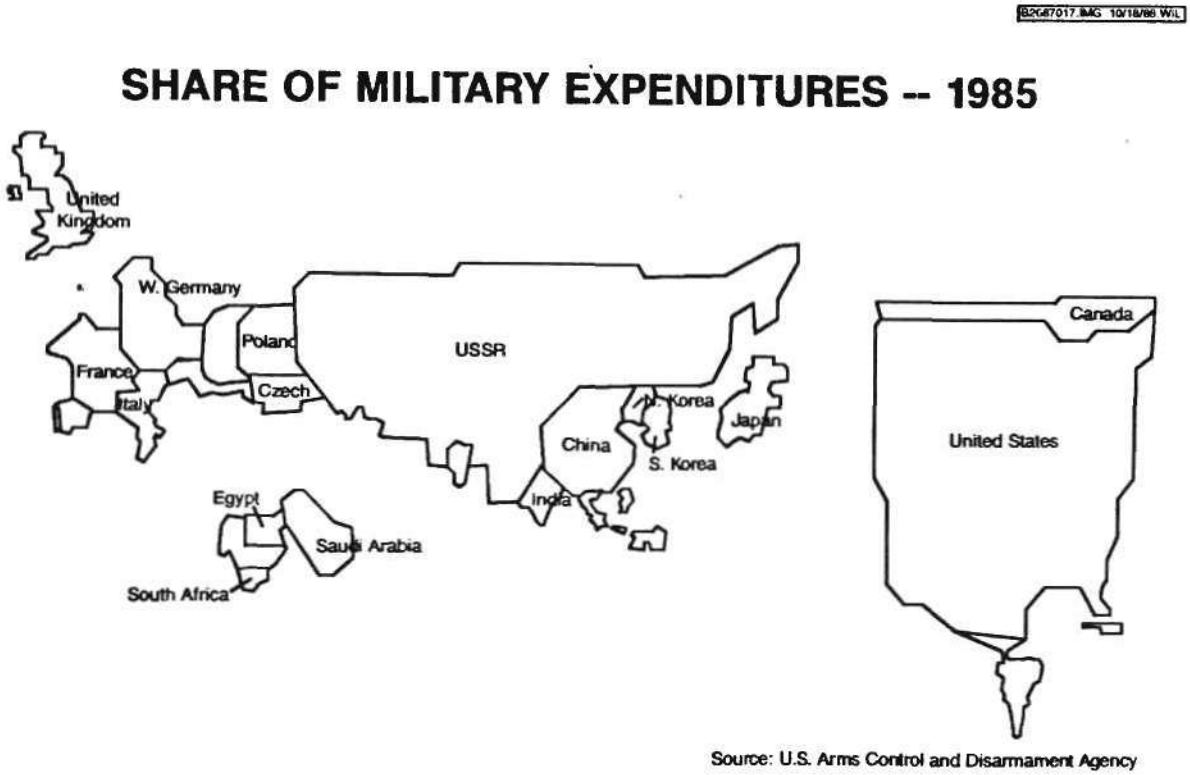

Source: U.S. Arms Control and Disarmament Agency

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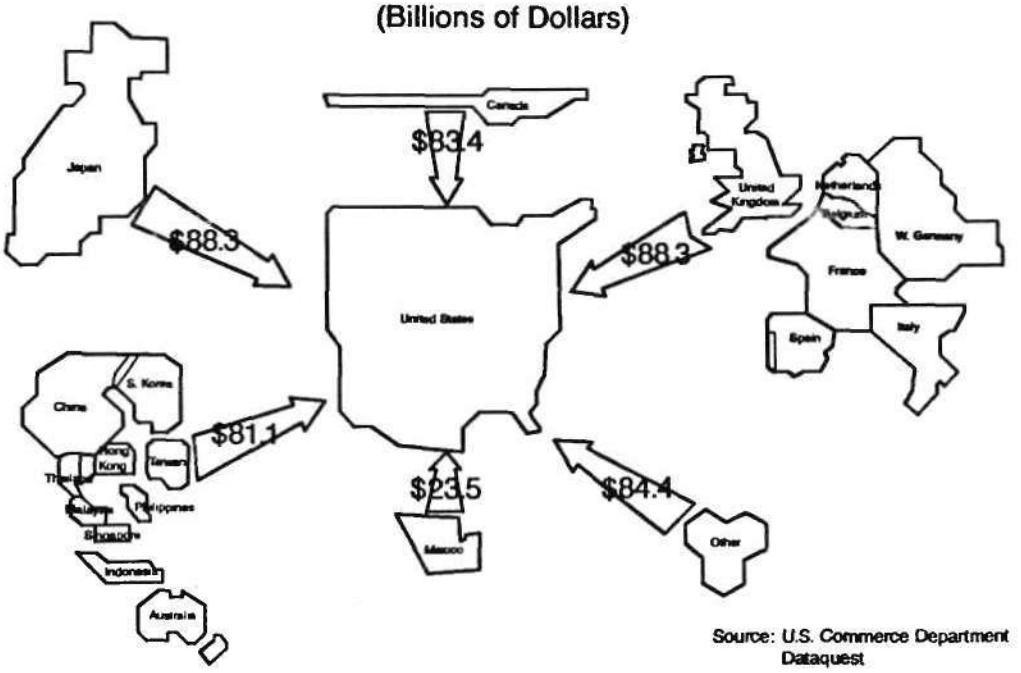
U.S. MERCHANDISE IMPORTS - 1988

(Billions of Dollars)



Source: U.S. Commerce Department
Dataquest

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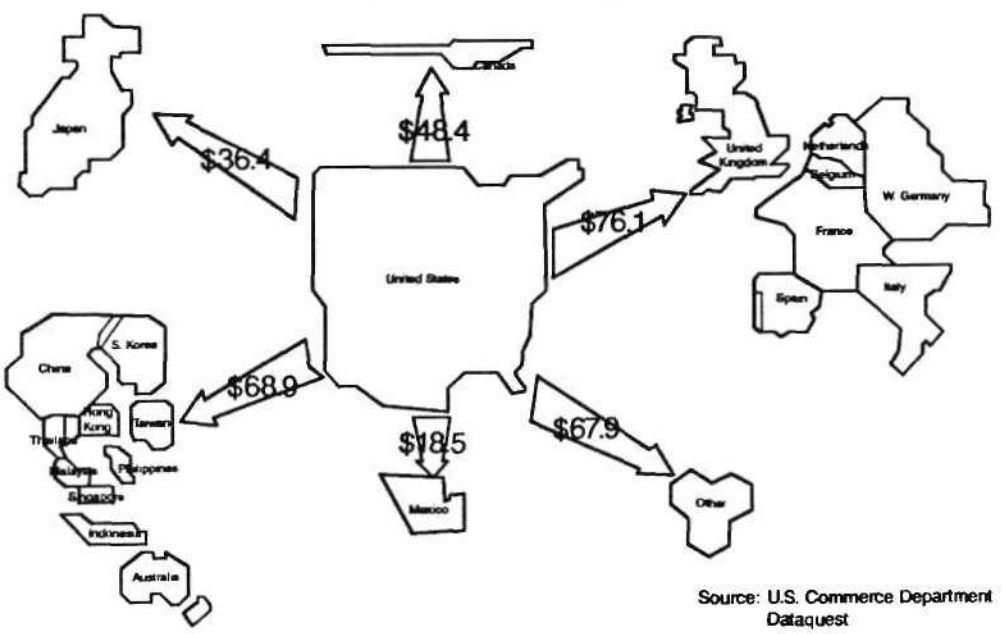
U.S. MERCHANDISE EXPORTS - 1988

(Billions of Dollars)



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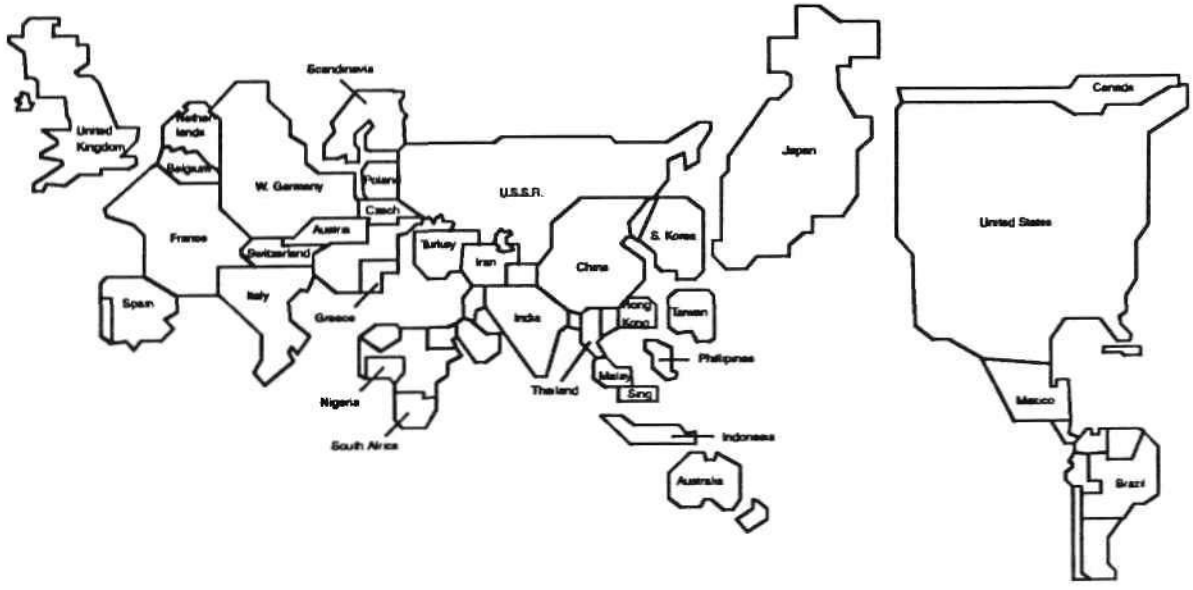
SHARE OF WORLD GDP - YEAR 2000



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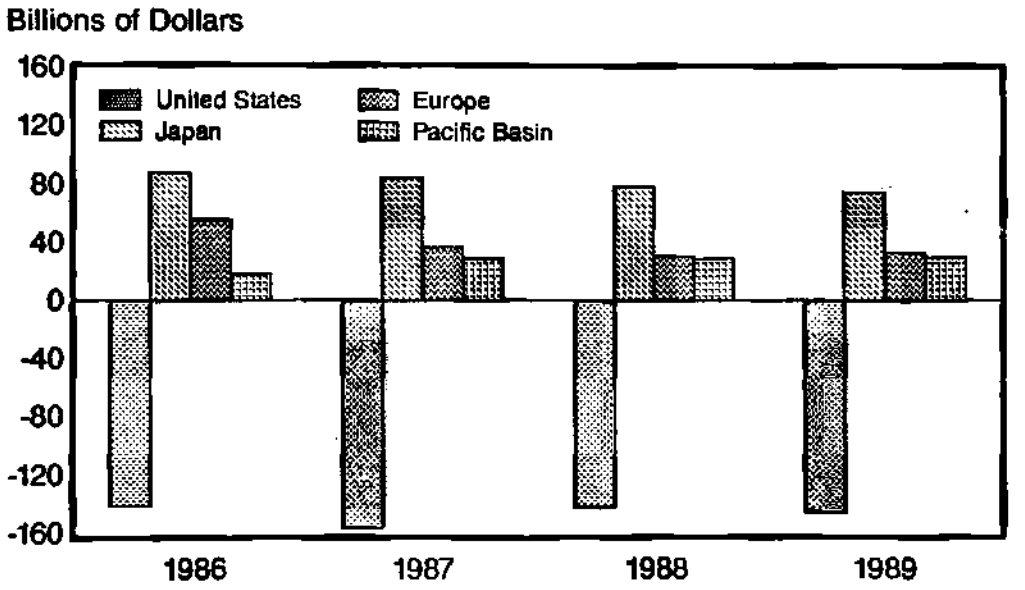
CURRENT ACCOUNT BALANCES



Source: WEFA Group

U.S. IMPORTS UNDER GSP -- 1987

(Billions of U.S. Dollars)

	Total Imports	GSP Imports	Percent
Taiwan	$ 24.6	$ 4.2	17.0%
Korea	$ 16.9	$ 2.5	14.8%
Hong Kong	$ 9.8	$ 1.7	17.4%
Singapore	$ 6.2	$ 1.3	21.0%
World	$400.4	$16.3	4.1%

Source: U.S. Dept. of Commerce

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WHAT THE TRADE BILL DOES

- Expands definition of "unfair" trade
- Requires action against violators
- Broadens list of "unfair" subsidies
- Expedites handling of dumping cases
- Attacks telecommunications barriers
- Strengthens intellectual property protection
- Blocks some foreign takeovers

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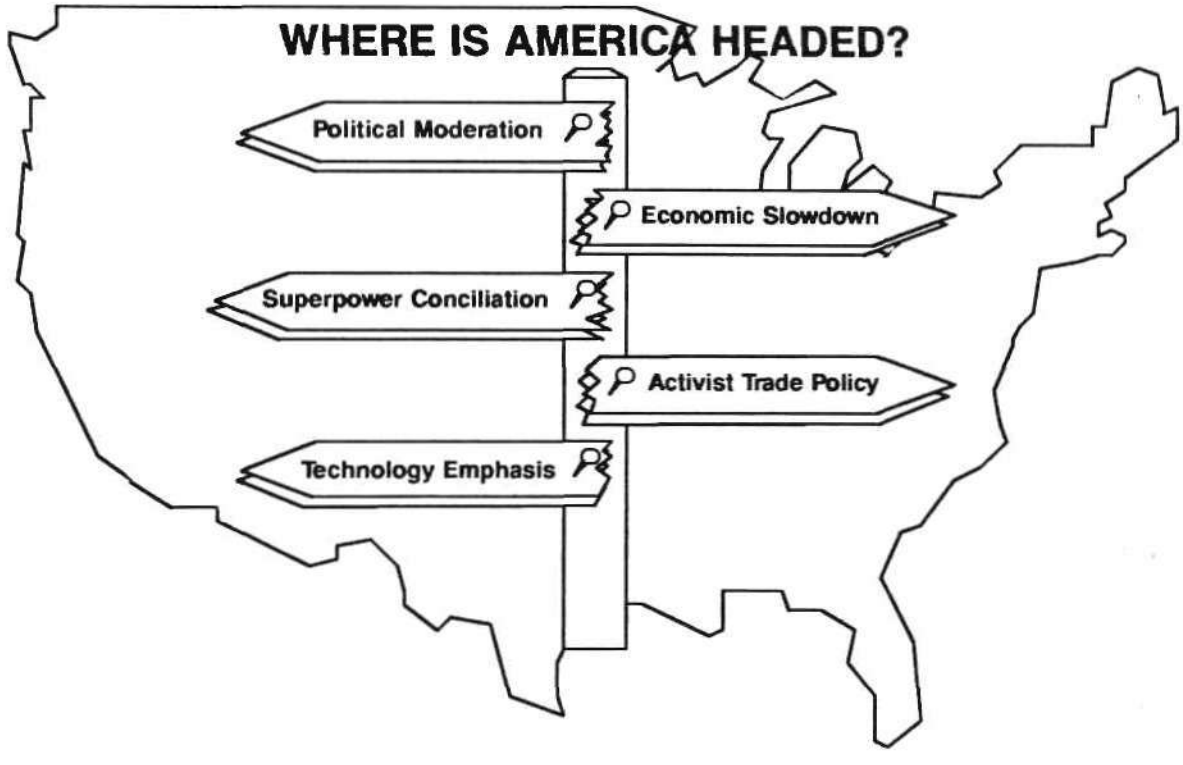

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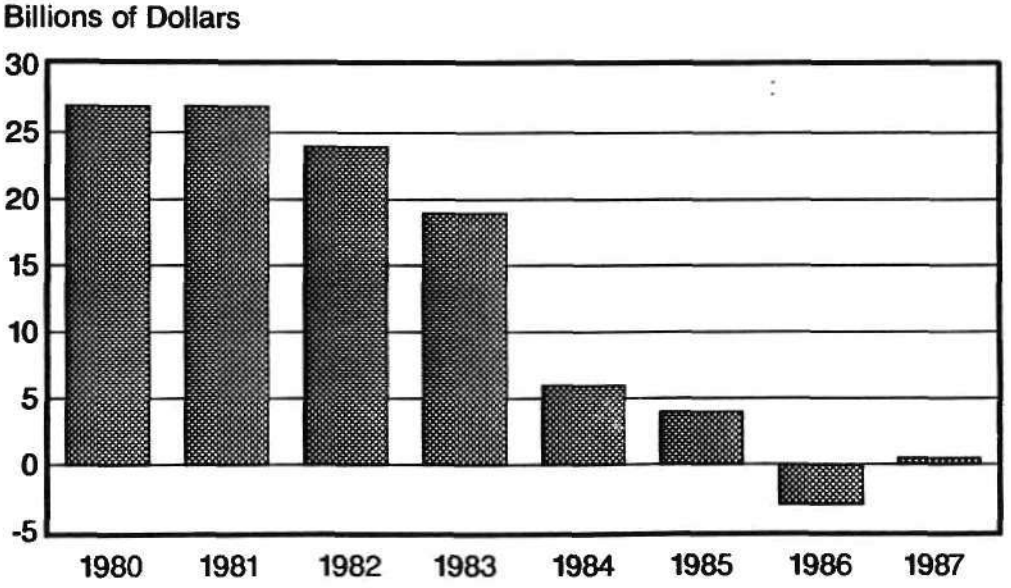
U.S. BALANCE IN HIGH-TECHNOLOGY TRADE



Source: National Science Foundation

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PRIORITIES FOR U.S. COMPETITIVENESS

- Restore fiscal discipline
- Strengthen trade policy
- Improve machinery for technology policy
- Increase investment in education
- Widen focus of national R&D efforts

Source: Council on Competitiveness

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JERRY LYNCH
DIRECTOR OF SALES
ADVANCED MICRO DEVICES

Jerry Lynch received a BSEE from Southern Methodist University in 1965. After college he worked for Texas Instruments in Dallas in integrated circuits product marketing.

He went to Japan in 1967 with Texas Instruments to set up the sales organization in Asia with Focus on integrated circuits.

He joined Fairchild in Japan in 1970 and was vice President of Marketing and Sales for T.D.K. Fairchild, a joint venture between the two companies.

After 6 years in Japan, he spent two years in London with Fairchild as Area Manager-Northern Europe.

He has been with AMD since 1976 in various international sales positions with primary focus on Asia.

Data quest conference
Seoul-Korea
Nov. 7-8, 1988

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Approaching
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U.S. COMPANIES' MARKET STRATEGIES FOR ASIA: AN OUTSIDER'S VIEW

Jerry Lynch

Director of Strategic Program and Southeast Asia Sales
Advanced Micro Devices

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U.S. Companies
Market Strategies for Asia
An Outsider's View

Jerry Lynch
Director Asia Sales
Advanced Micro Devices

DATAQUEST NOV 88

Strategy

Market

Products

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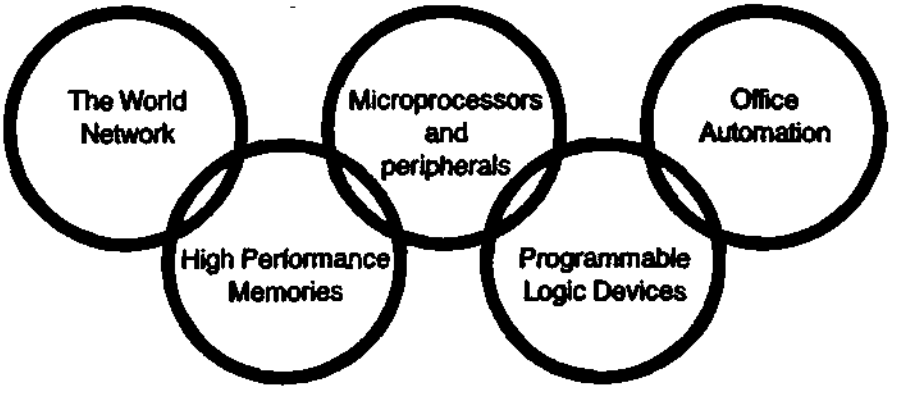
Spheres of Influence



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Manufacturing

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Strategy

Market

Products

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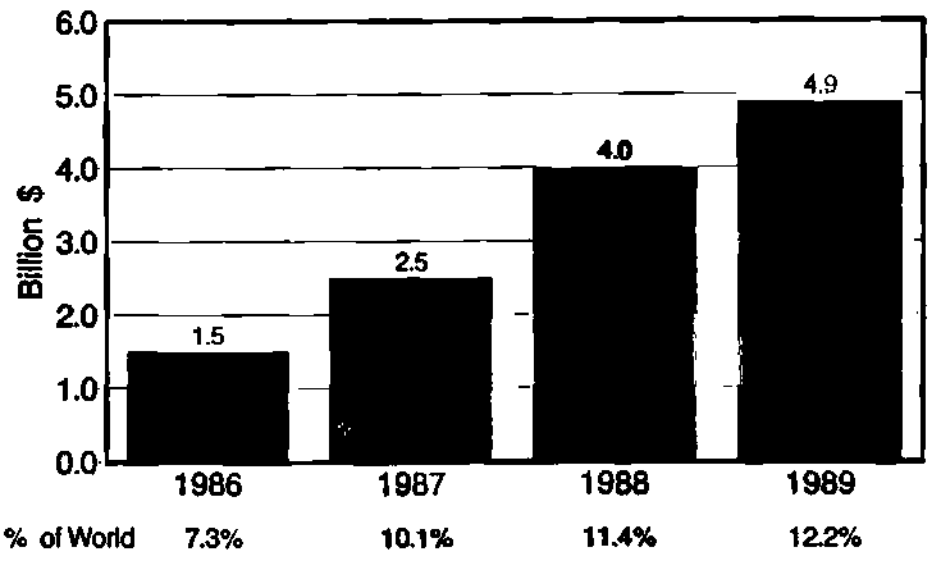
Asia I.C. Market



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AMD's Primary Mission

Supply total high-performance system solutions to the manufacturers of computation and communications equipment

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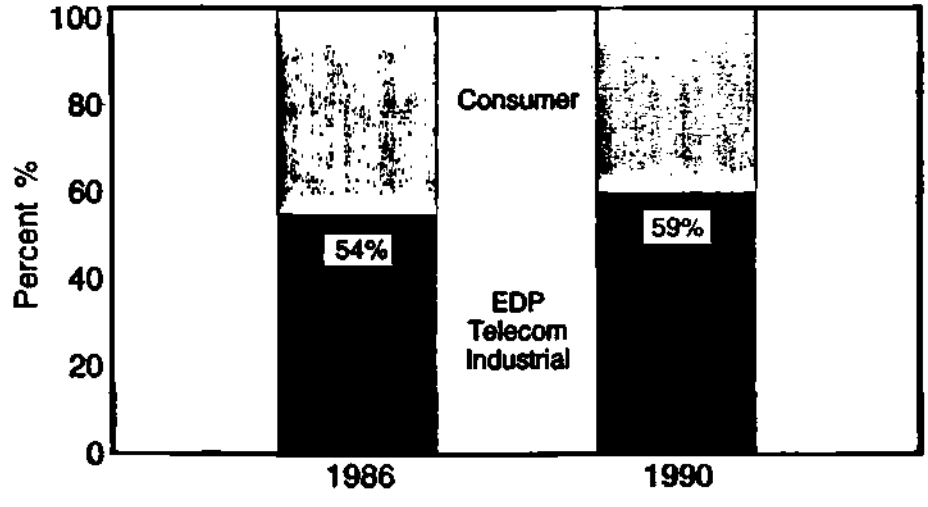
Asia
Semiconductor Consumption



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Environment

- Trade Barriers
- Protectionism
- Intellectual Property

DATAQUEST NOV 88

Asia
American I.C. Suppliers 1987

AMD	G.I.	National
AMI	Intel	Silicon Systems
Chips & Technology	Micron	T.I.
G.E.	Motorola	

1987 Market Share:

$$\frac{\text{American}}{\text{Total IC Market}} = 32\%$$

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American Asia Strategy

- Foreign language and cultures
- Local market requirements
- Local purchasing and financial systems
- Tough competition

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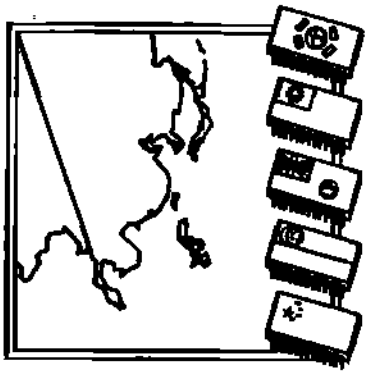
MARKET OPPORTUNITIES FOR U.S. COMPANIES: AN INSIDER'S VIEW

Goh Geok Ling
Vice President
Asia-Pacific Division
Texas Instruments Singapore (PTE) Ltd.

Mr. Ling is Vice President of Marketing for the Asia-Pacific Division of Texas Instruments. Earlier positions have included Director of Texas Instruments Singapore, a member of the Board of Texas Instruments Asia Limited (Delaware), Manager of the TI's Asia-Pacific Division, Marketing Director for Asian countries and India, Planning Manager of TI's Singapore Plant, Product Manager for Discrete and Metal Oxide Semiconductor Operations, Planning Manager, and Project Manager for Assembly Functions. Mr. Ling received a bachelor's degree in Engineering from the University of Sydney.

Dataquest Incorporated
ASIAN SEMICONDUCTOR AND ELECTRONICS TECHNOLOGY CONFERENCE
November 6-8, 1988
Seoul, Korea



Approaching
the Asian Age

MARKET OPPORTUNITIES FOR U.S. COMPANIES: AN INSIDER'S VIEW

Goh Guek Ling

Vice President, Asia Pacific Division
Texas Instruments Singapore Pte. Ltd.

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Good Morning Ladies and Gentlemen,

This morning the topic of my speech is Market Opportunities for U.S. Companies : An Insider's View.

The Asia Pacific Region offers an opportunity that is unique and yet difficult to comprehend. This region encompasses more than 60% of the world's population and is made up of many races, cultures, religions and languages. It can be reasonably divided into countries with 4 stages of economic development.

These are as follows:

A) Japan which has reached a stage of economic and technological development with a high per capita income of US$18,000. This matches or exceeds that of many Western Countries. It is a difficult market but is the single largest opportunity in Asia.

B) In the second grouping are the four Newly Industrialized Countries (NICs) of Korea, Taiwan, Hong Kong and Singapore. In these four countries, per capita income is approaching US$7000 annually. This in itself is creating a potential domestic market for product that are being produced or imported. These four countries share one common shortfall - the lack of natural resources and in the case of Singapore and Hong Kong, the necessity to import food to feed their population. Twenty years ago these countries shared the same dilemma. They were all faced with high unemployment and yet possessed few industries of any significance. Through adversity and the need to survive in difficult environment, these countries with stable governments, diligent, educated and trainable workforce have registered up to double digit economic growth in the past decade. The route taken by each of these countries may differ but it could be summarized as a combination of the promotion of local industries, the courting of foreign investment and the continuous expansion of specifically identified industries.

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C) *The third grouping consists of Malaysia and Thailand and possibly in the future the Philippines and Indonesia. These countries represent growth opportunities for foreign investors in this region. All these countries are blessed with abundance of natural resources. Malaysia, with a per capita income of US$1600 per year, has tremendous natural resources such as tin, petroleum and natural gas. She has developed her commodity based industries and is preeminent in her exploitation of palm oil, rubber, tin, oil and gas. Following its close neighbor Singapore, Malaysia has attracted significant foreign investment in the electronics industry. Today Malaysia is also one of the world's largest exporter of semiconductors.*
Thailand with a population of 54 million people has been successful in attracting foreign companies from USA, Japan, and Europe in the past three years. Per capita income has increased from US$400 per year in 1985 to approximately US$700 per year in 1987. In this category, both Indonesia and Philippines could be new targets of opportunity.

D) *The fourth category is China and India. These countries represent an opportunity for Western countries to participate in the future growth of their combined domestic market of 1.8 billion people. Together they account for 43% of the world's population. Unfortunately the per capita income of these two countries is low at US$300 per year. China, as you know, has been experimenting with the free economy concept for the past 10 years. It has recently announced a temporary price restraint for two years to curb excessive inflation which rose to 20% in 1988. While the repercussions of this new direction is detrimental to many investors in China, it nevertheless represents a hopeful sign that the government is capable of taking hard and unpleasant measures to ensure its future survival.*

India, a country of diverse cultures and languages represents a fairly large potential to foreign investors who are willing to comply with the local laws on investment to participate in this market. It has been estimated that approximately 70 million people in India are in the annual income group of US$2000 per annum, which by itself creates a sizeable consumer market.

Both the PRC and India, however, are plagued with poor infrastructure and as such constant improvement and upgrading will be required to improve the efficiencies of their industries.

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I have given you a breakdown of the economies of Asia which are at four distinct stages of economic development. Looking at these countries from a different perspective, only Singapore and Hong Kong offer free trade with little to no restriction to foreign investors who wish to participate in their local market. Of course, these two countries have come to realize that their small population afford them little to no comfort to protect their home markets but to compete in the world markets through higher productivity and efficiencies. All the other countries in Asia do possess significant markets in their own rights and while they are openly courting foreign investments for export purposes, they have protected their local market through various measures.

These are as follow:

1) *Import duty levied on components and finished goods.*
2) *Uplift on CIF values before the imposition of import duty.*
3) *Outright protection on certain segments of the industries. These are usually very subtly carried out.*
4) *Requirement of local equity partners for projects aimed at the local market.*
5) *Balancing on export and import requirements.*

I would like now to give you a brief breakdown of the barriers and opportunities for each of the countries in this region.

<u>Korea</u>

Korea has a population of 43 million people. She is currently a major exporter of VCRs, Televisions, Microwave Ovens, Audio products, automobile and other consumer products. With the investments made by Samsung, Hyundai and now Goldstar, Korea is also an exporter of semiconductors to world markets. Korea plans to increase her R&D spending from 1.58% of GDP in 1987 to 5.0% in 2001 to enable her to produce and compete in the higher end technological market.
Not contented with her success, Korea has mapped a very aggressive five year plan to be one of the 10 largest exporting nations in the world. To achieve this aim, Korea would have to expand exports of existing products to new geographical frontiers such as the PRC and the Eastern Bloc, and pioneer higher end consumer, computer and communication products. It is also envisaged that, with the growing prosperity and wealth, Korea will be a creditor nation by 1991. This, with the growing trade balance in her favor, will require Korea to continually rethink her posture on imports and status of foreign companies operating in the country. Currently, Korea imposes an import duty of 10% on semiconductors and 20% on computers. In consumer products, Korea imposes a 20% import duty on television sets to which must be added a 40% consumption tax.

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It is probable that in the foreseeable future we will see the reunification of North and South Korea. This would result in a greater Korea with a larger market with mineral resources at her disposal.

Taiwan

We have seen this country continually reducing import duties for semiconductors and computers. However, she still levies a 17.5% import duty for television and to this is added another 20% commodity tax. Taiwan, with a foreign exchange reserve of US$72B, can afford to be more accommodative to foreign investors. Unlike Korea, whose economy is largely dominated by the 4 Chaebols, Taiwan's economy is evenly spread among entrepreneurs who abound in this country.

In the past five years, Taiwanese entrepreneurs have been scaling new heights technologically. The country boasts of 3 diffusion plants which are in operation to which must be added another three plants in various stages of construction. The free wheeling entrepreneurial spirit has resulted in many Asic Design Houses for computer and peripheral products. A visit to Hsinchu Science Park will be a testimony of the proliferation of many new hitech companies and major expansion of existing ones. Today, Large corporations such as Taiwan Semiconductor Manufacturing Corporation, Acer and Mitac and others are operating there alongside other smaller companies.

Hong Kong / Singapore

Hong Kong and Singapore have little to no barriers against foreign investment. Both countries have been the manufacturing bases for foreign manufacturers from the U.S.A., Europe and lately Japan.

Hong Kong is further augmented by many local manufacturers such as Videotech, Bondwell, Applied Electronics, etc. Both countries possess good infrastructure for the financial and service industries in this region and will continue to remain so.

Both countries are suffering from labor shortage but have approached this problem in their own separate manner. In Hong Kong many labor intensive industries have moved their manufacturing operations to the Special Economic Zones (SEZ) in the People's Republic of China to take advantage of the abundance of low cost labor there. It is estimated that approximately 200,000 manufacturing jobs have been created by Hong Kong companies in PRC for this purpose.

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In Singapore, while the government is encouraging industries with high labor content to move to Malaysia, she has at the same time encouraged companies operating in Singapore to mechanize and to migrate to higher value added products. This is done through financial inducements and through government funded training of the workforce. In addition, she has adopted a pragmatic policy to allow the hiring of workers from neighboring countries to supplement her labor needs.

Singapore has also been vigorously pursuing multinational companies to take advantage of her strategic location and has actively sought these companies to set up their Operational Headquarters (OHQ) and International Purchasing Offices (IPO) in Singapore.

Thailand / Malaysia

Much has been written about Thailand and Malaysia joining the league of newly industrialized countries within the next five years. In the accompanying slide you will note that both countries do protect local markets with high import duties ranging from 12.2% to 50% depending on the products imported. Both these countries require local equity if the manufactured product is primarily targeted for the local market. However, lower labor costs than the four NICs will give Malaysia and Thailand a competitive edge where labor content is a major factor. Many Americans, Taiwanese, Japanese and European companies are capitalizing on these opportunities to minimize high cost of mechanization.

PRC

The PRC has continually increased its import duty for semiconductor, computer and consumer products in the past four years. In the accompanying slide you will note that semiconductors carry duties ranging from 25% to 40%, computers from 30% to 80% while television is banned. Duties for other consumer goods ranges from 50% to 200%.

These duties were levied primarily to curb the pent up demand for imported products which resulted in a drain on it foreign exchange reserve. This reserve fell to a critically low level of US$8B in 1984. The foreign exchange reserve has recently risen to $18B but the value of the PRC Foreign Exchange Currency (FEC) has fallen from 2.4 FEC to US$1 in 1984 to 3.7 FEC to US$1 currently. In the unofficial market it will require 7 to 8 Renminbi to exchange for US$1.

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The PRC has enacted several new laws in the past few years to transform state-owned corporations to enterprises. To improve industrial efficiency, the PRC government is planning to reduce state-owned sector from 60% in 1987 to 30% in 1993. In an attempt to encourage foreign investment, 100% new foreign investment is now allowed for companies wishing to participate in the local market. However, because of the shortage of foreign exchange, companies are required to balance their foreign exchange requirement. In the present economic environment in the PRC, companies are urged to be patient and cautious in their investment there. However, due to its size and population of 1.1B people, one cannot choose to ignore completely this market from a strategic point of view. The concept of a greater China consisting of PRC, Hong Kong and Taiwan could be a reality within the decade. This would create anew market horizon in these countries.

India

In India the duties for many products have been continually readjusted in the past few years. High duties of 60% to 314% for semiconductors and computers certainly deters import of these products. In truth a personal computer while technically importable would require a memory size approach a mainframe before such import is considered legal. In order to participate in the local market, foreign investors are required to hold less than 40% of the equity to qualify as an Indian company. DEC has recently formed a joint venture company with its local partner, Hinditron, to participate in this market. In the recent two years, the Indian Government has also included export requirements for joint ventures operating in India. Bureaucracy and Governmental requirements tend to delay any potential new operation in India. Nevertheless, like China, this is a market that few can completely ignore from a strategic point of view.

Japan

I do not intend to discuss in great detail about Japan as many of you would be better informed than I in this market. However, it would suffice to mention that this great land of consumer innovation and production would also be hard pressed to make reforms in opening up her market, readjust to the strengthened Yen, readjust to pressures from her trading partners in the Western World and face competition from the lower cost producers, from the four NICs plus the newly emerging nations of South East Asia Companies planning to participate in the Japanese market must also learn to prise open the Japanese distribution system.

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A parallel to Japan today is when the U.S.A. and Europe started moving their uncompetitive industries to lower cost regions in Asia in the late fifties. Japan is approaching this same crossroad with but its singular vigor, planning and stamina, Japan would undoubtedly come out of this upheaval unscathed.

I would now like to give you a briefing of Texas Instruments in Asia. Twenty years ago, Texas Instruments built its first Asian plants in Japan and Singapore. Since then we have added plants in Taiwan, Malaysia and the Philippines. Today, we have a total of 8 plants in Asia plus sales, marketing, application and Asic Design establishments in all major cities in Asia and a software design centre in Bangalore (India). This year we have also started a bar design centre and will establish a factory for our Semiconductor and Metal & Control products in Korea. The total Asian activities have contributed US$709M of trade billing and to our corporation in 1987.

In closing, I would like to reaffirm our faith in Asia and we are glad to have made the significant investments for the past 20 years in what is now termed as "The Fasted Growing Region In The World".

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JAPANESE ELECTRONICS MANUFACTURING IN ASIA: AN OUTSIDER'S VIEW

Arthur T. Suyama
General Manager, International Marketing Division
Matsushita Electronics Corporation

Mr. Suyama is General Manager of the International Marketing Division of Matsushita Electronics Corporation (MEC). Previous positions at MEC have included General Manager of Export for the Semiconductor Sales Division and Semiconductor Sales Manager in the Chicago office. Mr. Suyama received a degree from the Science Faculty at Osaka University.

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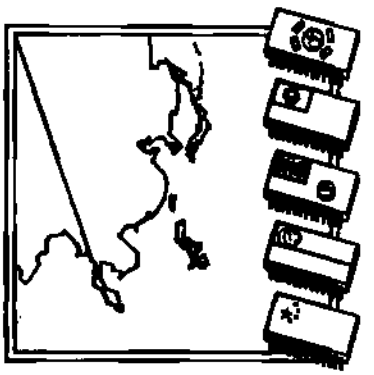

Approaching
the Asian Age

JAPANESE ELECTRONICS MANUFACTURING IN ASIA: AN OUTSIDER'S VIEW

Arthur T. Suyama

General Manager, International Marketing Division
Matsushita Electronics Co.

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JAPANESE ELECTRONICS MANUFACTURING IN ASIA

—— AN OUTSIDER'S VIEW ——

Arthur T. Suyama
General Manager
International Marketing Division
Matsushita Electronics Corporation
Japan.

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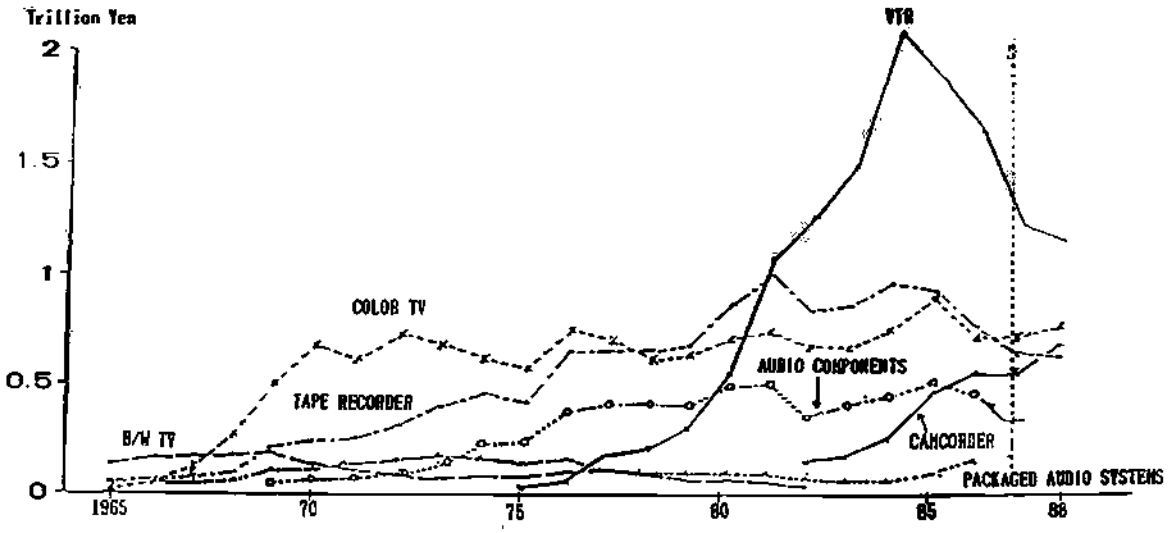
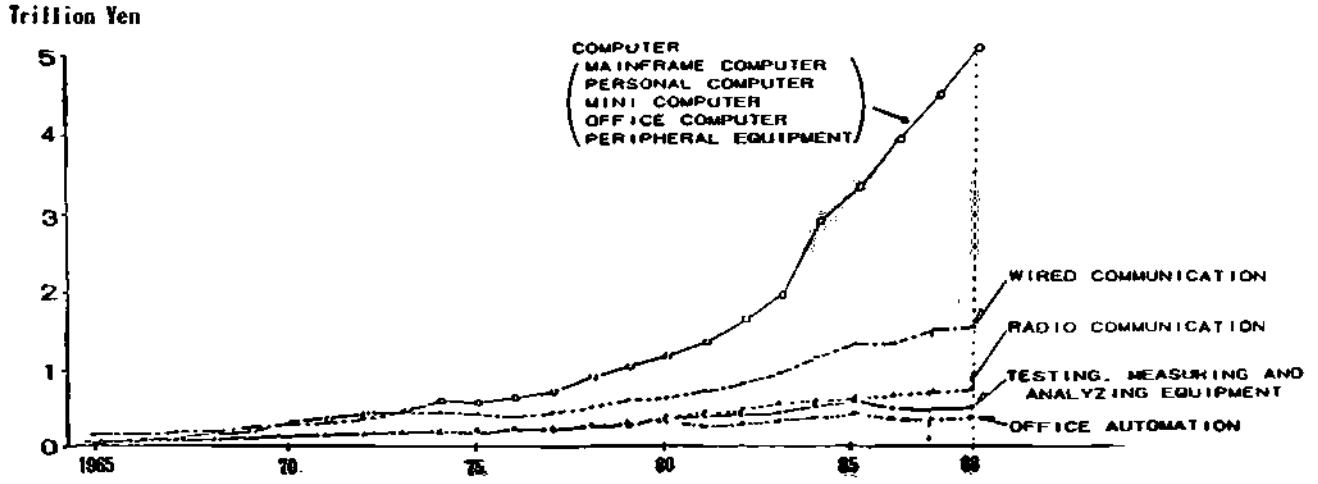
1. PRODUCTION TREND OF CONSUMER EQUIPMENTS IN JAPAN



SOURCE: E I A J

2. PRODUCTION TREND OF INDUSTRIAL EQUIPMENTS IN JAPAN



SOURCE: E I A J

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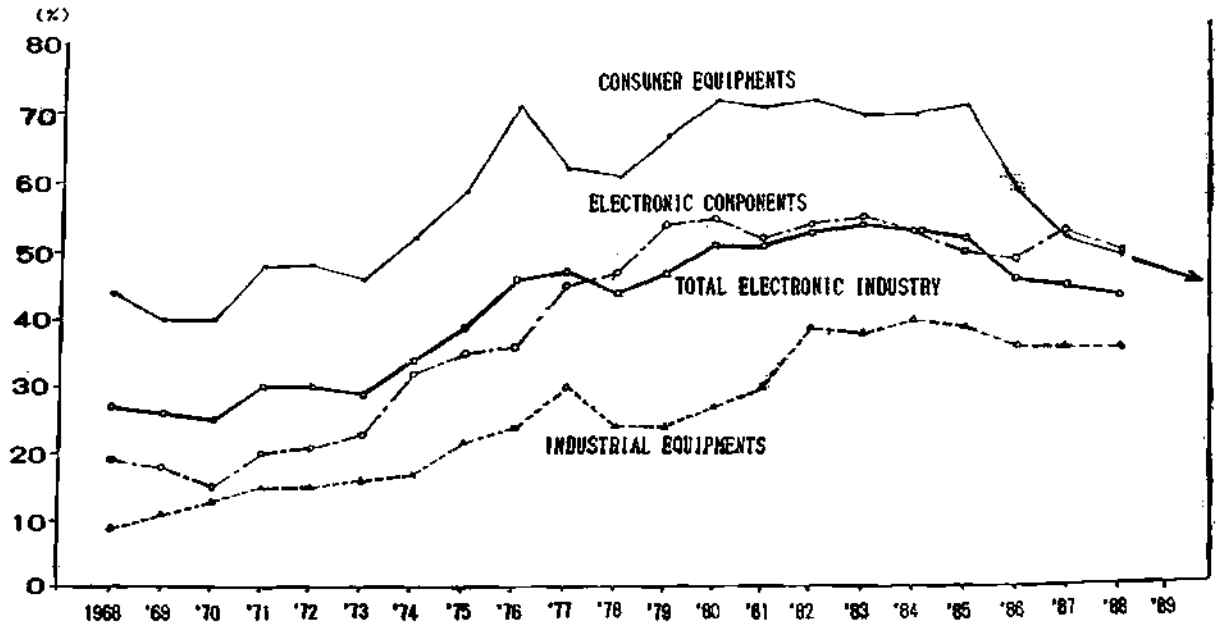
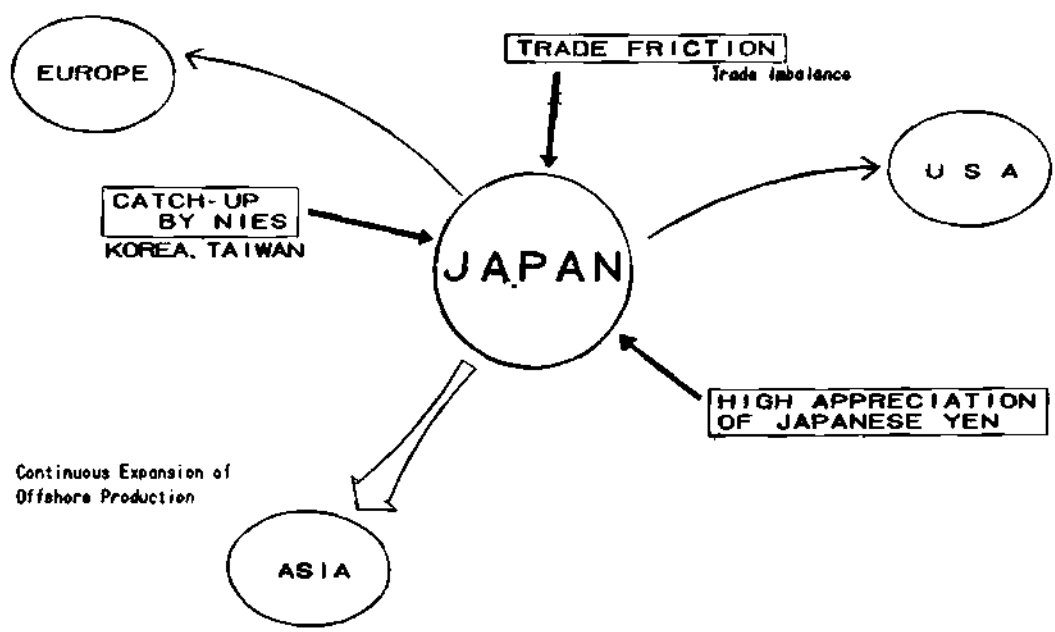
3. EXPORT RATIO OF ELECTRONIC EQUIPMENTS IN JAPAN



SOURCE: EIAJ

4. BACKGROUND OF OFFSHORE PRODUCTION OF JAPANESE ELECTRONIC COMPANIES



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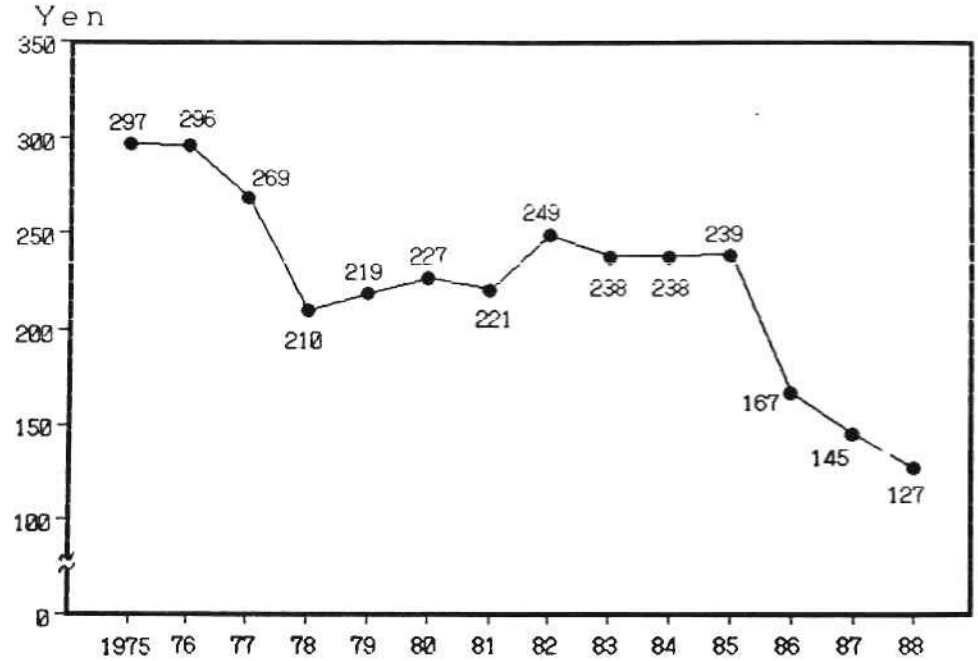
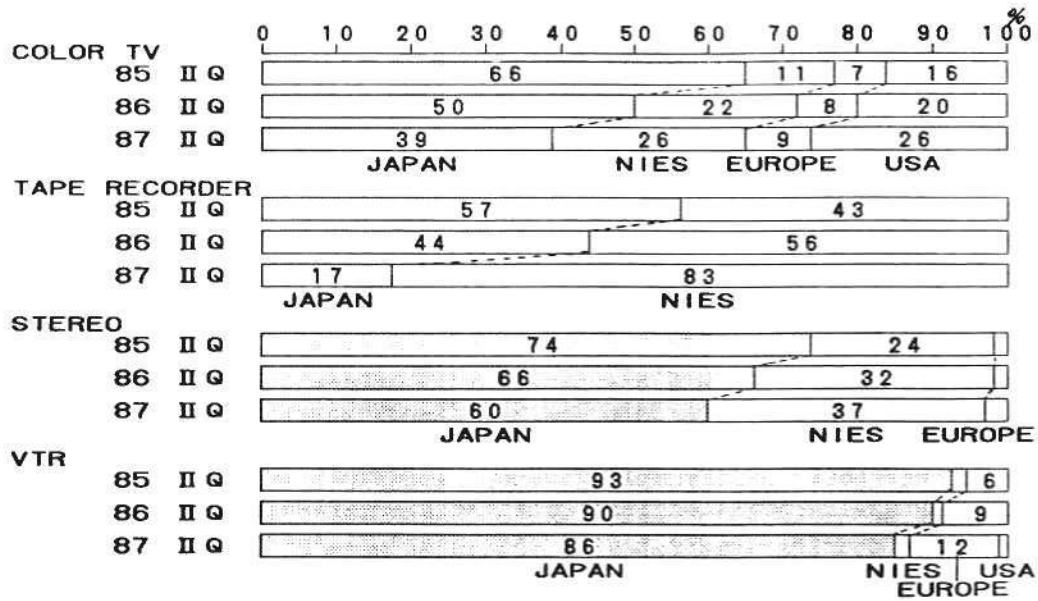
5. EXCHANGE RATE OF JAPANESE YEN

(VS US$)



SOURCE : Nikkei shinbun, Japan

6. REGIONAL PRODUCTION TREND OF JAPANESE MANUFACTURERS



SOURCE : NRI, JAPAN

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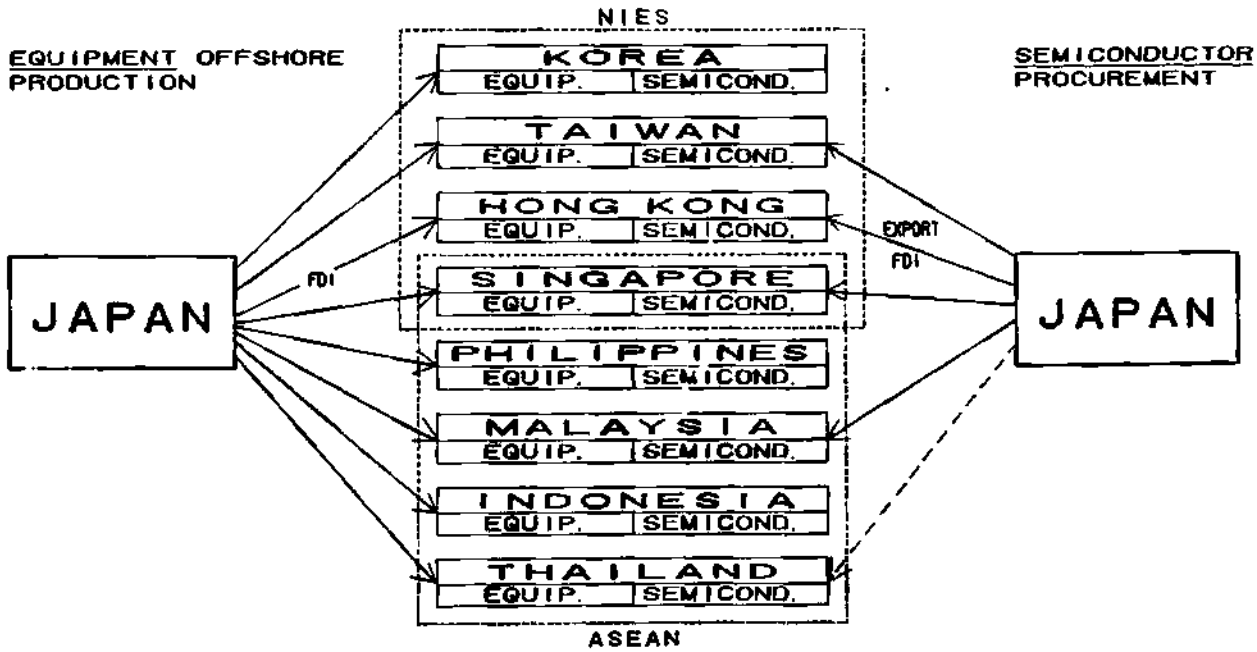
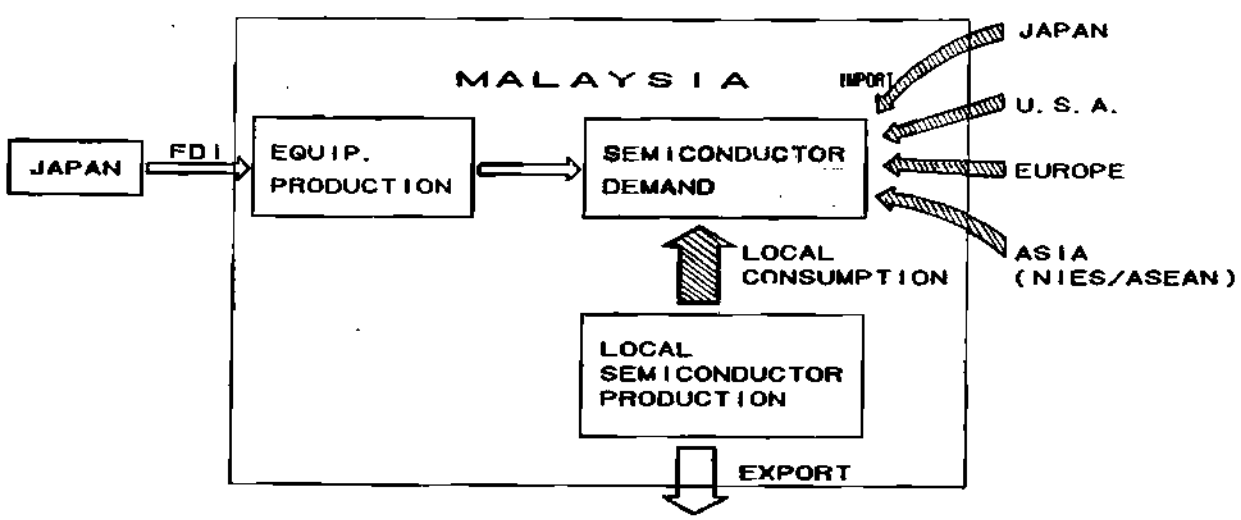
7. IMPACT OF JAPANESE OFFSHORE PRODUCTION OF EQUIPMENTS ON SEMICONDUCTOR PROCUREMENTS



8. SOURCING OF SEMICONDUCTOR FOR OFFSHORE PRODUCTION OF ELECTRONIC EQUIPMENTS

CASE : MALAYSIA

— COLOR TV —



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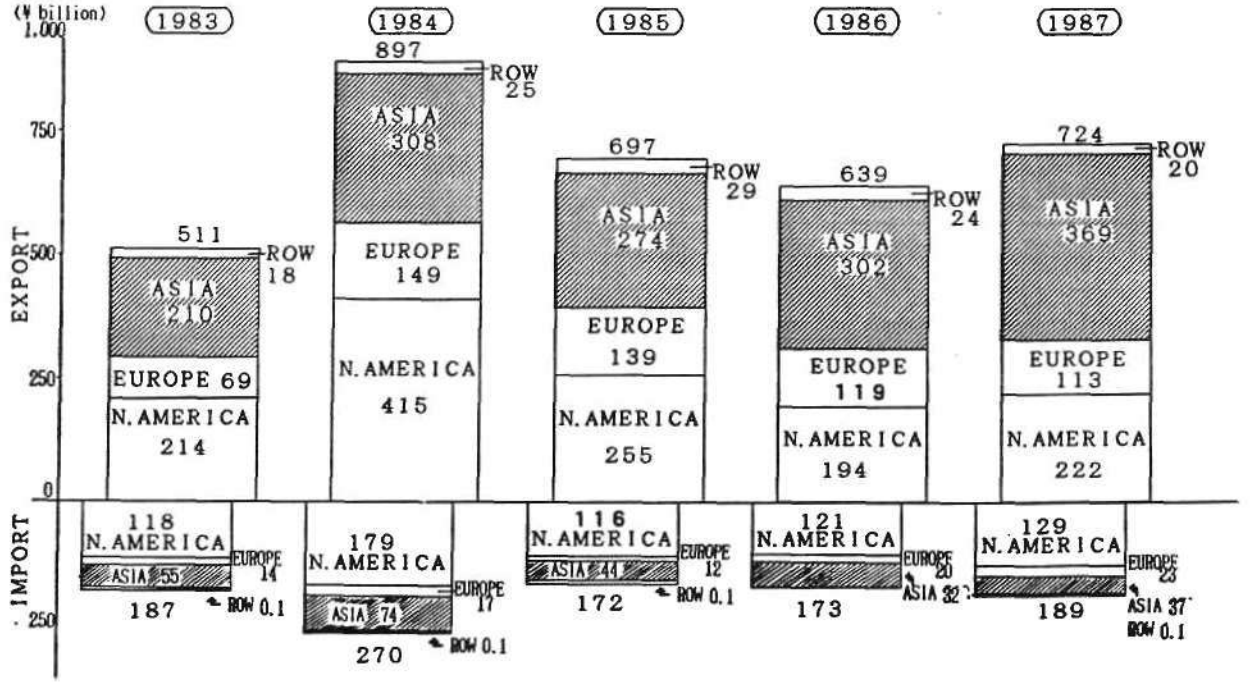
9. JAPANESE SEMICONDUCTOR EXPORTS & IMPORTS

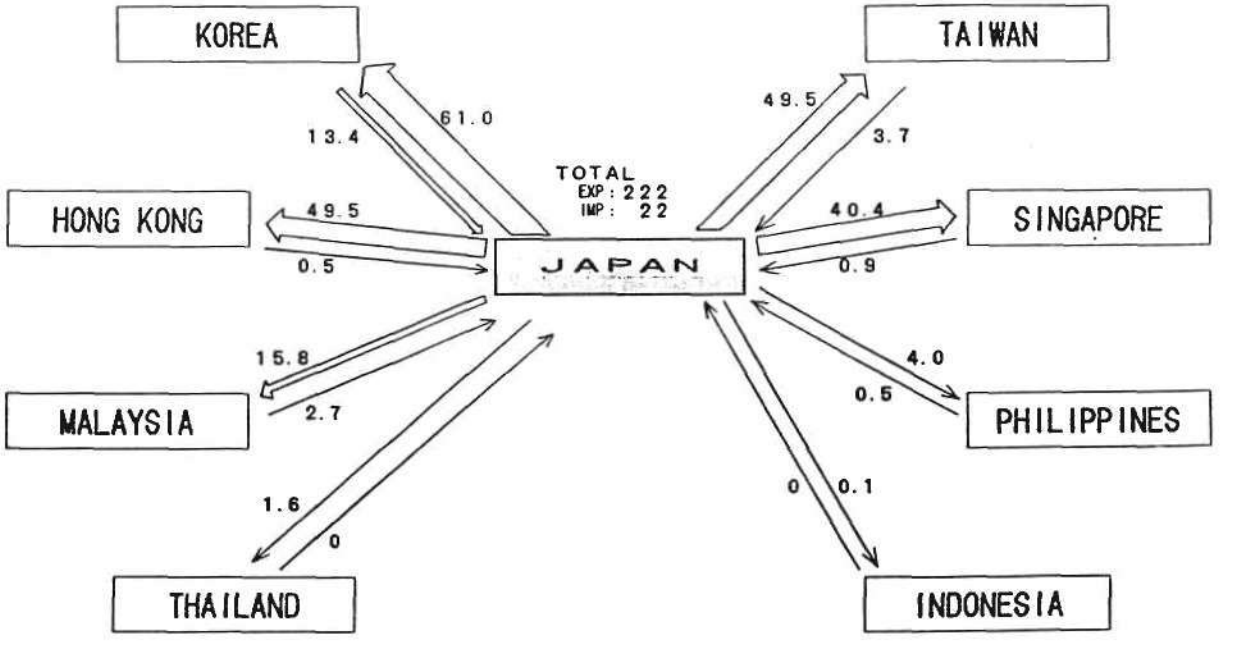


Source : Ministry of Finance (Japan)

10. SEMICONDUCTOR TRADE BETWEEN JAPAN AND NIES / ASEAN

[1] COUNTRY BY COUNTRY
1988 JAN. ~ JUNE.

Unit:billion yen
Chip included



Source : Ministry of Finance (Japan)

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[2] PRODUCT BY PRODUCT

(1988 JAN - JUN)

[IMPORTS]

	¥ Billion	Structure
MOS Memory	1.6	7%
Micro	1.0	5
Logic	2.1	10
Bipolar Digital	1.7	8
Linear	4.3	19
Discrete	8.9	40
Hybrid	2.3	10
Chip	0.1	1
Total	22.0	100%

JAPAN

IMPORTS	EXPORTS
22 Bil.	222 Bil.

NIES & ASEAN

[EXPORTS]

	¥ Billion	Structure
MOS Memory	42.6	19%
Micro	22.0	10
Logic	24.2	11
Bipolar Digital	6.8	3
Linear	35.0	16
Discrete	38.5	17
Hybrid	7.8	4
Chip	45.1	20
Total	222.0	100%

Source : Ministry of finance (Japan)

11. PRODUCTION ITEM OF SEMICONDUCTOR IN ASIA BY JAPANESE MANUFACTURERS

1967~ DISCRETE (TR,DIODE)

1980~ BIPOLAR LINEAR

1985~ MOS MEMORY (64K/256K/1M DRAM)

1987~ MOS LOGIC (ASIC)

SOURCE: MATSUSHITA

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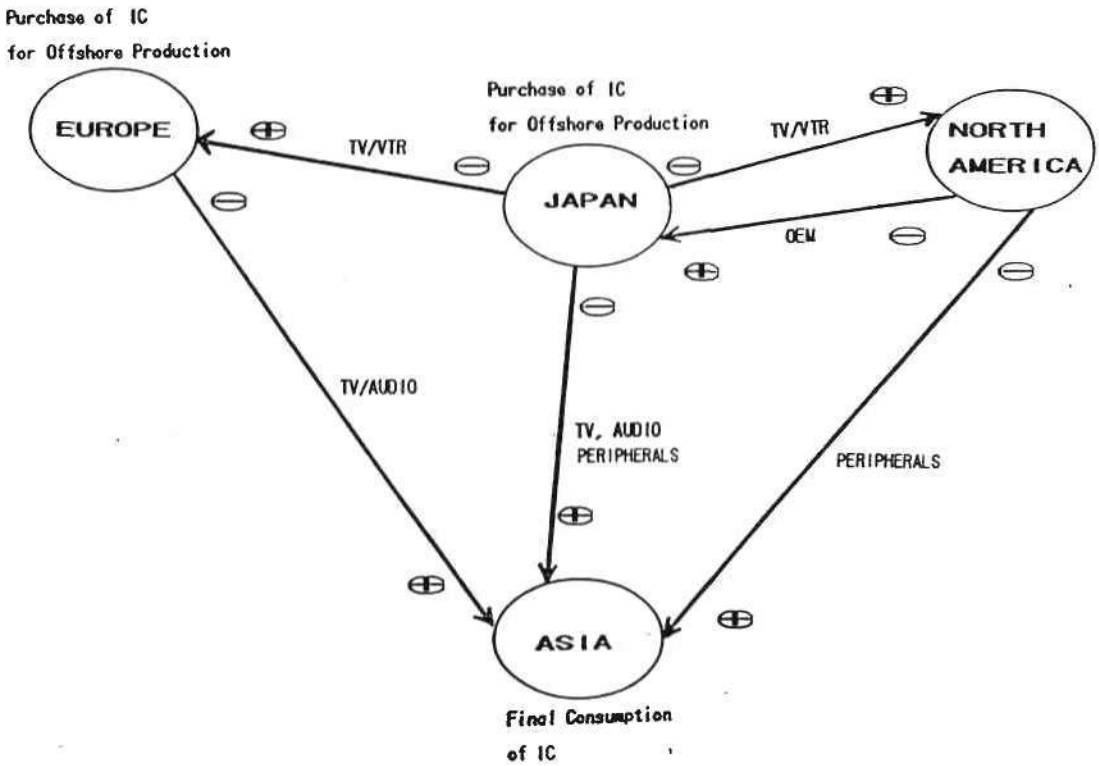
12. GLOBAL SHIFT OF ELECTRONIC EQUIPMENT PRODUCTION



13. FUTURE TREND OF SEMICONDUCTOR SOURCING FOR EQUIPMENT OFFSHORE PRODUCTION

OFFSHORE PRODUCTION OF EQUIPMENTS	MEANS / SEMICONDUCTOR	SOURCING [A] LOCAL PURCHASE (Locally Assembled)	[B] IMPORT (SEMICONDUCTOR)	[C] IMPORT (ON BOARD / WITH KIT)
↗	MOS MEMORY	↗		(THAILAND, PHILIPPINE, INDONESIA)
	MICRO		↗ EG) 4bit MCU	
	LOGIC (ASIC)	↗ (Increase of Design Center)		↗
	BIPOLAR LINEAR	↗	↗ EG) VTR	
	DIGITAL	↗		
	DISCRETE	↗		

SOURCE: MATSUSHITA

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THE EMERGING EUROPEAN-ASIAN CONNECTION

Yi-Chiang Lo
President
Philips Taiwan Ltd.

Mr. Lo is President of Philips Taiwan Ltd. Previously, he held a variety of engineering and management positions at Philips Taiwan, most recently as Executive Vice President of Manfacturing/Engineering and Quality Management. Earlier, he was Executive Vice President for Quality Management and General Manager, I.C. Factory Manager, and an I.C. Engineer at Philips Electronic Building Elements Industries. Mr. Lo attended the National Chen Kung University, where he majored in Physics, and took the Executive Management course at Harvard Business School.

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November 6-8, 1988
Seoul, Korea

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Approaching
the Asian Age

THE EMERGING EUROPEAN-ASIAN CONNECTION

Y.C. Lo
President
Philips Taiwan Ltd.

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PERSONAL MARKET OPPORTUNITIES FOR ASIA

Sheridan Tatsuno
Senior Industry Analyst
Asian Components Group
Dataquest Incorporated

Mr. Tatsuno is a Senior Industry Analyst for Dataquest's Asian Semiconductor and Electronics Technology Service (ASETS). He is responsible for analyzing Asian high-technology industry trends, economic and political issues, Japan-Asia relations, and emerging Asian market opportunities. Prior to joining Dataquest in 1983, he had seven years of experience in market research, planning, and international finance with Bechtel Corporation and Woodward-Clyde Consultants. Mr. Tatsuno received a B.A. degree in Political Science from Yale University and a master's degree in Planning and Policy Analysis from Harvard University's Kennedy School for Government. In addition to these credentials, Mr. Tatsuno is fluent in Japanese, French, and Spanish, and has authored a book called The Technopolis Strategy: Japan High Technology and other Control of the 21st Century.

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Approaching
the Asian Age

PERSONAL COMPUTER MARKET OPPORTUNITIES FOR ASIA

Sheridan Tatsuno
Senior Industry Analyst
Asian Components Group
Dataquest Incorporated

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AGENDA

- Worldwide PC industry trends
- Emerging PC standards
- Asian market opportunities

WORLDWIDE PC INDUSTRY TRENDS

- Worldwide
- United States
- Asia
- Japan

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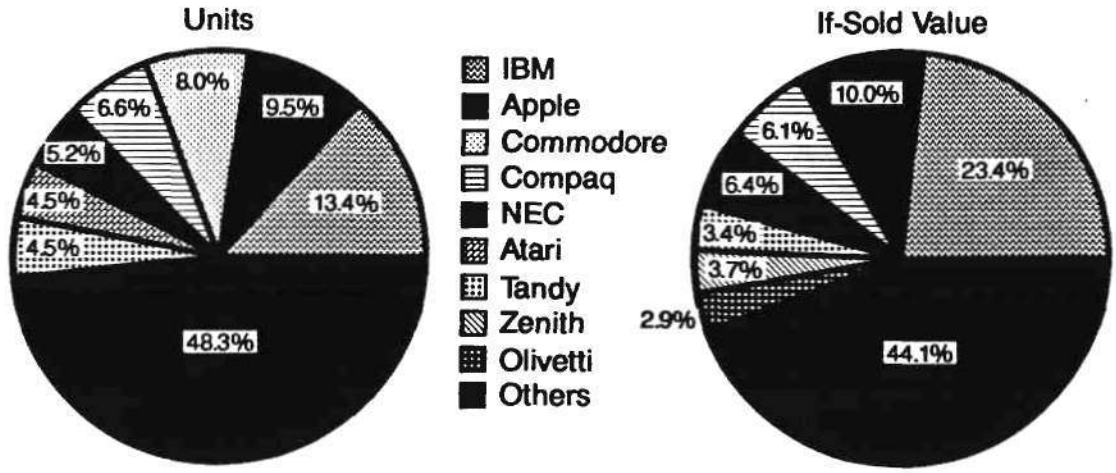
S2871004.IMG 10/28/88 TAT

ESTIMATED 1988 WORLDWIDE PC MARKET SHARES



Source: Dataquest

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WORLDWIDE PC SHIPMENTS (VALUED UNDER $10,000) BY REGION

(Thousand of Units)

	1988	1991	1988-1991 % CAGR
United States	9,816.6	12,640.3	8.8%
Canada	840.3	1,114.1	9.9%
Western Europe	4,070.1	5,343.7	9.5%
Japan	2,209.7	2,677.7	6.6%
Rest of World	4,946.0	7,610.0	15.4%
Total	21,882.7	29,385.8	10.3%

Source: Dataquest

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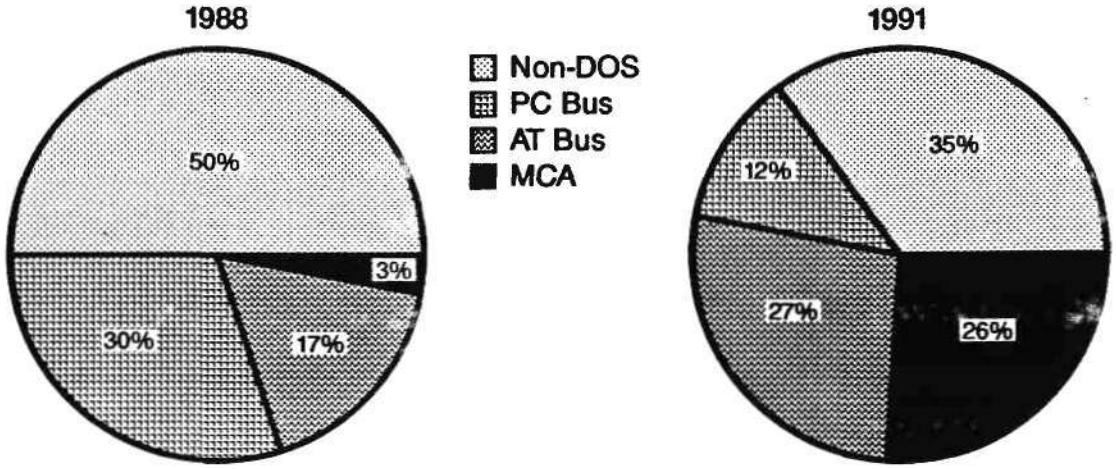
ESTIMATED WORLDWIDE PC SHIPMENT TRENDS BY ARCHITECTURE



Source: Dataquest

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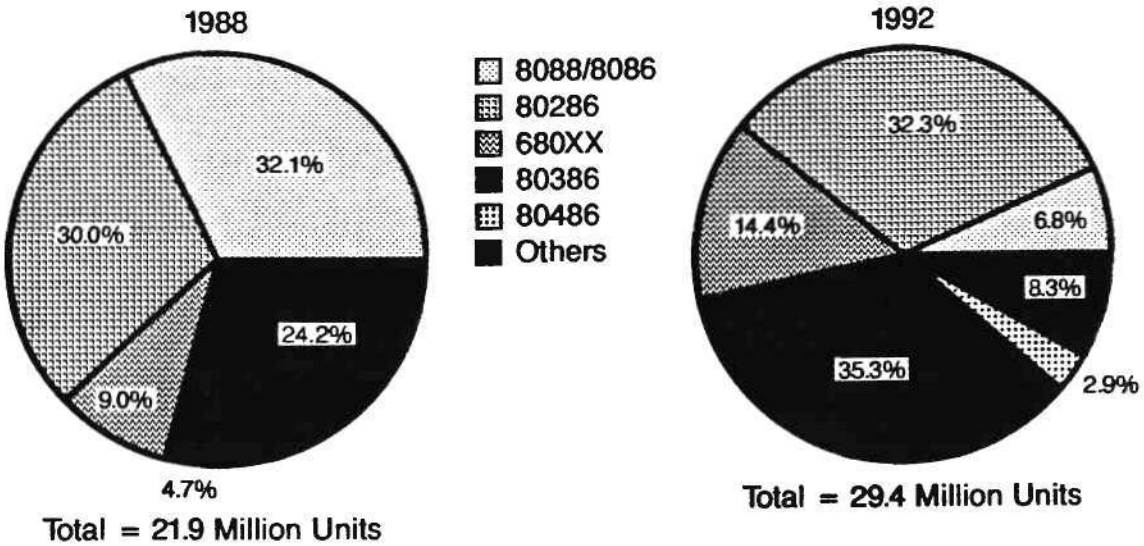
ESTIMATED WORLDWIDE PC SHIPMENTS BY MICROPROCESSOR



Source: Dataquest

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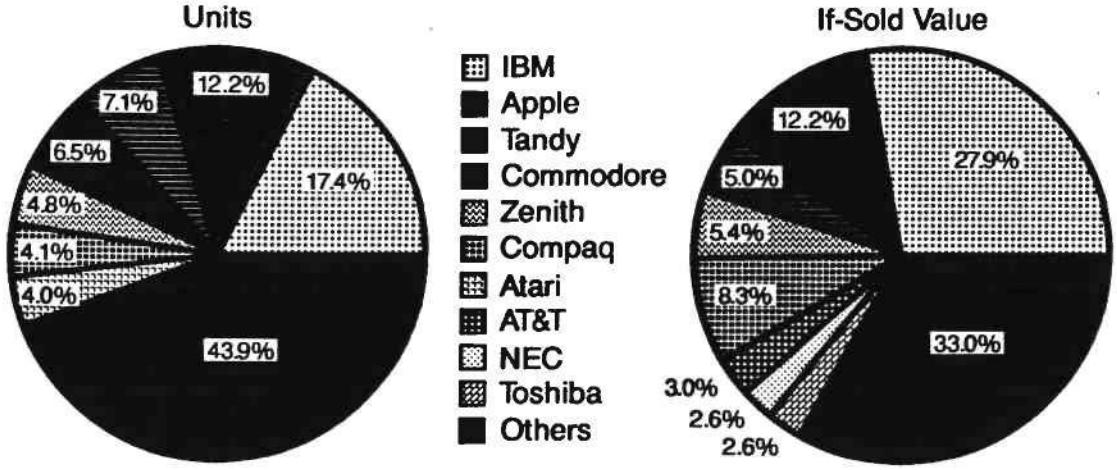
ESTIMATED 1988 U.S. PC MARKET SHARES



Source: Dataquest

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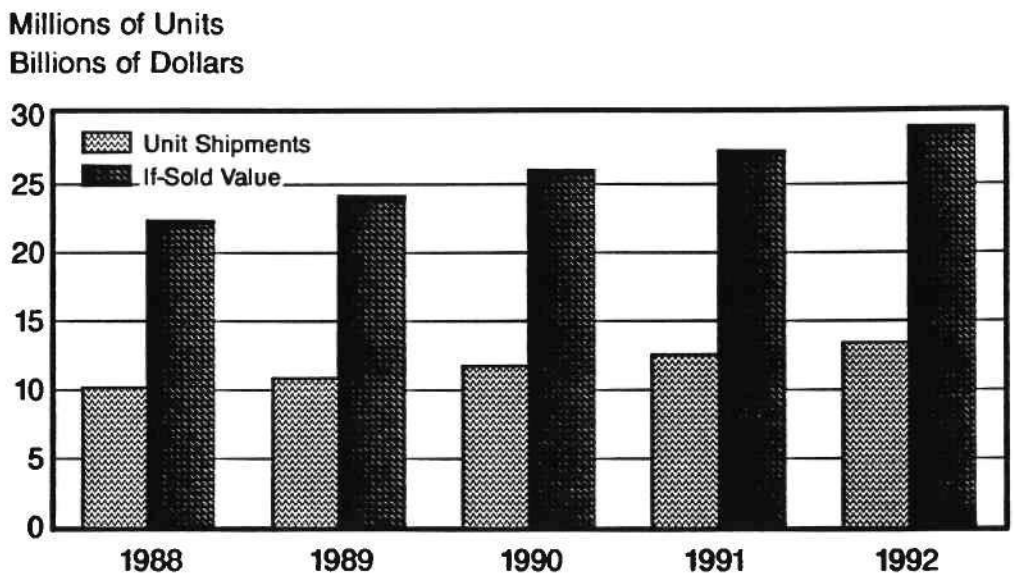
U.S. PERSONAL COMPUTER FORECAST



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ESTIMATED ASIAN PERSONAL COMPUTER PRODUCTION

(Thousand of Units)

	1987	1988	1991	1988-1991 % CAGR
Taiwan	2,098	2,559	3,853	14.6%
South Korea	1,327	1,970	2,966	14.6%
Singapore	160	247	377	15.1%
Hong Kong	19	44	136	45.7%
Other	70	126	278	30.2%
Total	3,674	4,946	7,610	15.4%

Source: Dataquest

ESTIMATED ASIAN PERSONAL COMPUTER MARKET

	1986	1987	1988	1989	1990	1986-1990 CAGR
Shipments (Thousands of Units)	227	365	548	795	1,150	50%
Market Size (Millions of U.S. $)	$220	$410	$980	$1,550	$2,200	78%
Average Price	$969	$1,123	$1,788	$1,950	$1,913	19%

Source: MIC/III, ERSO

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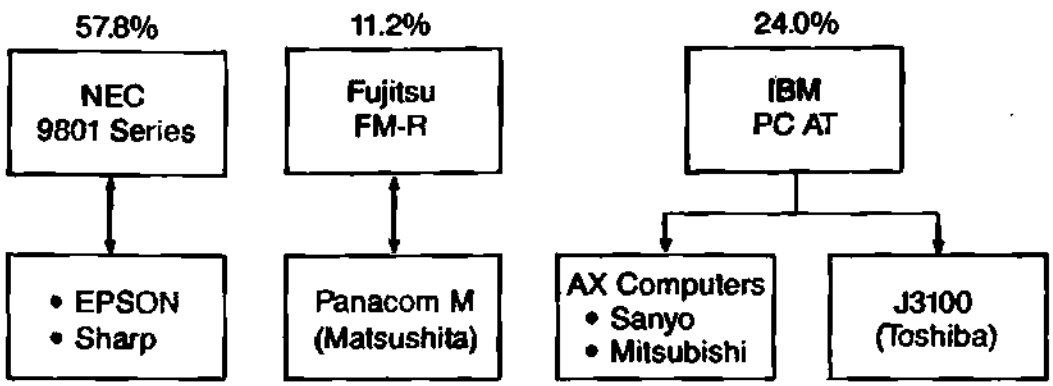
JAPANESE PC MARKET

- The market is dominated by three groups:



- The remaining 7 percent is "others"

Source: ERSO

JAPANESE PC SHIPMENTS, BY CPU

(Thousand of Units)

	1983	1989	1985	1986	1987	1983-1987 % CAGR
8-bit	719	917	789	685	457	(10.7%)
16-bit	166	279	398	551	728	44.7%
32-bit	0	0	0	0	15	-
Total	885	1,196	1,187	1,236	1,200	7.9%

Source: JEIDA
Dataquest

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EMERGING PC STANDARDS

- Competing standards
- IBM's PS/2 strategy
- Extended Industry Standard Architecture (EISA)
- NeXT Computer

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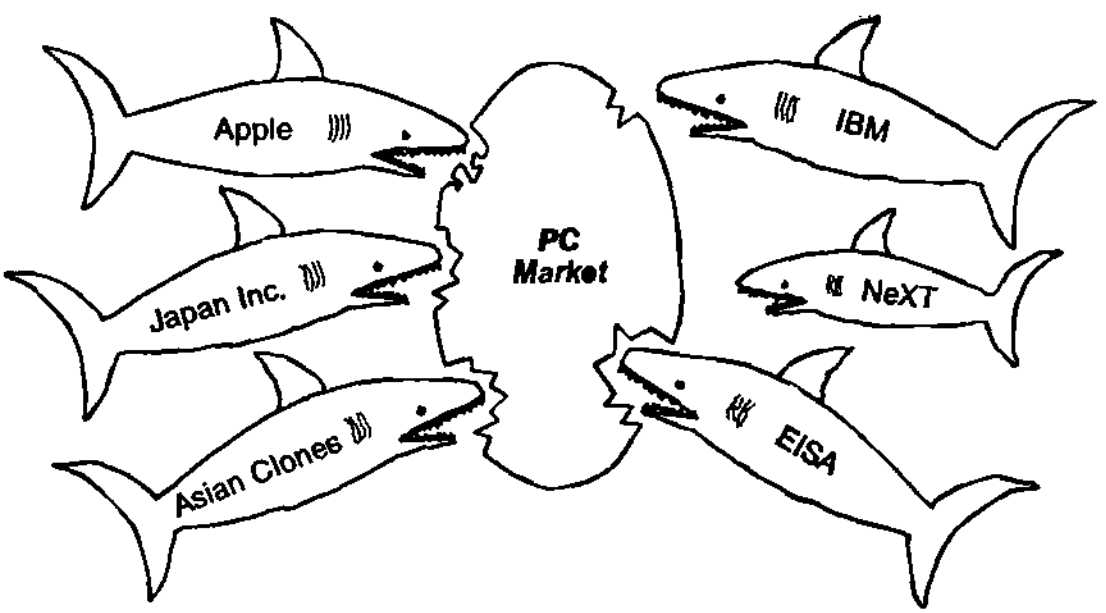
THE GLOBAL BATTLE FOR PC MARKET SHARE



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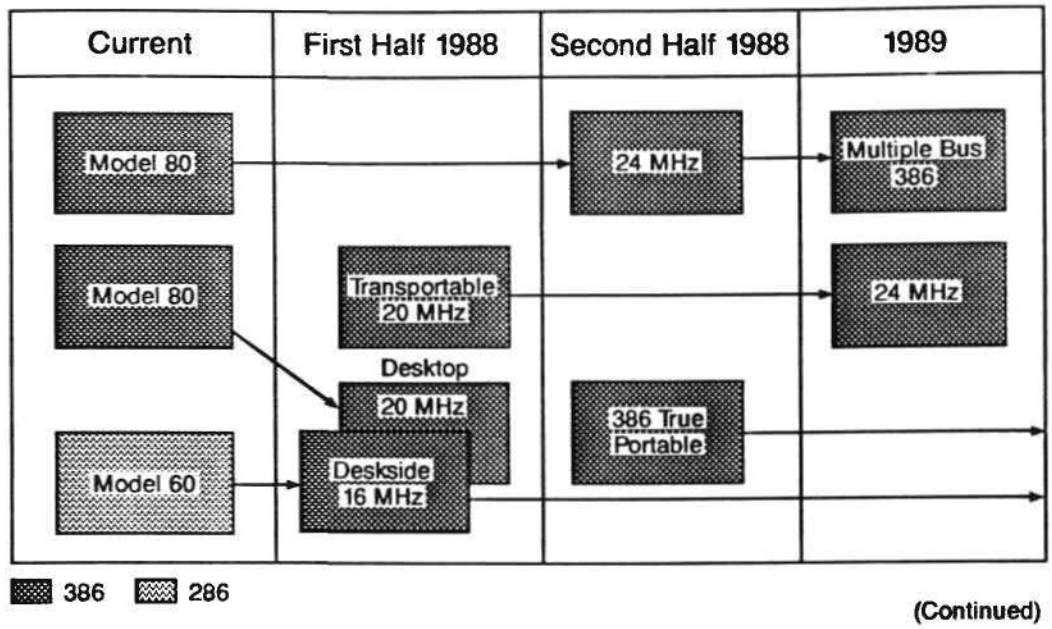
DATAQUEST PREDICTS: IBM PRODUCT STRATEGY FOR THE NEXT 15 MONTHS

- An 80286-based AT bus system ($1,995)
- The Model 60 becomes and 80386SX tower
- A new portable based on the 80386SX
- A 25-MHz Model 80

IBM PS/2 PRODUCT STRATEGY



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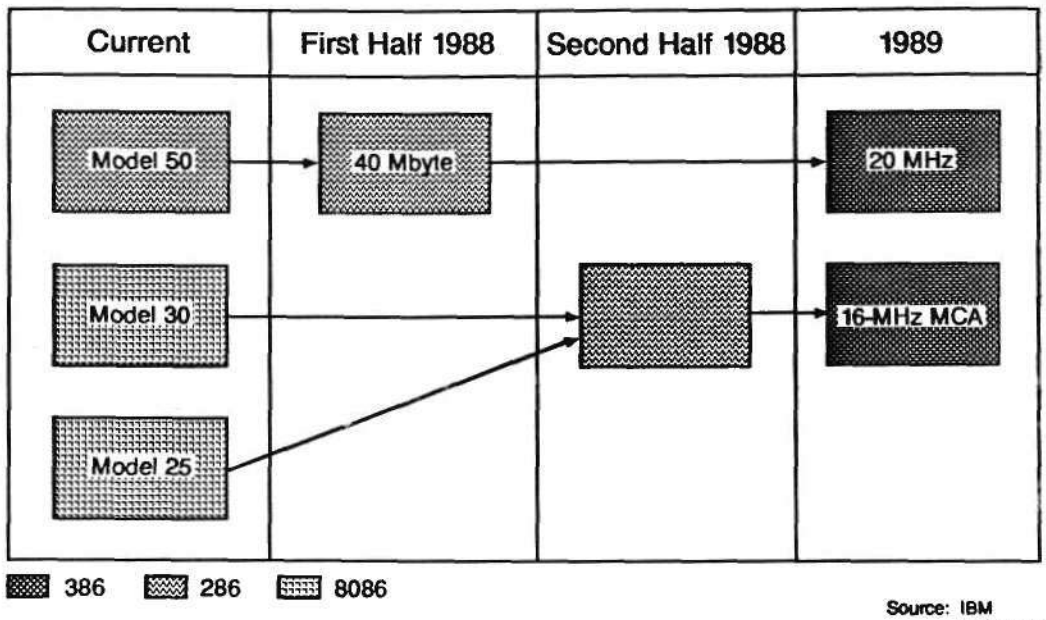
IBM PS/2 PRODUCT STRATEGY



Source: IBM
Dataquest

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DATAQUEST PREDICTS: COMPAQ PRODUCT STRATEGY FOR THE NEXT 15 MONTHS

- Introduce multiuser 80386 and 80486
- Become an OEM for 8088 and 80286 systems
- The first 80486 vendor
- Introduce an 80386-based portable (clamshell)

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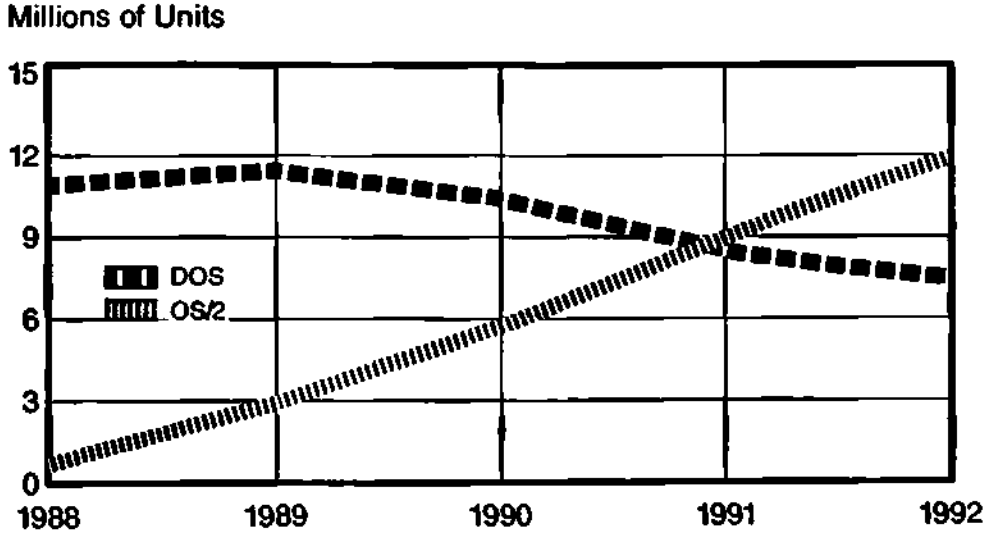
WHAT WILL 80486-BASED PCs BRING TO THE MARKET?

- 82385 integration
- Faster throughput
- Multiprocessing
- Integrated floating-point option
- $1,200 price tag for chip
- First system – Fall 1989 (Compaq)

PROJECTED WORLDWIDE OPERATING SYSTEM SHIPMENTS



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[illegible]

EXTENDED INDUSTRY SYSTEM ARCHITECTURE (EISA)

- Compete with IBM's micro channel (MCA)
- Compatible with existing AT bus, 80386, 80486
- Microsoft involved
- Features:
  - 32-bit address and data bus extension
  - 32-bit direct memory access
  - 32-bit bus-master support
  - Programmable board setup

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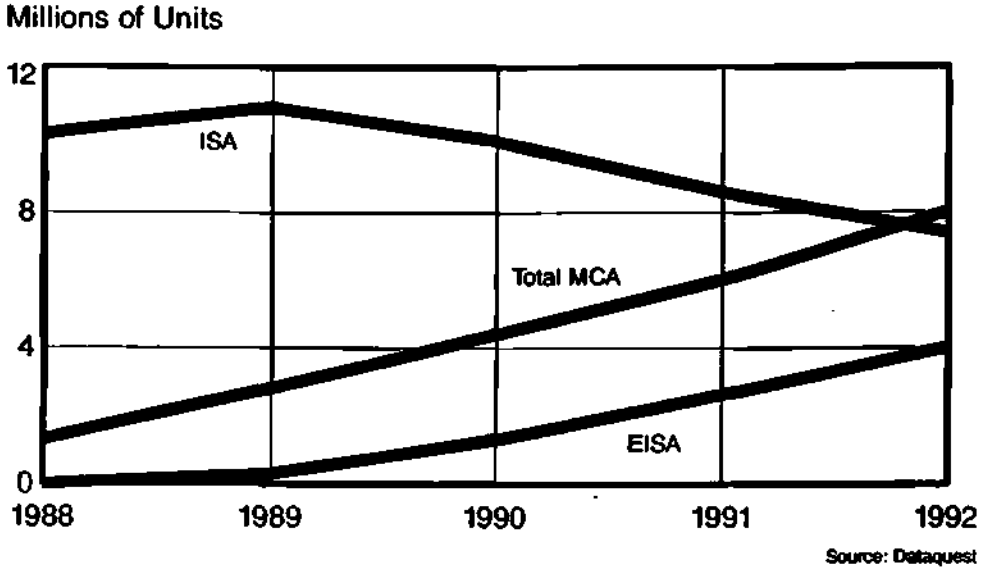
WORLDWIDE PC SHIPMENT FORECAST BY BUS TYPE



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ASIAN PC OPPORTUNITIES

- Asian market opportunities
- 1989 PC purchasing plans
- Asian PC device market opportunities

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ASIAN MARKET OPPORTUNITIES

- Not easy to sell total systems to the Asian market
  - Price
  - Native language application software
- Opportunities exist in providing key components to system vendors
  - Memories
  - ASICs
  - Microprocessors -- RISC and CISC
  - Chip sets

Source: ERSO

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WHAT PERCENTAGE OF PCs TO BE PURCHASED IN THE NEXT 12 MONTHS WILL BE THE FOLLOWING?

80386-based	34.5%
80286-based	47.9%
8088/8086-based	10.0%
680XX-based	2.8%
Other	4.8%

Source: Dataquest

ASIAN PC DEVICE MARKET OPPORTUNITIES

(Millions of U.S. Dollars)

	1988	1991	CAGR
DRAMs	$ 850	$1,320	15.8%
Micros	460	530	4.8%
ASIC	300	590	25.3%
Standard Logic	70	50	(10.6%)
Chip Sets	90	440	69.7%
Total	$1,770	$2,930	18.3%

Source: Dataquest

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DATAQUEST CONCLUSIONS:

- The IBM-compatible market is still strong
- End users are moving to 80286- and 80386-based systems
- The dealer channel is still king
- MCA: The Missouri Syndrome
- Will Compaq drive the industry?
- Asia will produce 26% of all PCs worldwide by 1991

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