European Semiconductor Industry Conference

June 3–5, 1992
Jurys Hotel
Dublin, Ireland

Dataquest Europe Limited
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Denham, Uxbridge, Middx UB9 5HP
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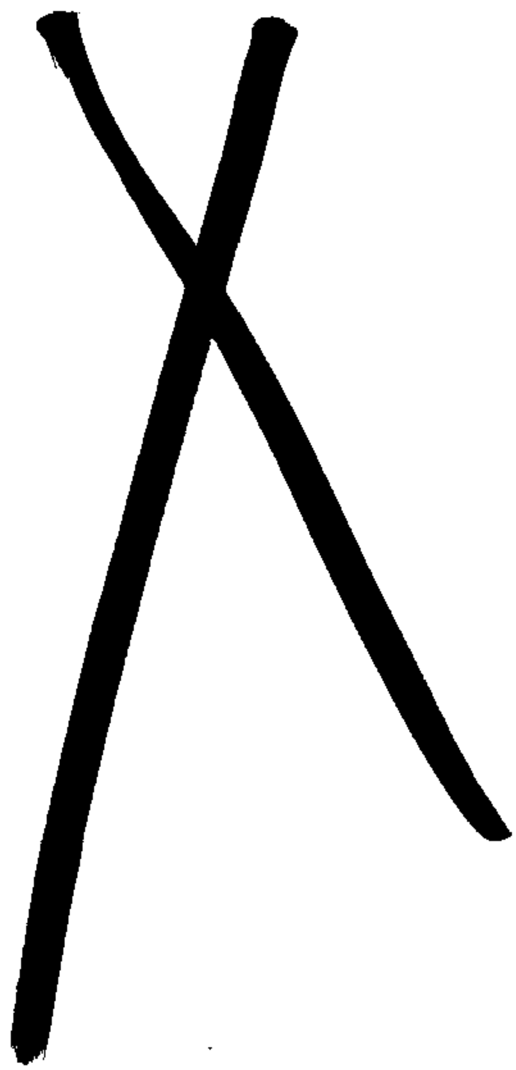

1992 EUROPEAN SEMICONDUCTOR INDUSTRY CONFERENCE

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Dublin, Ireland

WEDNESDAY, June 3
DATAQUEST'S FORECASTS AND ANALYSIS

1200 to 1400	**Registration**	*Ball Room Foyer*
1400	**Welcome and Conference Introduction** Bipin Parmar Group Director European Semiconductors and Conference Chairman Dataquest Europe Limited	*Ball Room*
1415	**Welcome to Ireland** Desmond O'Malley Minister of Industry and Commerce	*Ball Room*
1430	**Semiconductor Market Forecast and Market Share Analysis** Jim Eastlake/Mike Glennon/Byron Harding European Semiconductor Group Dataquest Europe Limited	*Ball Room*
1515	**Results of the 1991 European Procurement Survey** Bipin Parmar Group Director European Semiconductors and Conference Chairman Dataquest Europe Limited	*Ball Room*
1530	**Coffee Break**	*Ball Room Foyer*
1600	**Investing in Electronics** Dan Flinter Executive Director Industrial Development Authority of Ireland	*Ball Room*
1630	**Semiconductor Distribution in the '90s** Gary Kibblewhite Managing Director Europartners Consultancy	*Ball Room*
1700	**Strategic End-User Trends** Bipin Parmar Group Director European Semiconductors and Conference Chairman Dataquest Europe Limited	*Ball Room*
1730	**Close**	
1930	**Cocktails**	*Ball Room Foyer*
2000	**Dinner** **Evening sponsored by the Industrial Development Authority of Ireland**	*Ball Room*

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THURSDAY, June 4

EMERGING APPLICATIONS AND TECHNOLOGIES

0900 **Introduction** . . . . . *Ball Room*
Byron Harding
Industry Analyst
European Semiconductor Group
Dataquest Europe Limited

0915 **PC Cards** . . . . . *Ball Room*
John Reimer
Chairman and President
PC Memory Card International Association

0945 **Personal Communications** . . . . . *Ball Room*
Dean Eyers
Industry Analyst
European Telecommunications Group
Dataquest Europe Limited

1005 **Videophones** . . . . . *Ball Room*
Jeffrey Goldberg
Industry Analyst
European Document Management Group
Dataquest Europe Limited

1030 **Coffee Break** . . . . . *Ball Room Foyer*

ENABLING TECHNOLOGIES

1100 **Flash Memory Revolutionizes Portable Computing** . . . . . *Ball Room*
Anthony G. Barre
Director of Strategic Planning
Memory Components Division
Intel Corporation

1130 **Fuzzy Logic** . . . . . *Ball Room*
Professor A. J. van der Wal
Manager
European Technical Centre
Omron Electronics Europe BV

1200 **Lunch** . . . . . *Elm and Oak Room*

PRODUCT MARKETS ANALYSIS—LOGIC

1345 **Introduction** . . . . . *Ball Room*
Mike Glennon
Senior Industry Analyst
European Semiconductor Group
Dataquest Europe Limited

1400 **Is Standard Logic Dead?** . . . . . *Ball Room*
Glenn Louch
Director
Standard Products Division
National Semiconductor Europe

1430 **Future Trends in General Purpose Logic** . . . . . *Ball Room*
Peter Dennstedt
Manager
European General Purpose Logic
Texas Instruments Europe

1500 **Coffee Break** . . . . . *Ball Room Foyer*

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1530 **PANEL SESSION 1: Evolution of Semiconductor Procurement** .... *Ball Room*

Chairman: *Mark Giudici*
Director and Principal Analyst
Semiconductor Procurement Service
Dataquest Incorporated
John Hudson
European Regional Supply Base Manager
Apple Computer Ltd.
Keith Williams
European Managing Director
Avnet EMG
Earl Kitchen
Purchasing Manager
GEC Plessey Telecoms
Klaus Wangerin
Director
European Procurement
Sony Europa GmbH

1530 **PANEL SESSION 2: Semiconductor Manufacturing in Europe** .... *Elm and Oak Room*

Chairman: *Bipin Parmar*
Group Director European Semiconductors
and Conference Chairman
Dataquest Europe Limited
Thomas E. Hartman
General Manager
Ireland Components Manufacturing
Intel Corporation
George Bennett
Vice President and General Manager
MOS Memory and Microprocessor Division (Europe)
Motorola Ltd.
Larry Murtagh
Managing Director
NEC Semiconductors Ireland Ltd.
Laurent Bosson
Corporate Vice President
Manufacturing
SGS-Thomson

1700 **Panel Session Adjourns**

1730 **Depart for Intel Fab Tour** .... *Outside Main Entrance*
1930 **Return**

1945 **Cocktail Reception** .... *The Chapel, The Royal Hospital, Kilmainham*
2030 **Dinner (black tie optional)** .... *The Great Hall, The Royal Hospital*
and European Vendor of the Year Awards

(over)

FRIDAY, June 5

EXECUTIVE ISSUES: THE SEMICONDUCTOR INDUSTRY

0900 **Introduction** .... *Ball Room*
Jim Eastlake
Senior Industry Analyst and Manager
European Semiconductor Group
Dataquest Europe Limited

0915 **Future Trends in LCD Markets and Technologies** .... *Ball Room*
Isamu Washizuka
Corporate Director
Sharp Electronics Europe GmbH

0945 **Achieving Critical Mass Through Industrial Cooperation** .... *Ball Room*
Giulio Cesare Grata
Director of Microelectronics DGXIII
European Commission

1015 **Coffee Break** .... *Ball Room Foyer*

1045 **Introduction** .... *Ball Room*
Bipin Parmar
Group Director European Semiconductors
and Conference Chairman
Dataquest Europe Limited

1050 **Horizontal Integration in Europe** .... *Ball Room*
Guy Dumas
Matra-MHS Honorary President
Representative of the Telefunken
Electronic Group for European Affairs

1120 **Riding the Second Wave in Europe** .... *Ball Room*
Hans Geyer
Director and General Manager
Intel Europe

1150 **How to Safeguard Europe's High-Technology Future** .... *Ball Room*
Heinz W. Hagmeister
Chairman and CEO
Philips Semiconductors International BV

1220 **Closing Remarks** .... *Ball Room*
Bipin Parmar

1230 **Conference Adjourns**
Lunch .... *Elm and Oak Room*

EUROPEAN SEMICONDUCTOR INDUSTRY CONFERENCE 1992
EVALUATION QUESTIONNAIRE

Dublin, Ireland
June 3–5, 1992

Thank you for attending our European Semiconductor Industry Conference. Would you please assist us in planning our next conference by completing and returning this questionnaire.

1. Please rate each presentation on a scale of 1 to 10 (where 10 is highest in terms of your approval):

	CONTENT (1 to 10)	DELIVERY (1 to 10)	COMMENTS (Use reverse side if necessary)
European Semiconductor Market Overview:			
Eastlake			
Glennon			
Harding			
Flinter, Investing in Electronics			
Kibblewhite, Semiconductor Distribution in the '90s			
Parmar, Strategic End-User Trends			
Reimer, PC Cards			
Eyers, Personal Communications			
Goldberg, Videophones			
Barre, Flash Memory Revolutionizes Portable			
van der Wal, Fuzzy Logic			
Louch, Is Standard Logic Dead?			
Dennstedt, Future Trends in General Purpose Logic			
PANEL SESSION 1:			
Evolution of Semiconductor Procurement			
Giudici			
Hudson			
Williams			
Kitchen			
Wangerin			
PANEL SESSION 2:			
Semiconductor Manufacturing in Europe			
Hartman			
Bennett			
Murtagh			
Bosson			

(over)

	CONTENT (1 to 10)	DELIVERY (1 to 10)	COMMENTS (Use reverse side if necessary)
Washizuka, Future Trends in LCD Markets	______	______	______________________
Grata, Achieving Critical Mass	______	______	______________________
Dumas, Horizontal Integration in Europe	______	______	______________________
Geyer, Riding the Second Wave in Europe	______	______	______________________
Hagmeister, How to Safeguard Europe's	______	______	______________________

2. Overall meeting rating (1 to 10) ______

3. What did you like most about the conference? ______________________

4. In what areas do you think our conference could be improved? ______________________

5. At our next industry conference, would you prefer more ______ or fewer ______ Dataquest speakers?

6. Suggestions for the theme for next year's European Semiconductor Industry Conference: ______________________

7. Do you prefer the current three-day conference format? Yes ______ No ______

   Comments: ______________________

8. Would you prefer a full two-day conference (example: ALL day Thursday and Friday) versus a two-day conference agenda spread over three days? Yes ______ No ______

9. How would you rate the conference facilities (1 to 10)?

   Location ______ Guest Rooms ______ Meals ______ Meeting Rooms ______

10. How would you rate the Dataquest registration staff (1 to 10)?

    Courtesy ______ Efficiency ______

11. Which of the following locations would you prefer for the 1993 Dataquest European Semiconductor Industry Conference?

    Düsseldorf ______ Frankfurt ______ Other (Please indicate) ______

12. Comments: ______________________

Name and Company (optional) ______________________

Please hand this form to a member of Dataquest's staff.

FOR SPEAKER QUESTIONS

Name of speaker: ______________________________

Title of speech: ______________________________

If you have any questions, please write them down in the space provided below. A Dataquest representative will collect them at the end of the presentation.

No. 1: ______________________________

No. 2 ______________________________

EUROPEAN SEMICONDUCTOR INDUSTRY CONFERENCE

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List of Attendees by Name

Raymond Ambrose	SGS-Thomson Microelectronics Ltd
P. Anders	Samsung Semiconductor Europe GmbH
Gian Carlo Andra	Ing. C. Olivetti & C. SpA
Dave Angel	Information Storage Devices
Willi Bacher	First Components GmbH
Paul Andrew Baker	Hyundai Semiconductor
Giovanni Barbati	Finmeccanica
Anthony G. Barre	Intel Corporation
Daniel J. Barrett	Cypress Semiconductor
Glenn Bartzsch	Eastman Kodak Company
George Bennett	Motorola Ltd
Gunter A. Berner	Sharp Electronics (Europe) GmbH
John Berry	Toshiba Electronics (UK) Ltd
Gerhard Beuttler	IBM
Alfred Borsig	Toshiba Electronics Europe GmbH
Laurent Bosson	SGS-Thomson Microelectronics
Bill Brandon	IDA Ireland
John Brothers	GEC Plessey Semiconductors
Robert Brown	Sony (UK) Ltd
David Brown	LTX (Europe) Ltd
Abhi Budhwar	Canon Europa NV
Sergio Castaldi	Hitachi Europe GmbH
Keith Chapple	Intel Corporation (UK) Limited
Jacques Cheviron	Alcatel Business Systems
Robert Dailey	Samsung Semiconductor Europe GmbH
Hans De Haan	VLSI Technology GmbH

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Jurgen Dietz	Advantest (Europe) GmbH
Walter Dittrich	IBM Germany
Guy Dumas	Matra Harris Semiconductor
Doug Dunn	GEC Plessey Semiconductors
Jim Eastlake	Dataquest Europe Ltd
John Evans	Johnson Matthey
Dean Eyers	Dataquest Europe Ltd
Dave Farrar	Hoya Europe BV
Frederic Fassot	Electronique International Hebdo
Peter W. Frey	Telefunken Electronic GmbH
Robert Funcke	Meissner & Wurst Gmbh
Masao Furuya	Mitsubishi Electric Europe
Marie Noelle Gachet	Ministère de l'Industrie
John Gearing	Sony (UK) Ltd
Hans Geyer	Intel GmbH
Jurgen Giessmann	Meissner & Wurst GmbH
Mark Giudici	Dataquest Incorporated
Raymond Gleason	GEC Plessey Semiconductors
Mike Glennon	Dataquest Europe Ltd
Jeffrey Goldberg	
Heinz W. Hagmeister	Philips Semiconductors International BV
John Hannah	Hitachi Europe
Paul Hanron	IDA Ireland
Masatoshi Harada	Nissin Electric Co. Ltd
Byron Harding	Dataquest Europ Ltd
Tom Hartman	Intel
Tom Hartmann	Intel GmbH
Ruell Harwig	Siemens AG
Brian Heap	Kyocera Fineceramics Ltd
Heinz Heumann	NEC
Sugai Hidesuke	Mitsubishi Electric Europe GmbH
O. Hintringer	Siemens AG, Semiconductor Group
Heiner Hirsch	Texas Instruments

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Steven T. W. Huang	UMC (Europe) BV
John Hudson	Apple Computer Ltd
H. Izumi	Toshiba Electronics (UK) Ltd
James Jarrett	Intel
Pat Jefferson	Mitsubishi Electric UK
Kenneth Jones	Sony Semiconductor Europe
Y. Kato	Sony Semiconductor Europe Ltd
Earl Kitchen	GPT Telecomunications Systems Group
Werner Koepf	European Silicon Structures GmbH
Takashi Komiya	Daiwa Institute of Research
Marco Landi	Texas Instruments
Thomas Lane	NEC Electronics
Robert Lennox	Fagor Electronica
S. Loe	Electronic World News
Glenn Louch	National Semiconductor (UK) Ltd
Dave Manners	Electronics Weekly
Cliff Marks	National Semiconductor (UK) Ltd
Alfred Marmann	Harris Semiconductor - Europe
Hikotaro Masunaga	Fujitsu Mikroelektronik GmbH
Noel Matthews	Meissner & Wurst ATS Ltd
Alan Matthews	Xilinx Ltd
C. McAneny	Toshiba Electronics (UK) Ltd
Martin Mitchell	International Herald Tribune
Larry Murtagh	NEC Semiconductors Ireland Ltd
Dr. Y. Nakajima	Sharp Laboratories of Europe Ltd
Brian Nash	Johnson Matthey
Robert Nikolai	Goldstar Electron
Jean-Jacques Novelli	Serete Industries
Caitriona O'Kennedy	IDA Ireland
Robin Paling	Toshiba Electronics Europe GmbH
Bipin Parmar	Dataquest Europe Ltd
Sylvie Pheulpin	Schlumberger ATE Division
Nick Phillon	LSI Logic GmbH

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Ernest Pusey	GEC Plessey Semiconductors
Barbara Rash	Intel GmbH
John Reimer	SunDisk
Niall M. Reynolds	Intel Ireland Ltd
Andy Rosenbaum	Electronics Magazine
Dicken Ross	European Semiconductor
Robert Samsinger	IBM - Europe
A. Sasaki	Sharp Electronics (Europe) GmbH
Dan Sattler	Eastman Kodak Company
Arthur Sidorsky	Standard Microsystems Corporation
Mike Solomon	BOC Ltd
Jonghoon Song	Goldstar Electron
William J. Stypa	Standard Microsystems Corporation
Kevin Taylor	Digital Equipment Co. Limited
Pieter Te Booy	Philips Semiconductors
Ted Terushima	Hoya Europe BV
Waldo Thorn	SGS-Thomson Microelectronics Ltd
Matthew Trowbridge	Hitachi Europe
Gabriel van Cauwenberge	Alcatel Bell Telephone
Arien J. van der Wal	Omron
Eduord Voorn	Automatisering Gids
Barry Waite	Motorola Inc.
Adrian Walker	Hitachi Europe
John Walsh	IDA Ireland
Klaus Wangerin	Sony Europa GmbH
I. Washizuka	Sharp
Ian White	Intel Ireland Ltd
Keith Williams	Avnet Access Ltd
David Wollen	Dialog Semiconductor Ltd
Klaus Wustrack	Intel GmbH
Ed Wynne	Eastman Kodak Company
Gunter Ziegenbalg	ZMD GmbH

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EUROPEAN SEMICONDUCTOR INDUSTRY CONFERENCE

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List of Attendees by Company

Advantest (Europe) GmbH	Jurgen Dietz
Alcatel Bell Telephone	Gabriel van Cauwenberge
Alcatel Business Systems	Jacques Cheviron
Apple Computer Ltd	John Hudson
Automatisering Gids	Eduord Voorn
Avnet Access Ltd	Keith Williams
BOC Ltd	Mike Solomon
Canon Europa NV	Abhi Budhwar
Cypress Semiconductor	Daniel J. Barrett
Daiwa Institute of Research	Takashi Komiya
Dataquest Europe Ltd	Dean Eyers
	Jeffrey Goldberg
	Jim Eastlake
	Mike Glennon
	Byron Harding
	Bipin Parmar
Dataquest Incorporated	Mark Giudici
Dialog Semiconductor Ltd	David Wollen
Digital Equipment Co. Limited	Kevin Taylor
Eastman Kodak Company	Glenn Bartzsch
	Dan Sattler
	Ed Wynne
Electronic World News	S. Loe
Electronics Magazine	Andy Rosenbaum
Electronics Weekly	Dave Manners
Electronique International Hebdo	Frederic Fassot

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European Semiconductor	Dicken Ross
European Silicon Structures GmbH	Werner Koepf
Fagor Electronica	Robert Lennox
Finmeccanica	Giovanni Barbati
First Components GmbH	Willi Bacher
Fujitsu Mikroelektronik GmbH	Hikotaro Masunaga
GEC Plessey Semiconductors	John Brothers
	Doug Dunn
	Raymond Gleason
	Ernest Pusey
Goldstar Electron	Robert Nikolai
	Jonghoon Song
GPT Telecomunications Systems Group	Earl Kitchen
Harris Semiconductor - Europe	Alfred Marmann
Hitachi Europe	John Hannah
	Matthew Trowbridge
	Adrian Walker
Hitachi Europe GmbH	Sergio Castaldi
Hoya Europe BV	Dave Farrar
	Ted Terushima
Hyundai Semiconductor	Paul Andrew Baker
IBM	Gerhard Beuttler
IBM - Europe	Robert Samsinger
IBM Germany	Walter Dittrich
IDA Ireland	Bill Brandon
	Paul Hanron
	Caitriona O'Kennedy
	John Walsh
Information Storage Devices	Dave Angel
Ing. C. Olivetti & C. SpA	Gian Carlo Andra
Intel	Tom Hartman
	James Jarrett
Intel Corporation	Anthony G. Barre

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Intel Corporation (UK) Limited	Keith Chapple
Intel GmbH	Hans Geyer
	Tom Hartmann
	Barbara Rash
	Klaus Wustrack
Intel Ireland Ltd	Niall M. Reynolds
	Ian White
International Herald Tribune	Martin Mitchell
Johnson Matthey	John Evans
	Brian Nash
Kyocera Fineceramics Ltd	Brian Heap
LSI Logic GmbH	Nick Phillon
LTX (Europe) Ltd	David Brown
Matra Harris Semiconductor	Guy Dumas
Meissner & Wurst ATS Ltd	Noel Matthews
Meissner & Wurst Gmbh	Robert Funcke
	Jurgen Giessmann
Ministère de l'Industrie	Marie Noelle Gachet
Mitsubishi Electric Europe	Masao Furuya
Mitsubishi Electric Europe GmbH	Sugai Hidesuke
Mitsubishi Electric UK	Pat Jefferson
Motorola Inc.	Barry Waite
Motorola Ltd	George Bennett
National Semiconductor (UK) Ltd	Glenn Louch
	Cliff Marks
NEC	Heinz Heumann
NEC Electronics	Thomas Lane
NEC Semiconductors Ireland Ltd	Larry Murtagh
Nissin Electric Co. Ltd	Masatoshi Harada
Omron	Arien J. van der Wal
Philips Semiconductors	Pieter Te Booy
Philips Semiconductors International BV	Heinz W. Hagmeister

Samsung Semiconductor Europe GmbH	P. Anders
	Robert Dailey
Schlumberger ATE Division	Sylvie Pheulpin
Serete Industries	Jean-Jacques Novelli
SGS-Thomson Microelectronics Ltd	Raymond Ambrose
	Waldo Thorn
SGS-Thomson Microelectronics	Laurent Bosson
Sharp	I. Washizuka
Sharp Electronics (Europe) GmbH	Gunter A. Berner
	A. Sasaki
Sharp Laboratories of Europe Ltd	Dr. Y. Nakajima
Siemens AG	Ruell Harwig
Siemens AG, Semiconductor Group	O. Hintringer
Sony (UK) Ltd	Robert Brown
	John Gearing
Sony Europa GmbH	Klaus Wangerin
Sony Semiconductor Europe	Kenneth Jones
Sony Semiconductor Europe Ltd	Y. Kato
Standard Microsystems Corporation	Arthur Sidorsky
	William J. Stypa
SunDisk	John Reimer
Telefunken Electronic GmbH	Peter W. Frey
Texas Instruments	Heiner Hirsch
	Marco Landi
Toshiba Electronics (UK) Ltd	John Berry
	H. Izumi
	C. McAneny
Toshiba Electronics Europe GmbH	Alfred Borsig
	Robin Paling
UMC (Europe) BV	Steven T. W. Huang
VLSI Technology GmbH	Hans De Haan
Xilinx Ltd	Alan Matthews
ZMD GmbH	Gunter Ziegenbalg

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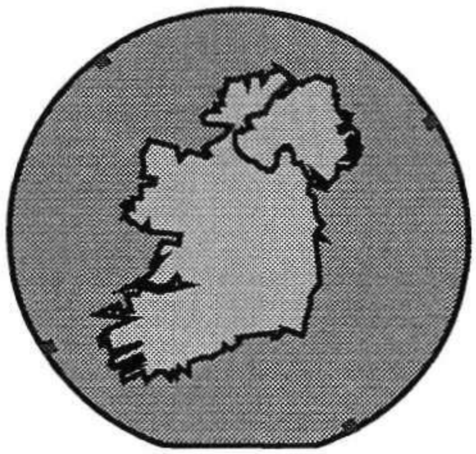
First Day



WELCOME AND CONFERENCE INTRODUCTION

Bipin Parmar
Group Director European Semiconductors
and Conference Chairman
Dataquest Europe Limited

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WELCOME AND CONFERENCE INTRODUCTION

Bipin Parmar
Group Director European Semiconductors
and Conference Chairman
Dataquest Europe Limited

Mr. Parmar is Group Director European Semiconductors (ESG) for Dataquest, based in Denham, England. Mr. Parmar has additional responsibility as Director of European Sales, Conferences and Dataquest's German operations. He has more than 15 years of experience in the electronics industry. Prior to joining Dataquest, he was European Product Marketing Manager for ASICs at Fairchild Europe Semiconductor. Earlier, he was Strategic Product Planning Manager at Fairchild, responsible for launching the FACT advanced CMOS logic family and silicon system compiler technology. His previous marketing management experience was gained at General Instrument and General Electric Company plc in microcomputer and semi-custom/custom logic. Mr. Parmar also worked as Communications Systems Engineer at Marconi based in the Middle East and Far East. He graduated in Electronics and Communications Engineering from the University of Essex, England, and has attended various Business Administration courses at the Management Centre Europe in Brussels.

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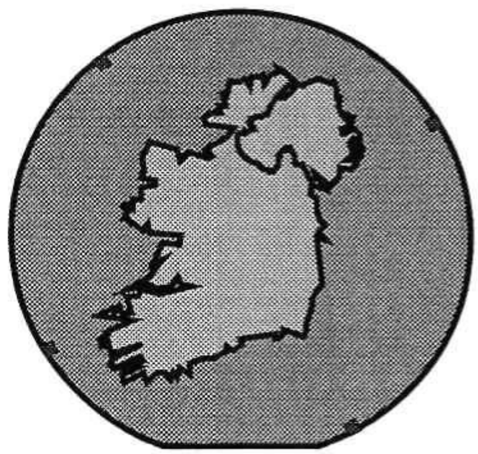

WELCOME TO IRELAND

Desmond O'Malley
Minister of Industry and Commerce

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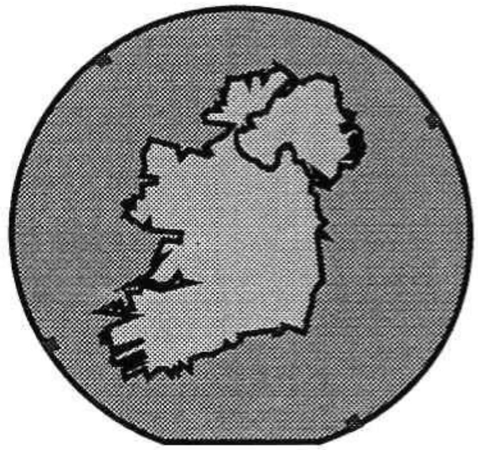

SEMICONDUCTOR MARKET FORECAST AND MARKET SHARE ANALYSIS

Jim Eastlake
Mike Glennon
Byron Harding

European Semiconductor Group
Dataquest Europe Limited

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SEMICONDUCTOR MARKET FORECAST AND MARKET SHARE ANALYSIS

Jim Eastlake
Senior Industry Analyst and Manager
European Semiconductor Group
Dataquest Europe Lmited

Mr. Eastlake is a Senior Industry Analyst and Manager of Dataquest's European Semiconductor Group (ESG) based in Denham, England. He has 12 years of experience in the electronics industry. Prior to joining Dataquest, Mr. Eastlake was with Texas Instruments' (TI) Northern European Semiconductor Division. In his most recent position at TI, he ran the European distribution program for the Linear Functions Business Group. Earlier, he managed TI's advanced bipolar logic families and was responsible for launching TI's programmable logic families and bit-slice functions in Northern Europe. He also held a product marketing position for 8- and 16-bit microprocessors and peripherals. Mr. Eastlake graduated from the University of Newcastle upon Tyne, with an honours degree in Physics.

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SEMICONDUCTOR MARKET FORECAST AND MARKET SHARE ANALYSIS

Michael Glennon
Senior Industry Analyst
European Semiconductor Group
Dataquest Europe Limited

Mr. Glennon is a Senior Industry Analyst for Dataquest's European Semiconductor Group (ESG) based in Denham, England. He has 12 years of design and marketing experience in the electronics industry. Prior to joining Dataquest, Mr. Glennon was with European Silicon Structures where he was North Europe Marketing Manager, with marketing responsibility for ASICs and ASIC design software. Before this he was with Fairchild Europe Semiconductor, responsible for the marketing and technical support for the company's advanced silicon compiler VLSI design tool. Mr. Glennon's design experience was gained while developing Fairchild's advanced CMOS logic family and also in the development of the company's VLSI system design tool. Before this he worked as an IC designer at Marconi Electronic Devices, developing design techniques, and as a member of the CODEC design team. Mr. Glennon graduated from the University of London with an honours degree in Electronic Engineering.

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SEMICONDUCTOR MARKET FORECAST AND MARKET SHARE ANALYSIS

Byron Harding
Industry Analyst
European Semiconductor Group
Dataquest Europe Limited

Mr. Harding is an Industry Analyst for Dataquest's European Semiconductor Group (ESG), based in Denham, England. He is responsible for the management of the European semiconductor market share database which tracks vendor rankings. He also manages all Dataquest's European memory market research, coordinating with analysts in Tokyo, Seoul and San Jose. In addition, Mr. Harding tracks European semiconductor booking prices and lead-times for end-user clients of standard services and consulting programs. He also keeps up to date with EC tariff and trade issues. Prior to joining Dataquest, Mr. Harding worked at the Royal Observatory, Edinburgh and more recently, worked in computer marketing. Mr. Harding received a B.Sc. degree in Mathematics and Physics from the University of Newcastle upon Tyne, England.

Dataquest Europe Limited
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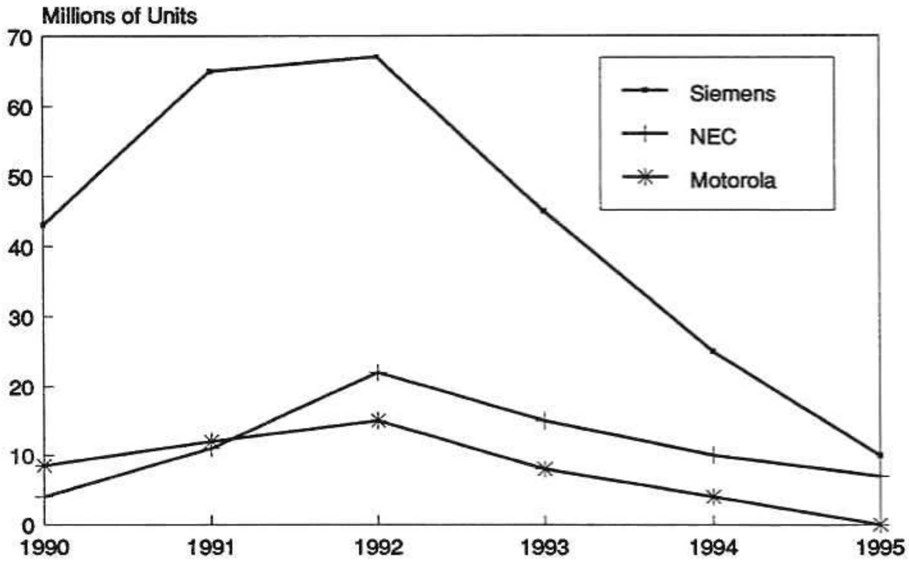
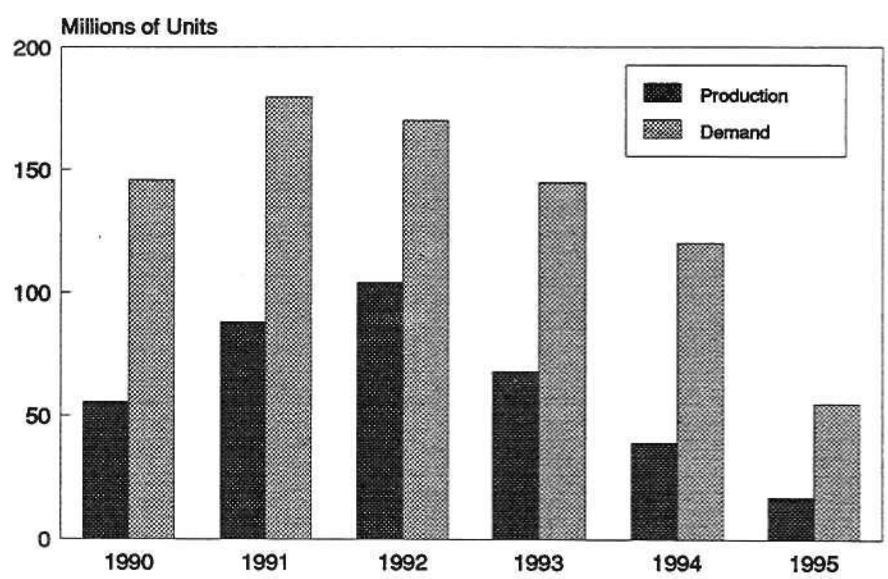
1M DRAM PRODUCTION IN EUROPE
(PROJECTION)



Source: Dataquest

1M DRAM PRODUCTION vs DEMAND IN EUROPE
(PROJECTION)



Source: Dataquest

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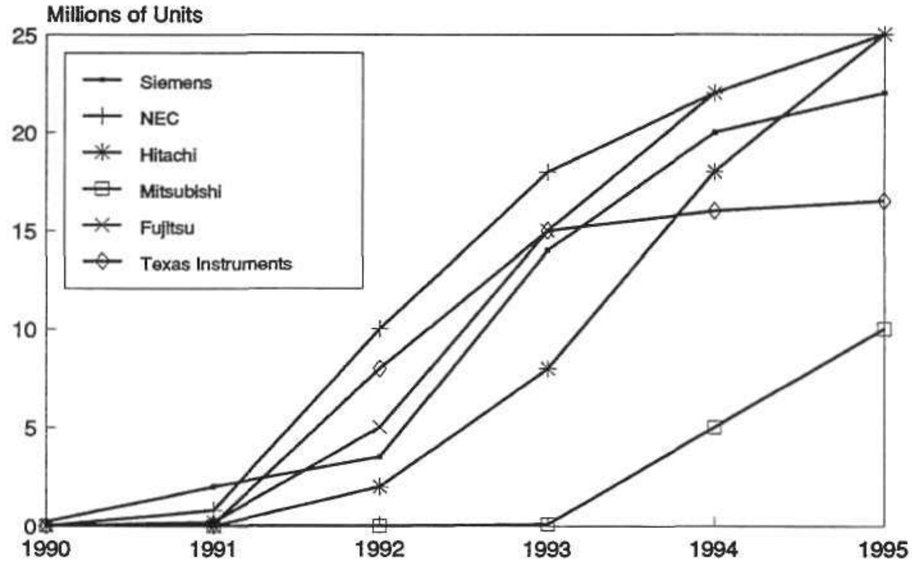
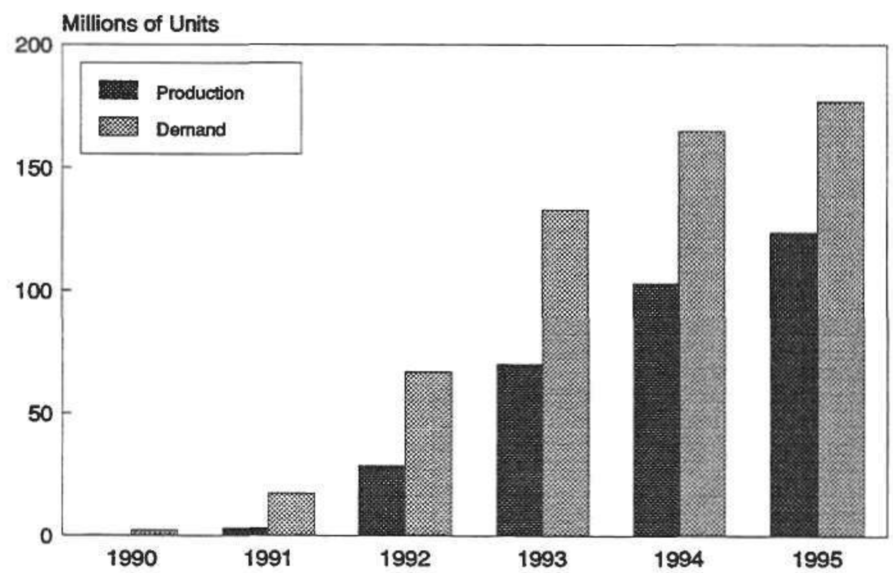
4M DRAM PRODUCTION IN EUROPE
(PROJECTION)



Source: Dataquest

4M DRAM PRODUCTION vs DEMAND IN EUROPE
(PROJECTION)



Source: Dataquest

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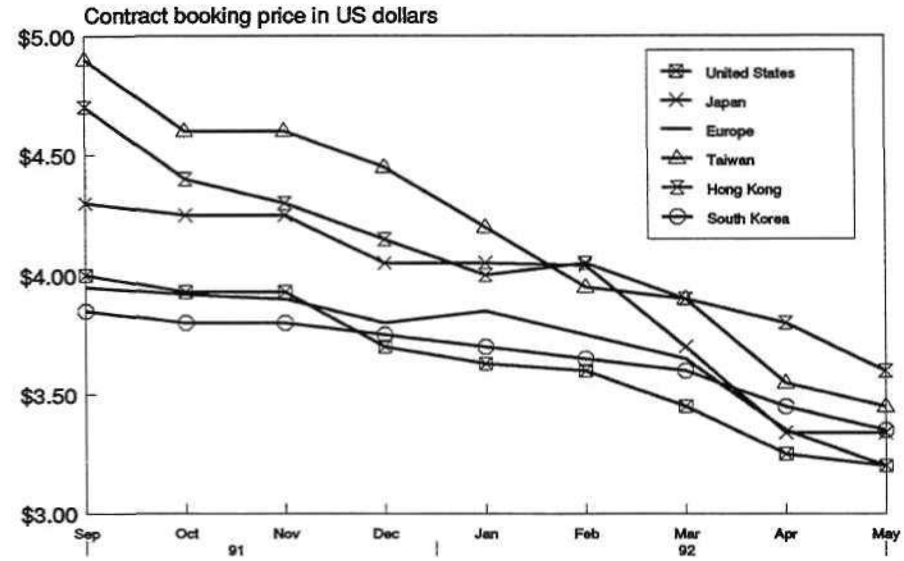
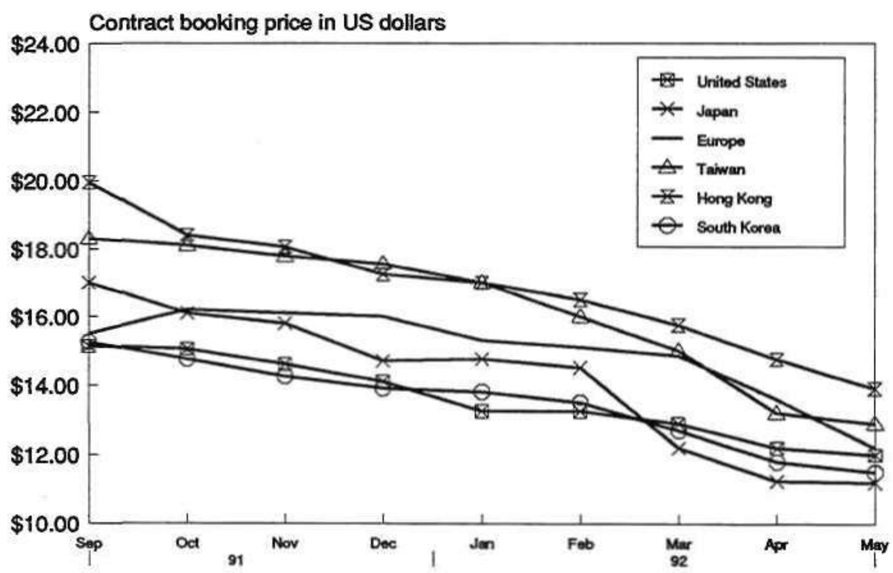
WORLDWIDE MARKET PRICES
1M (256Kx4) DRAM



Source: Dataquest

WORLDWIDE MARKET PRICES
4M (4Mx1) DRAM



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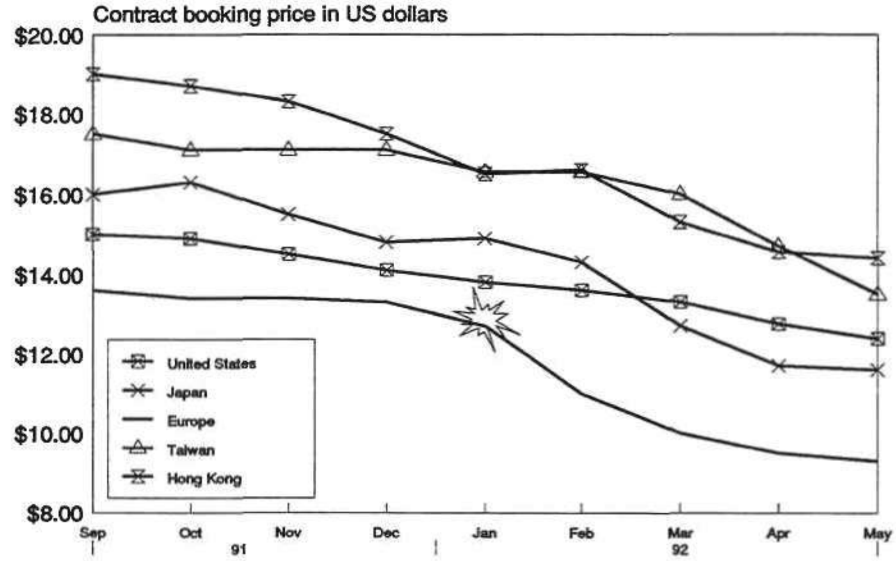
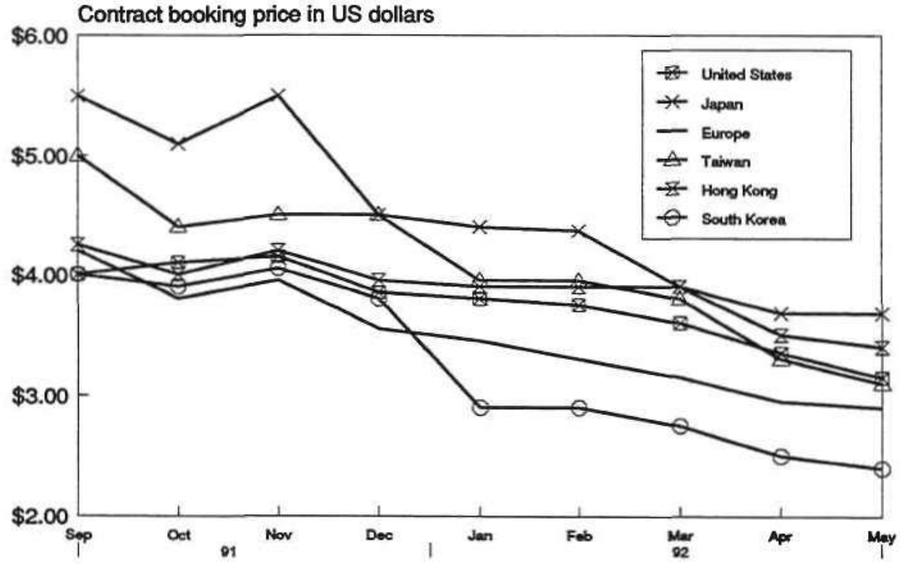
WORLDWIDE MARKET PRICES
SLOW 1M (128Kx8) SRAM



Source: Dataquest

WORLDWIDE MARKET PRICES
1M (128Kx8) EPROM



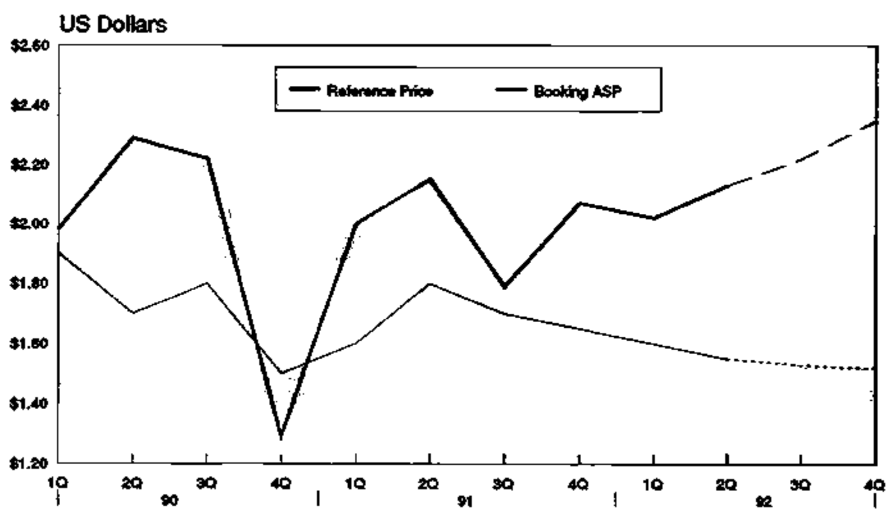
Source: Dataquest

EC ANTI-DUMPING ACTION IN MEMORY

Japanese DRAMs:	Imposed January 1990
Japanese EPROMs:	Imposed March 1991
S Korean DRAMs:	Verdict expected in June 1992

SRAMs next?

ESTIMATED EC DRAM REFERENCE PRICE versus EUROPEAN MARKET PRICE 256K DRAM



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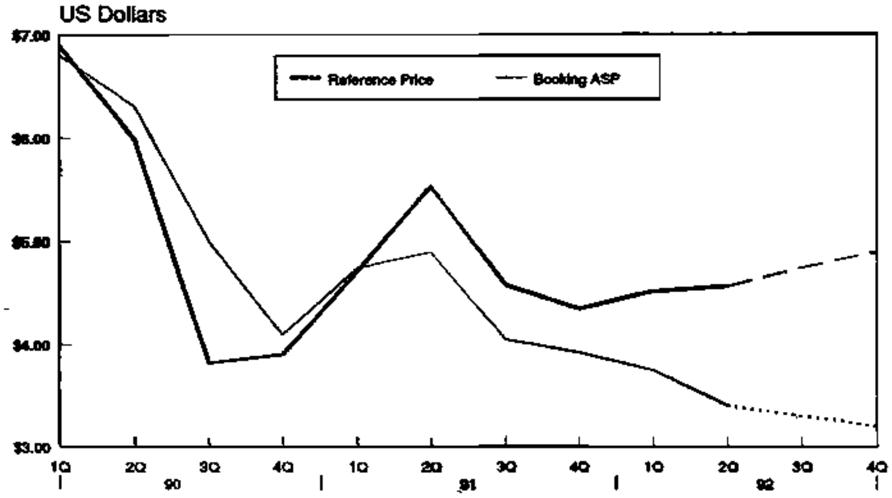
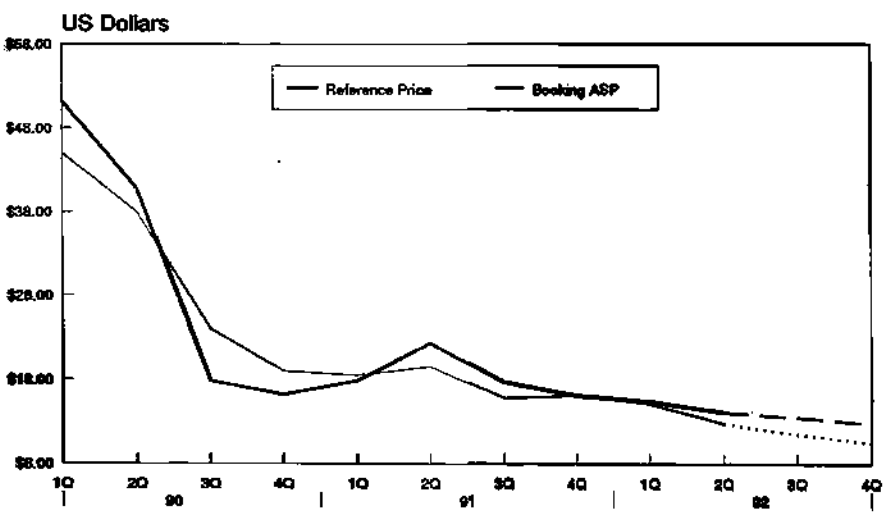
ESTIMATED EC DRAM REFERENCE PRICE versus EUROPEAN MARKET PRICE 1M DRAM



Source: Dataquest

ESTIMATED EC DRAM REFERENCE PRICE versus EUROPEAN MARKET PRICE 4M DRAM



Source: Dataquest

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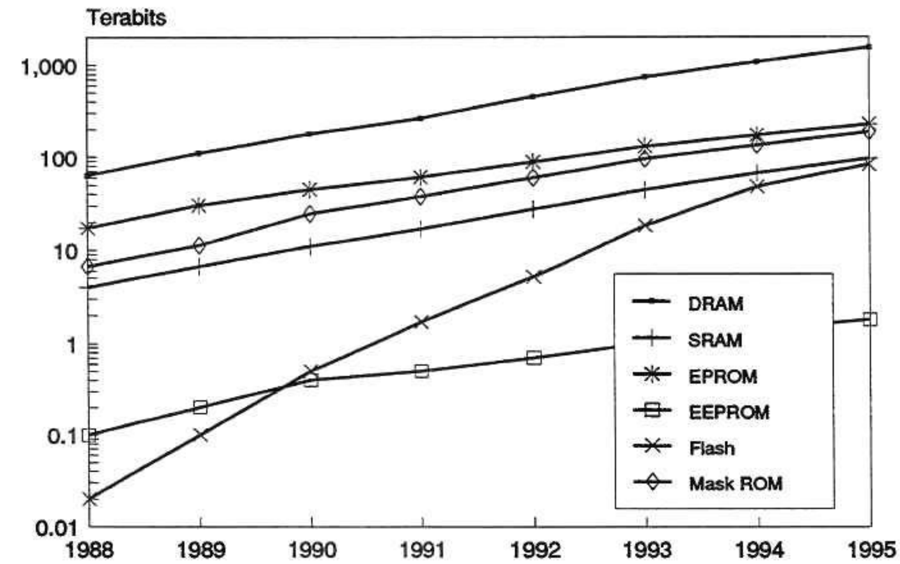
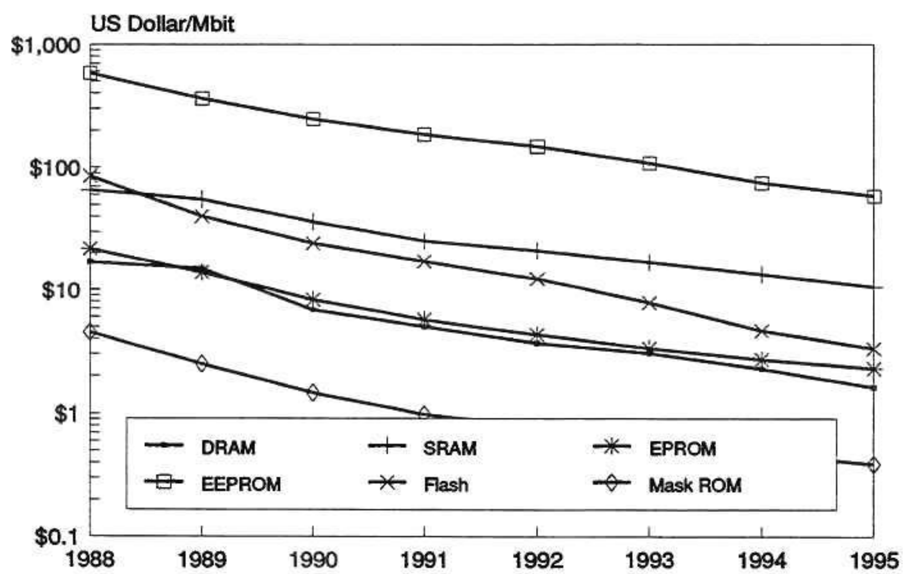
EUROPEAN MOS MEMORY CONSUMPTION
(Bit CONSUMPTION)



Source: Dataquest

EUROPEAN MOS MEMORY PRICE/Mbit
(AVERAGED ACROSS ALL DENSITIES)



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FLASH MEMORY PRODUCT ANNOUNCEMENTS

	1M	2M	4M	8M	16M
Intel	4/89	6/90	1/92	4/92	4/93
AMD	9/90	4/91		1/93	9/93
Toshiba	11/90		9/91		6/93
Hitachi	9/90		3/92		
Atmel	9/90				
Samsung				3/93	
SGS-Thomson	1/92		9/93		3/93
WSI					
SEEQ	6/89		6/93		
Mitsubishi	9/90		1/93		8/93
Catalyst	3/91				

Source: Dataquest

FLASH MEMORY PRODUCT ANNOUNCEMENTS

	1M	2M	4M	8M	16M
NEC	1/91		3/92		6/93
Fujitsu	1/93		6/93		12/93
Texas Inst.	1/91		1/93		1/95
NMB				1/95	1/95
Cypress	9/92		3/93		9/93
Sharp				1/95	3/95
Vitelic			9/93		
Hualon			9/93		
Macronix					9/95
Oki			3/93		3/94
TSMC				3/93	1/94

Source: Dataquest

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EUROPEAN SEMICONDUCTOR MARKET

(Millions of ECU)

	1991	1992	% AGR	1996	% CAGR
MOS					
Memory	1,787	2,000	11.9	3,584	14.9
Microcomponent	1,701	1,929	13.4	3,167	13.2
Logic	1,366	1,463	7.1	2,455	12.4

Source: Dataquest

AGENDA

- European market share
- European market analysis
  - Products and applications
- Vendor analysis
- European market analysis
  - Regions
- Closing remarks

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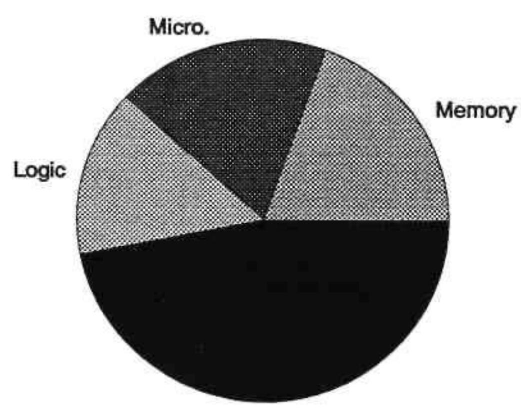
FORECAST ANALYSIS

- Products
- Applications
- Countries

EUROPEAN SEMICONDUCTOR MARKET
PRODUCT SHARE



1991 Product Share

Source: Dataquest

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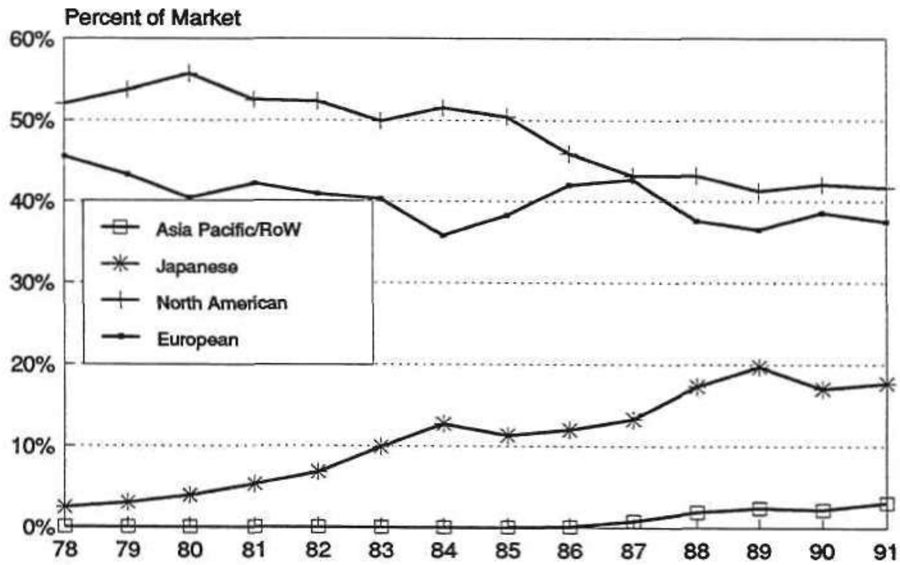
PRELIMINARY EUROPEAN MARKET SHARE RANKINGS 1991

(Millions of US Dollars)

1990 Rank	1991 Rank	Name	1991 Revenue	91/90 % Growth
1	1	Philips	1,172	1.5
2	2	Siemens	958	-0.6
3	3	SGS-Thomson	887	-2.3
4	4	Motorola	770	0.7
6	5	Intel	760	22.2
5	6	Texas Instruments	629	-1.3
7	7	Toshiba	509	3.9
8	8	NEC	452	8.4
9	9	National Semiconductor	408	0.0
10	10	Hitachi	318	16.5

Source: Dataquest

PRELIMINARY EUROPEAN MARKET SHARE BY SUPPLIER BASE REGION



Source: Dataquest

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AGENDA

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  - Products and applications
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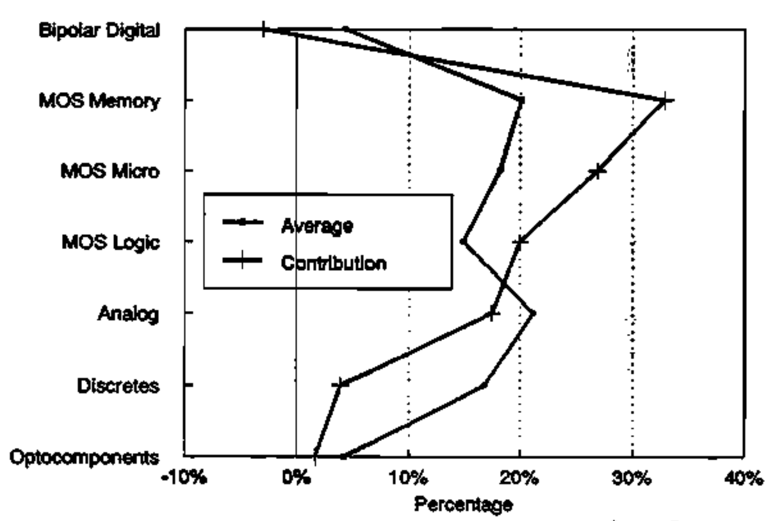
  - Regions
- Closing remarks

PORTFOLIO ANALYSIS
EUROPEAN PRODUCT SPLIT



Source: Dataquest

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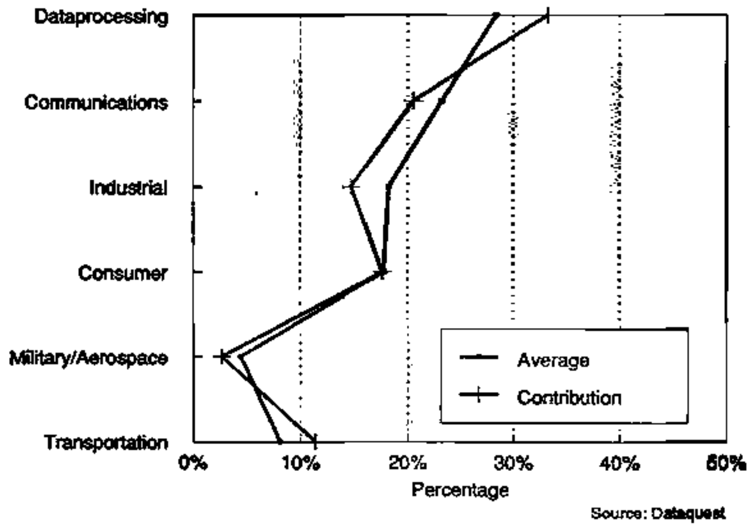
PORTFOLIO ANALYSIS
EUROPEAN APPLICATIONS SPLIT



MARKET SHARE ANALYSIS

- Europeans: Philips, Siemens, SGS-Thomson
- United States: Motorola, Intel, Texas Instruments
- Japanese: Toshiba, NEC, Hitachi

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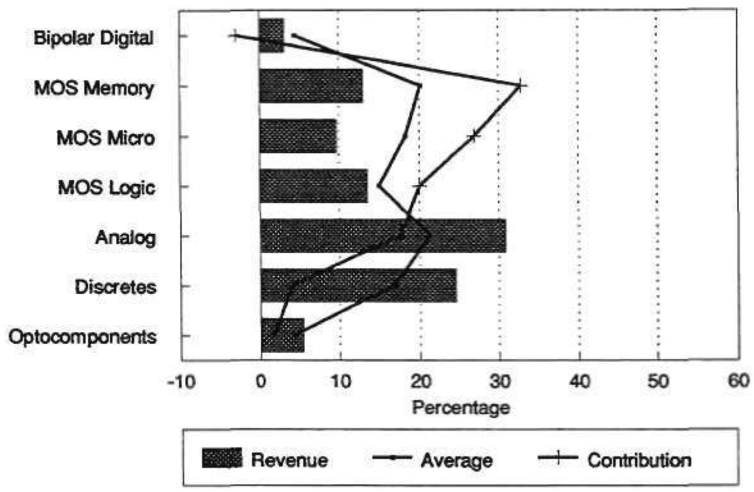
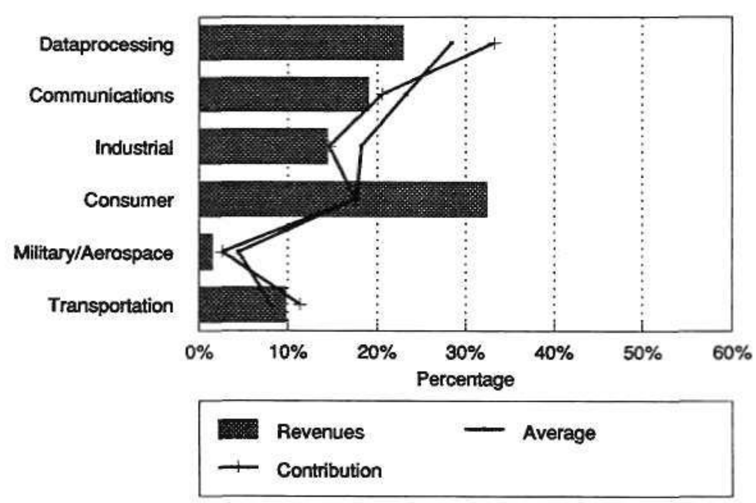
EUROPEAN COMPANIES PORTFOLIO ANALYSIS
EUROPEAN PRODUCT SPLIT



Source: Dataquest

EUROPEAN COMPANIES PORTFOLIO ANALYSIS
EUROPEAN APPLICATIONS SPLIT



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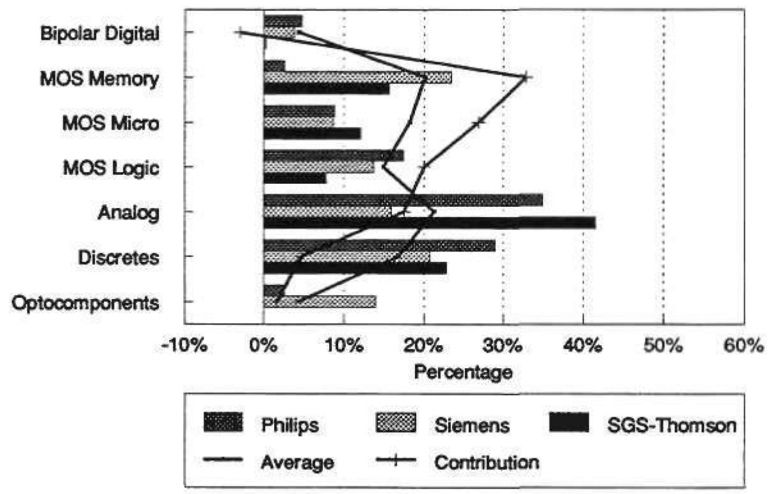
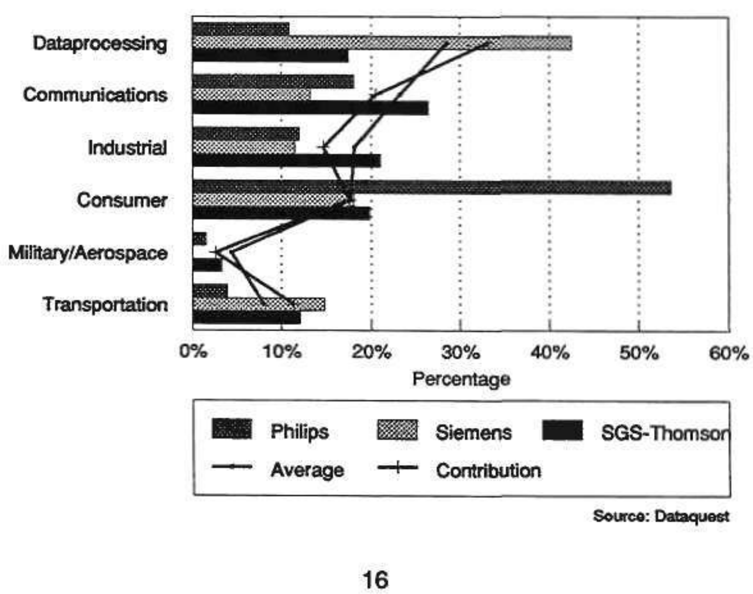


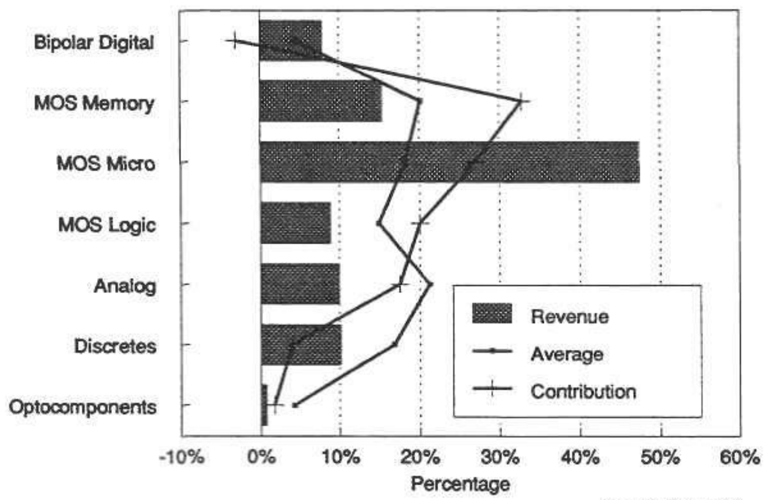
Source: Dataquest

EUROPEAN COMPANIES PORTFOLIO ANALYSIS
EUROPEAN APPLICATIONS SPLIT



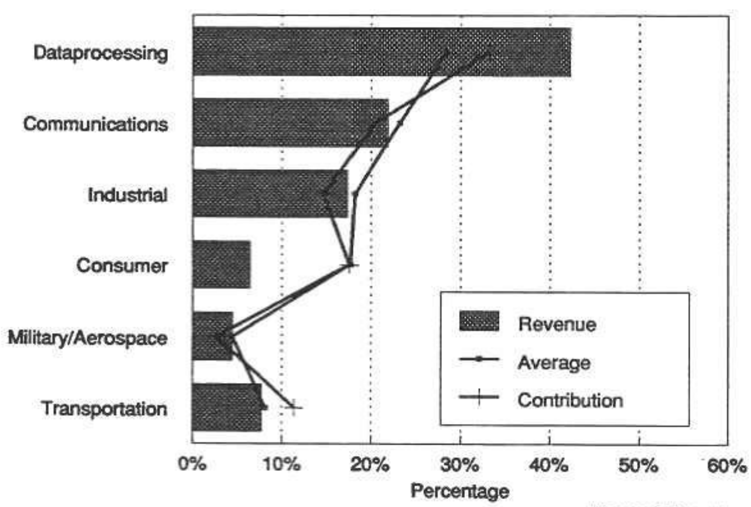
Source: Dataquest

US COMPANIES PORTFOLIO ANALYSIS
EUROPEAN PRODUCT SPLIT



Source: Dataquest

US COMPANIES PORTFOLIO ANALYSIS
EUROPEAN APPLICATIONS SPLIT



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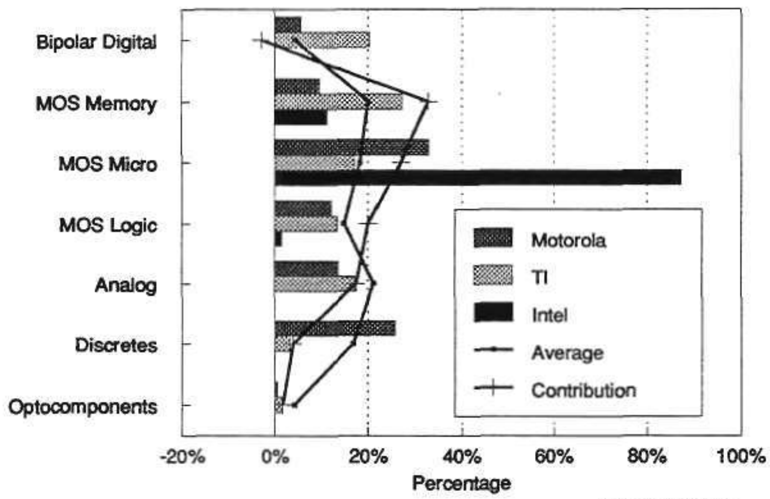
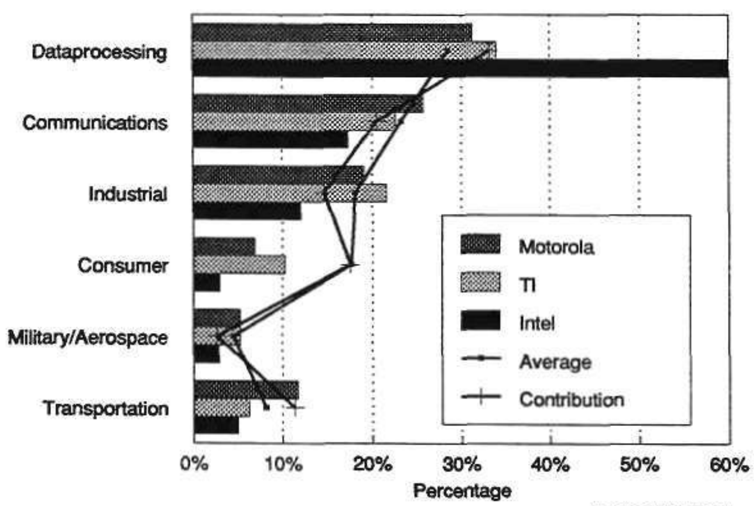
US COMPANIES PORTFOLIO ANALYSIS
EUROPEAN PRODUCT SPLIT



Source: Dataquest

US COMPANIES PORTFOLIO ANALYSIS
EUROPEAN APPLICATIONS SPLIT



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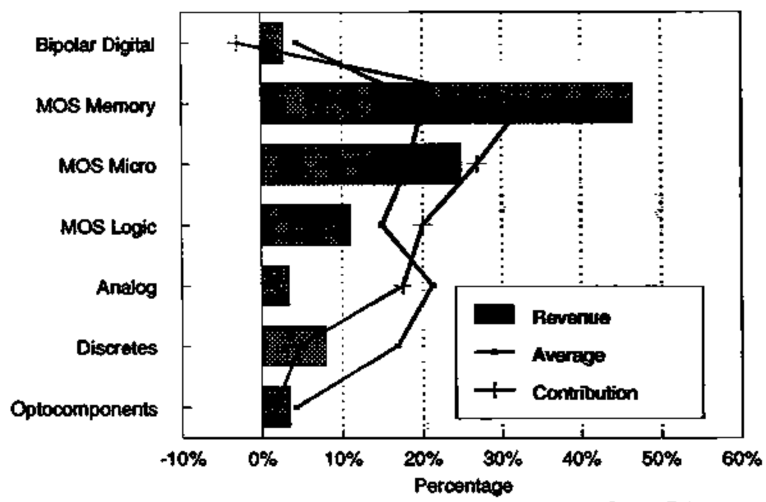
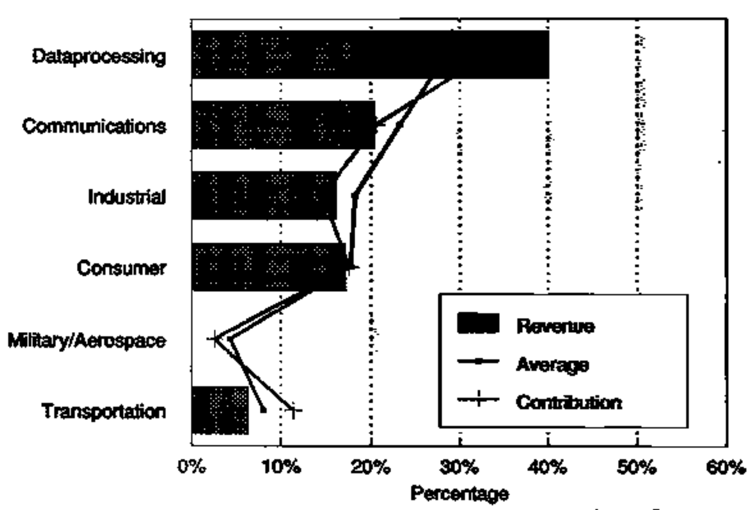
JAPANESE COMPANIES PORTFOLIO ANALYSIS
EUROPEAN PRODUCT SPLIT



Source: Dataquest

JAPANESE COMPANIES PORTFOLIO ANALYSIS
EUROPEAN APPLICATIONS SPLIT



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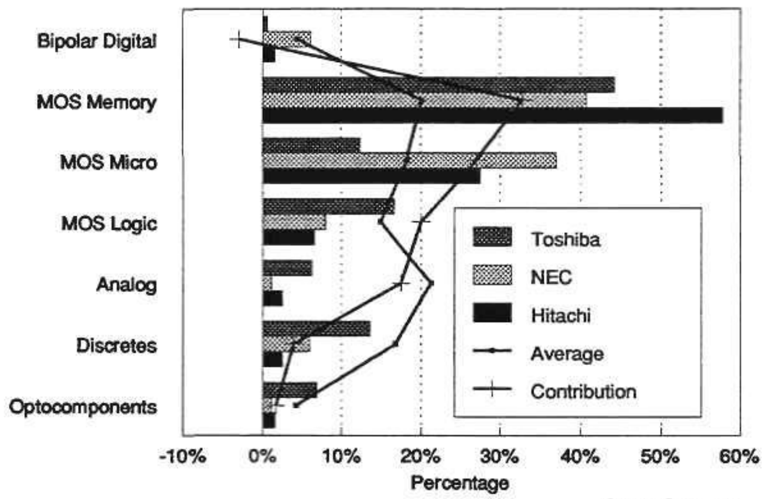
JAPANESE COMPANIES PORTFOLIO ANALYSIS
EUROPEAN PRODUCT SPLIT



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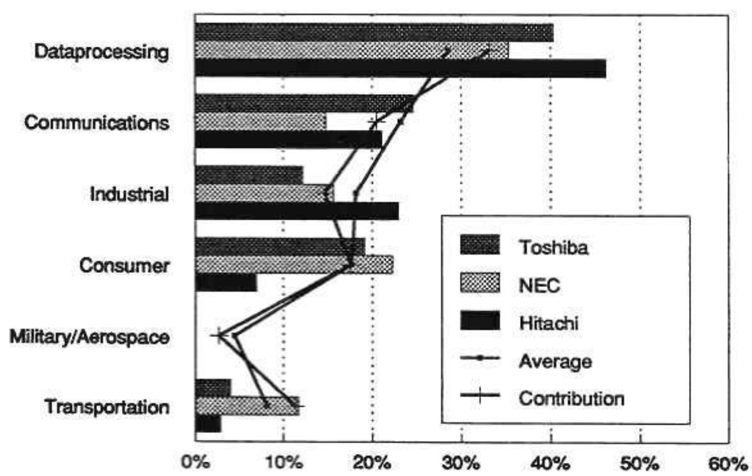

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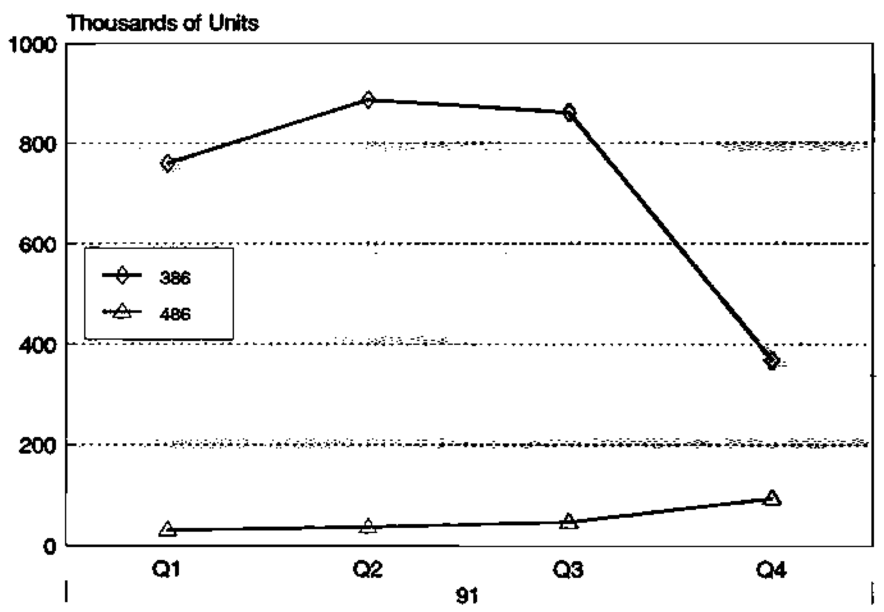
PRODUCTS - MICROCOMPONENT

- Microprocessor strengthened
  - Processor mix moved upmarket

EUROPEAN MICROCOMPONENT MARKET



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PRODUCTS - MICROCOMPONENT

- Microprocessor strengthened
  - Processor mix moved upmarket
- Microcontroller
  - Weak consumer market
  - GSM delays for DSP products
  - ISDN slower than expected
  - Transport segment slow
- Microperipheral
  - Significant price declines
  - Stronger competition than anticipated

PRODUCTS - MICROCOMPONENT

- Competition enters microprocessors
  - AMD, Chips & Tech, Cyrix, Texas, ST
  - Intel responding well
  - Consumer marketing comes to processors

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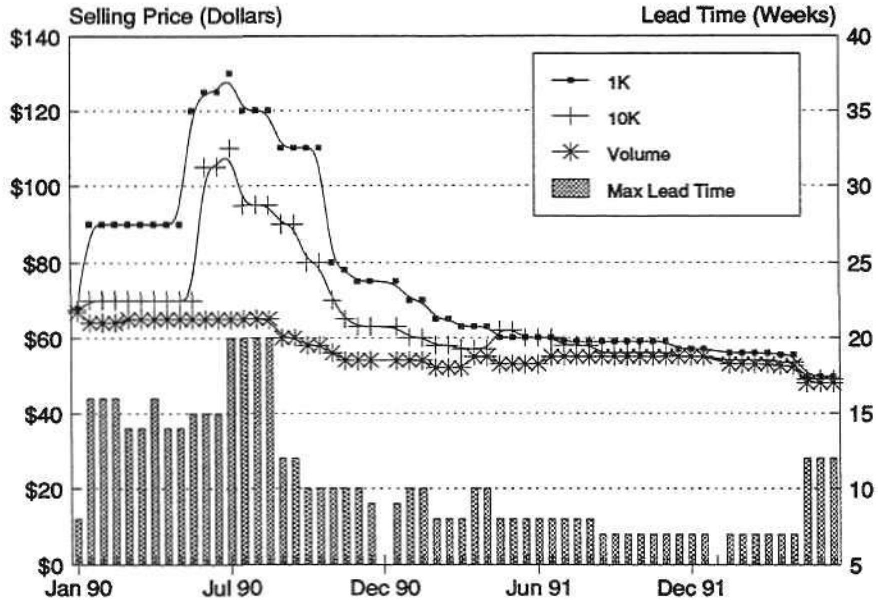
INTEL 386SX PRICING



Source: Dataquest

PRODUCTS - MICROCOMPONENT

- Competition enters microprocessors
  - AMD, Chips & Tech, Cyrix, Texas, ST
  - Intel responding well
  - Consumer marketing comes to processors

- RISC
  - Step improvement in performance
  - ACE consortium weakening
  - ARM achieving success
  - IBM endorsing the transputer

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EUROPEAN SEMICONDUCTOR MARKET

(Millions of ECU)

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Source: Dataquest

PRODUCTS - LOGIC

- Emphasis moving to standard products
  - ASIC is the loser here

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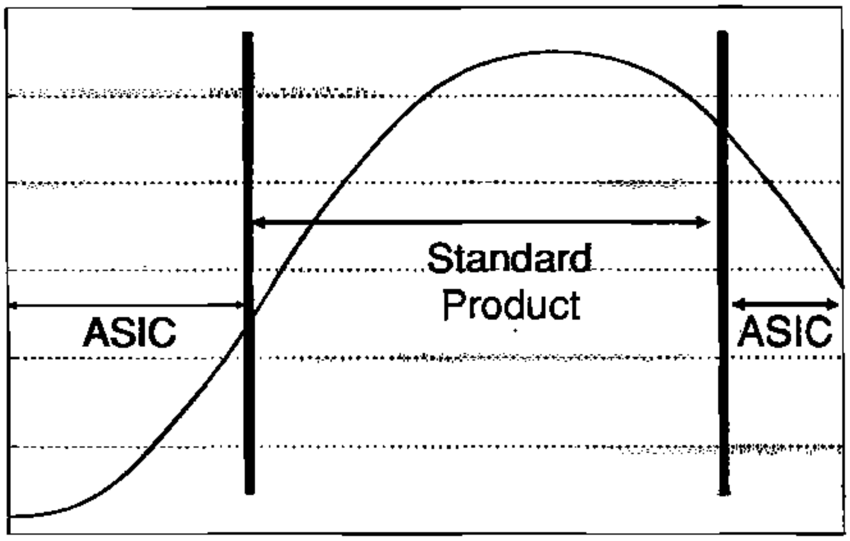
PRODUCT CYCLE TIMES



Product Lifetime

Source: Dataquest

PRODUCTS - LOGIC

- Emphasis moving to standard products
  - ASIC is the loser here
- Fierce competition in GSM, HDTV, data compression, will axe chip prices
- General purpose logic will move to CMOS and BiCMOS
- Bipolar still has a place in high-speed applications

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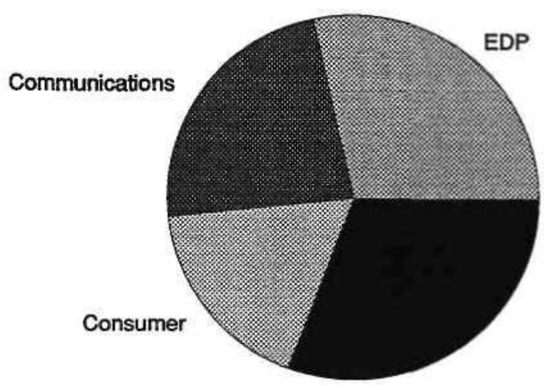
FORECAST ANALYSIS

- Products
- Applications
- Countries

EUROPEAN SEMICONDUCTOR MARKET APPLICATIONS SHARE



1991 Applications Share

Source: Dataquest

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EUROPEAN SEMICONDUCTOR MARKET

(Millions of ECU)

	1991	1992	% AGR	1996	% CAGR
EDP	2,594	2,837	9.4	4,392	11.1
Communications	2,123	2,240	5.5	3,225	8.7
Consumer	1,613	1,695	5.1	2,561	9.7

Source: Dataquest

APPLICATIONS - EDP

- High growth again
  - PC manufacture returns to Europe
- Mainframe and workstation manufacture in France and Italy rises
- Longer-term multimedia will be the application driver

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APPLICATIONS - COMMUNICATIONS

- Europe's greatest strength
- Internal consumption:
  - Digital communications
  - Mobile and cordless
  - Infrastructure in East Europe
- External exports:
  - Exchanges
  - Mobile handsets
- World's top hardware suppliers are European

APPLICATIONS - CONSUMER

- Short-term demand weak
  - Threat of recession in most countries
  - Excess inventory of all consumer goods
  - Olympics may not help
- Longer-term outlook is better
  - DCC and minidisk to stimulate demand
  - Consumer multimedia
  - HDTV: let's wait and see

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AGENDA

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- Vendor analysis
- European market analysis
  - Regions
- Closing remarks

INVESTMENT

- Investment grew from $5.1 billion to $14.4 billion from 1986 to 1991
- Reason: investment boom in Japan
- Result: excess capacity
- Evidence:
  - Memory prices
  - Japanese profit margins
  - Increase in foundry activity
  - Increased fab closures/delays

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DELAYED 200 mm FAB PLANS IN JAPAN

COMPANY	PRODUCTS	FAB TYPE
Fujitsu	16Mb DRAM	Production
Hitachi	4Mb/16Mb DRAM	Production
KTI	ASIC	Production
Matsushita	16Mb DRAM	R&D
Matsushita	16Mb/64Mb DRAM	Production
NEC	16Mb DRAM, MPU	Production
NEC	4Mb/16Mb DRAM, EPROM	Production
NKK	4Mb SRAM, ASIC, MPU	Pilot
Oki	16Mb DRAM	Production
Sanyo	16Mb DRAM	Production
Sharp	4Mb DRAM, ROM	Production
Toshiba	16Mb DRAM	Pilot

WORLDWIDE FORECAST OF PRODUCTION, CAPITAL SPENDING AND WAFER FAB EQUIPMENT

(Millions of Dollars)

	1991	1992	AGR	1995	CAGR 95/90
Production	69,231	78,769	14%	110,352	11.9%
Capital Spending	14,372	13,970	-3%	19,090	8.8%
Fab Equipment	6,026	5,568	-8%	8,883	8.7%

Source: Dataquest

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INVESTMENT

- Slowdown in Japanese foreign investment
- Slowdown in transfer of capital
- Migration from commodity to value-added products
- Spectre of increased trade friction
- Pervasiveness of semiconductors will restore balance

AGENDA

- European market share
- European market analysis
  - Products and applications
- Vendor analysis
- European market analysis
  - Regions
- Closing remarks

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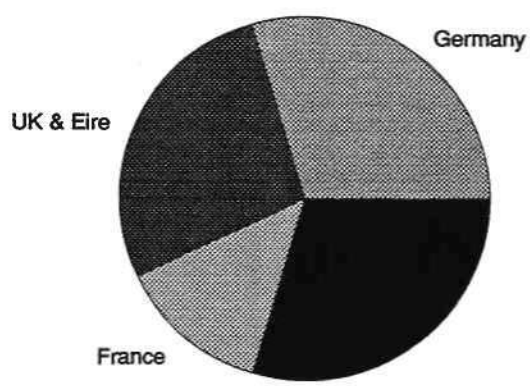
AGENDA

- European market share
- European market analysis
  - Products and applications
- Vendor analysis
- European market analysis
  - Regions
- Closing remarks

EUROPEAN SEMICONDUCTOR MARKET REGIONAL SHARE



1991 Regions Share

Source: Dataquest

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EUROPEAN SEMICONDUCTOR MARKET CONSUMPTION FORECAST

(Millions of ECU)

Country	1991	1992	AGR 92/91	1996	CAGR 96/91
France	1,228	1,275	3.8%	1,844	8.5%
United Kingdom & Ireland	2,405	2,669	11.0%	4,310	12.4%
Germany	2,770	2,878	3.9%	4,294	9.2%

Source: Dataquest

COUNTRIES - GERMANY

- Short-term demand weak
  - Cost of reunification is high
  - Excess consumer inventories
  - Automotive market is soft
- Positive factors are:
  - Telecoms business is strong
  - Industrial production is stable
  - PC manufacture rising
- Longer-term outlook good - due to size
- Attraction for foreign investment - medium

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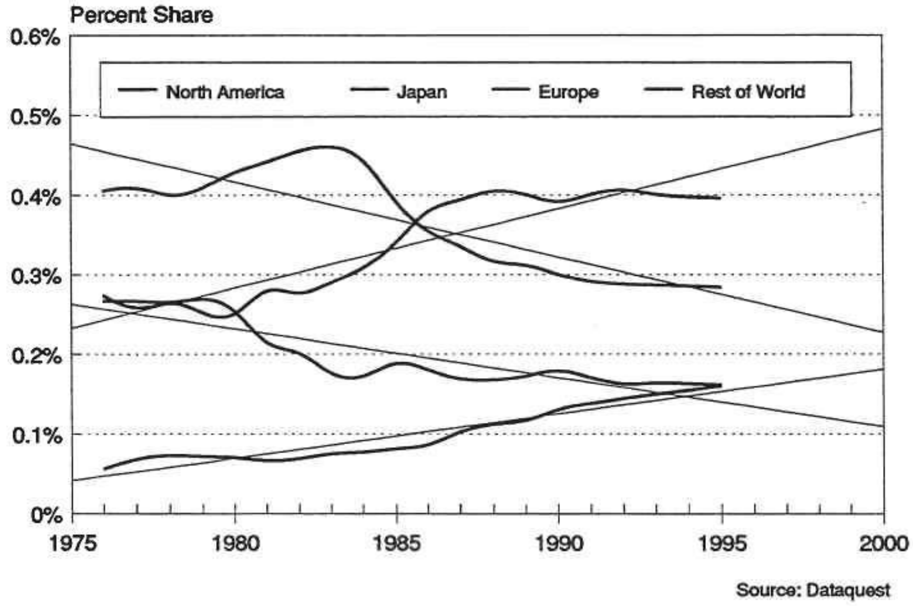
COUNTRIES - UK & EIRE

- High investment by multinationals
  - Strong manufacturing economy
  - Design wins are outside Europe however
- PC manufacture is concentrated here
- Longer-term outlook good
  - Due to foreign investment
- Attraction for foreign investment - good

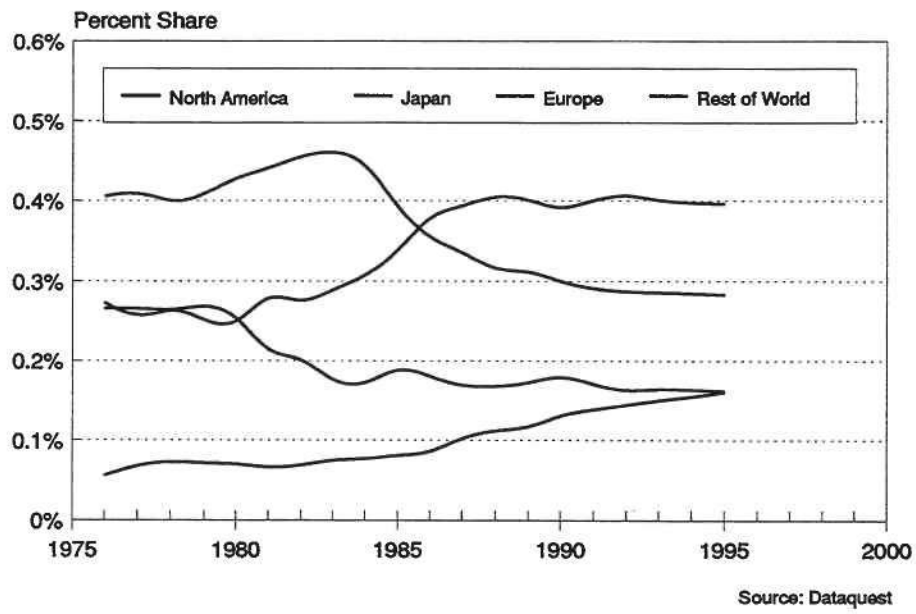
COUNTRIES - FRANCE

- Country close to recession
- Local manufacture moving outside Europe
- Good telecoms business
  - Alcatel No.1 telecoms manufacturer
- Attraction for foreign investment - poor

WORLDWIDE SEMICONDUCTOR FORECAST
MARKET SHARE BY WORLD REGION



WORLDWIDE SEMICONDUCTOR FORECAST
MARKET SHARE BY WORLD REGION



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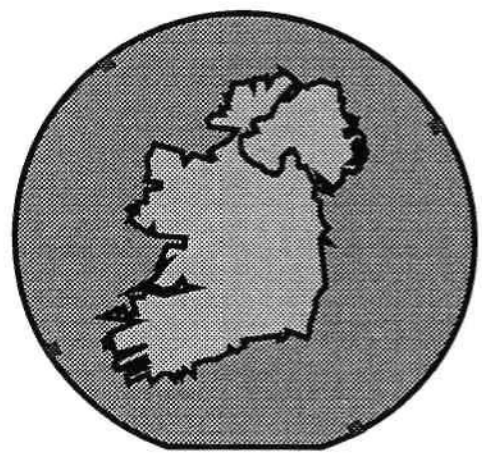

RESULTS OF THE 1991 EUROPEAN PROCUREMENT SURVEY

Bipin Parmar
Group Director European Semiconductors
and Conference Chairman
Dataquest Europe Limited

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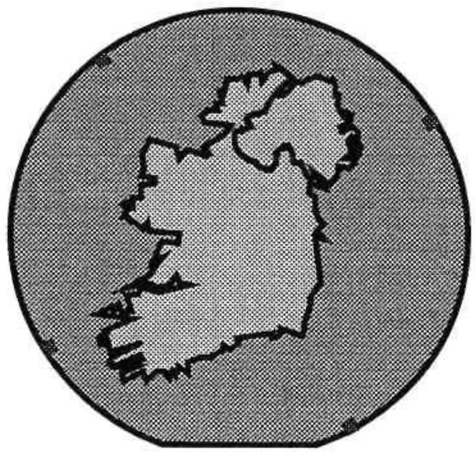

INVESTING IN ELECTRONICS

Dan Flinter
Executive Director
Industrial Development Authority of Ireland

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INVESTING IN ELECTRONICS

Dan Flinter
Executive Director
Industrial Development
Authority of Ireland

Mr. Flinter is Executive Director of the Industrial Development Authority of Ireland (IDA) with responsibility for overseas investment. Prior to this he was appointed to the IDA Board as Executive Director with responsibility for organization services and regional development. He has also been Planning Manager, Manager for Information Technology and Senior Economist. He joined IDA as a researcher in the planning division. Mr. Flinter graduated from University College Dublin with a Master's degree in Economics.

Dataquest Europe Limited
EUROPEAN SEMICONDUCTOR INDUSTRY CONFERENCE
June 3–5, 1992
Dublin, Ireland

SPEECH
BY DAN FLINTER AT
DATAQUEST CONFERENCE
3 June 1992

INTRODUCTION:

Many of the papers presented at this Conference over the next two days will be from representatives of international companies who are involved in the development, production and marketing of electronic components; software, etc. Although IDA has been in the electronics business since the 1970's our participation in the industry is from a different perspective than most of yours.

Ireland is a player in the electronics sector because it offers a competitive mix of skills, costs and financial advantages. The industry is important to us because it is one which can best meet our economic objectives. It is a sector which has grown at a remarkable pace in the eighties and further growth seems assured. Latest estimates suggest that the value of world electronics output in 1990 was $750 billion, a figure set to rise by close to 40% to $998 billion by 1995.

Our macro economic objective is to facilitate economic growth and job creation. As executives this translates into a simply stated business objective which is to win business investment decisions for Ireland. Our business objective is to be a significant player i.e. to win real market share in the mobile investment business in the various markets we operate in.

From an operational level, our participation in the electronics industry means we have to know our market; who the key players in the industry are; how Ireland can help them to achieve growth in profitability and gain a higher level of market share.

We have been involved in key decisions taken by major companies and observed the process of change in the industry over the past 20 years.

We have observed and experienced the evolution of the industry and the responses made by companies to these changes. We have also seen the responses that various Governments have made to these changes.

I would like here today to **share some of our experiences** with you and our view as to where the electronics industry is headed.

EVOLUTION OF THE ELECTRONICS INDUSTRY:

Electronics is one of the most important sectors of the Irish economy today. Twenty years ago it barely existed, with a handful of companies employing less than 2% of our industrial workforce and generating 6% of Ireland's industrial exports. Today, there are 200 companies in the sector employing almost 10% of the industrial workforce and accounting for almost 30% of industrial exports. On a capita basis, Ireland is now the most significant exporter of hardware and software products in Europe.

The industry in Ireland evolved relatively recently. In the early seventies, companies such as General Electric, Data Products and Westinghouse invested in Ireland.

They did so because Ireland offers lower manufacturing costs and lower corporate tax rates and their Irish operations were focussed on producing cost sensitive, commodity products.

When Digital arrived in 1974 to make computers for the European market, it was justifiably seen as a major coup. The infrastructure to support a vibrant electronics sector at that time however did not exist. All the country had to offer was its people. For many years Digital flew in parts from the US to be assembled in their Irish facility.

Today, most of the first wave of electronics companies are still operating in Ireland, but their operations are totally transformed. For example, in Dundalk, Harris Semiconductor (formerly General Electric) only makes one product family - but all the product design and development work takes place there. Recently Data Products was acquired by Hitachi and soon it will start making a range of DIY tools in its Irish factory.

A similar transformation ocurred for example, in Telectron, bought by the US giant A T & T as its first manufacturing investment outside its home market. Telectron was a domestic manufacturing company in the telecommunications business, selling about 5% of its output overseas and the balance to the Irish P & T. Under AT &T's ownership the Irish plant has operated its own Computer Aided Design Team, controls marketing of products in the MIddle East and Africa, and is almost 100% an export company.

The focus on developing the educational infrastructure in Ireland, has played a crucial role in this transformation. The establishment of a network of technical colleges and universities, with their focus on computer science, microelectronics and other business disciplines, provided the quality of skills required by the rapidly changing sector to develop and extend their activities in Ireland and to attract new employers.

By the end of the 1970's electronics companies in Ireland found themselves in a more attractive, less barren environment, with the development of the Irish subsupply base. As we gained a reputation for the quality and flexibility of our people, we began to win more investment and the early eighties saw a surge in our market share and an evolution in the kinds of projects locating in Ireland to include more complex products and more integrated manufacturing.

US companies lead the way with a range of investments

- high end dataprocessing companies like Stratus & Teradata.

- Companies like Dell and Quantum in the high value cost sensitive PC and disc drive business.

- Intel's new microprocessor facility in Dublin which will be a $500 million world class sub micron fab processing 8" wafers.

- Analog Devices now employ over 700 people in Ireland of whom more than 60 are involved in new product development.

- General Semiconductor is expanding its TVS product development and fabrication activity here.

- Motorola has selected Ireland as the European site for paging and two way radio products.

- Most recently highly successful datacommunications companies like 3Com and Cabletron are establishing their European manufacturing base.

Software:

Growth in the European software industry is running at 20% a year in some segments, particularly packaged software, and Ireland is well positioned to enjoy the benefits of this growth through the presence here of such US based world market leaders as Microsoft, Borland, Claris and Lotus.

Dublin is now regarded as the software capital of Europe, engaged in sophisticated product development as well as localisation of software for European markets and duplication and packaging. Ireland is where Motorola develops software for digital cellular communications, IBM has a 150 person software development laboratory, and Philips has a combined IC design and software laboratory employing about 100 engineers. The software sector accounts for 20% of the total number employed in the Irish electronics sector and we are confident that this will grow even further.

Ireland has also been selected by many Japanese companies.

There are two good reasons for putting Japanese and other Far Eastern electronics companies high on our list of target firms: they are an increasingly important force in the marketplace and they are often the quality standard setters in the industry. If Irish suppliers can work to the tolerances and overall quality standards set by the Japanese they can supply anyone.

In 1989, Ireland attracted Alps Electric, Ohshima, Fujitsu Isotec and Brother Industries to establish Irish operations - the two latter companies making sub-assemblies for plants located elsewhere in Europe. Many of the Japanese investments located elsewhere in Europe fall into this final assembly category - but, significantly, all of the 22 Japanese plants located in Ireland are genuine manufacturing operations in their own right, employing high levels of skills and expertise. IDA's strategy for the Japanese market is to position Ireland as the parts supply centre of Europe.

The recent announcement by Matsushita-Kotobuki Electronics Industries (MKE) of Japan, a company which is synonomous with the household name of "Panasonic" and Quantum Corporation of California who have come together to build one of the most advanced automated clean room assembly facilities in the world. MKE will produce disc drives in generic form which will then be customised in a separate manufacturing facility by Quantum Corporation.

In the electronics industry, as in other sectors, the concept of "critical mass" can be important. The strategy adopted by the IDA has been to identify those industries and operations which can contribute to the overall development of the sector, improving the infrastructure for existing and other new companies.

The recent successful pursuit of disk drive manufacturers is an example of this approach. Ireland targeted the top four disk drive manufacturers in the world and has persuaded three of them that we are the best base for planned European manufacturing facilities.
Because disk drive manufacture is recognised to be a highly cost sensitive industry the value of capturing these firms has an important demonstration effect for other manufacturers planning European investment. But equally important is that disk drives are a key component for computer manufacturers.

We are optimistic, and there are already signs that our optimism is justified, that many personal computer manufacturers will see considerable benefit in locating their operations close to the source of key components, like disk drives.

In today's environment, we have to be very aware of the cost sensitivity of potential projects. The employment potential of the market of mobile investment is like a pyramid, at the top of which are highly sophisticated projects at the leading edge of research and development providing good opprotunites for graduates.

Because of the availability of such skills in Ireland and our competitive unit costs, we consistently have an edge over competitors for such projects. Typically however these projects are not very large employers.

At the other end of the scale are high-volume manufacturing and assembly operations using low skill levels, but employing thousands of people. Because Irish labour costs while competitive in European terms are higher compared to less developed countries which have a surplus of low skill labour, these are projects which Ireland is less likely to win - even if it were socially and politically acceptable to pursue such projects.

Our constant challenge is to determine the cut off point in the middle of that pyramid above which projects are securable and below which they are unobtainable because of wage rate differentials.

Employment potential-electronics investments

R & D

Low volume,
high value products

Cut off point for Ireland (moves with costs)

High volume,
medium value products

High volume,
low value products

Employment

What lessons have we learned in our business?

In my view the electronics industry has over the past twenty years been an extraordinary example of how the "laws" of competitive advantage have in many instances been rewritten. The significance of the developments is the speed at which these changes have come about. Technology is clearly essential to competitive advantage now but will not necessarily deliver markets and profitability. Highly efficient manufacturing with effective low unit costs are crucial but not necessarily the final determinant. Quality, previously considered a guarantee of success now is a bench mark which a company must achieve before its customers, especially industrial customers, will even consider making a purchase.

Distance from the market and lost time in terms of the length of the supply chain and the attendant working capital costs are becoming of major significance. The much abused term of globailisation is increasingly real and is being constantly redefined. International companies constantly are seeking to achieve the optimum from a combination of alternative but compatible strategies.

There is clearly no one single solution. But companies in the industry must have:-

- shorter delivery times to customers
- a responsive manufacturing capability
- cost efficient component suppliers
- access to technology

All of these strategies have to be implemented in the context of geographical locations which are consistent with and supportive of the business needs of companies.

Ireland's own business strategy in terms of winning new investments from this sector has as I have already mentioned changed radically over the past twenty years:-

• Late sixties, Ireland focussed exlusively on attracting investment from the manufacturing sector, particularly the electronics & healthcare sectors. We were the first country in Europe to use fiscal incentives to attract investment. Other Development Agencies entered the market and began to compete directly with us for projects. To survive in the market place, it was necessary for us to become a competitive location for other value added industries such as product design, software development and production, technical market support, direct marketing and product repair.

• Improvements in the third level education system and our telecommunications system opened up the potential for new activities to be carried out in Ireland. For example, the software industry. The initial focus was on software development in hardware companies but the emphasis quickly changed to independent software houses. IDA was the first European development agency to enter this market and as a result quickly gained market share.

• Another area was the data processing sector. Today there are six American companies processing claims in Ireland including Mass Mutual; Cigna and Metropolitan Life.

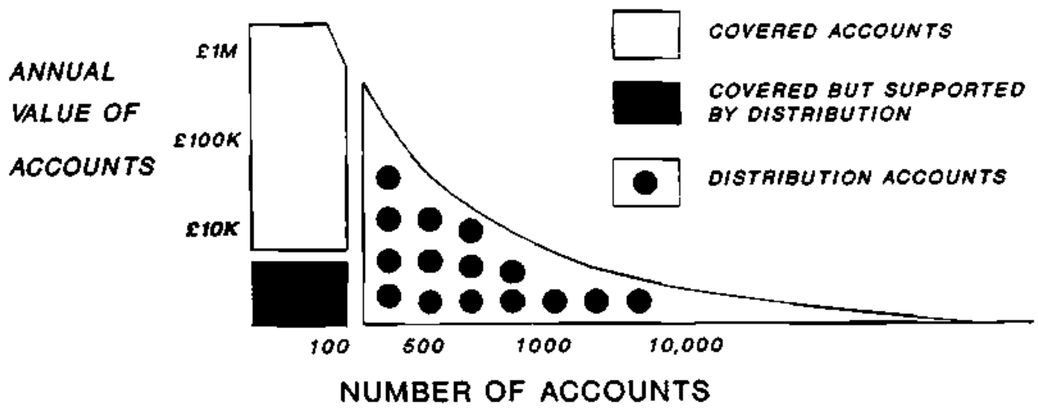
• The next phase in our development strategy was launched by the Government in the late eighties with the decision to establish the International Financial Services Centre in the nearby docks area in Dublin. Today over 190 institutions from all over the world have been licensed to establish in this Centre and already 130 of these are trading.

• Understand the new business opportunities and entering these markets before our competitors do, as we have done in the software industry and more recently the telemarketing area.

We are genuinely proud of our overseas clients and the significant contribution they make to the Irish economy.

Ends

DISTRIBUTION'S ROLE.



The major semiconductor manufacturers supplying the European market are focusing more attention on their "key" accounts and expanding their distribution coverage - more accounts, not more distributors.

Gary Kibblewhite.

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European Distribution Trends.

- Distribution today serves over 30% of total component demand (by value) and over 98% (by number of customers).
- Substantial changes occurring.
- In the 80's UK groups dominated the acquisition scene, Lex, Farnell, Memec, Electrocomponents, Electron-House.
- In the 90's it is now continental European and US companies that are acquiring.

Gary Kibblewhite.

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CHANGE, CHANGE, AND MORE CHANGE !

What is driving it ?

Gary Kibblewhite.

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- Poor profitability of both distributors and manufacturers.
- Repositioning of major semiconductor suppliers and distributors.
- Mergers and acquisitions.
- Formation of the Single Market.
- Logistics.
- Increased technical content of semiconductors.
- Electronic trading.

Gary Kibblewhite

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The Profitability/Size Equation.

Just because you are a global player does it mean you are necessarily profitable ?

Some major players ranked by market capitalisation:-

Electrocomponents	(UK)	$1043 million
Avnet	(US)	$ 892 million
Farnell	(UK)	$ 749 million
Arrow	(US)	$ 378 million
Diploma	(UK)	$ 332 million

How Have These Major Players Performed Over The Last Three Years.

(Source: Matheson Securities).

ELECTROCOMPONENTS.

Sales growth = +11.2%
Net asset growth = +32%
Profit before tax growth = +6%

ROCE = 47%
Operating margin = 14%
Working capital/sales = 3.3X

ARROW ELECTRONICS.

Sales growth = +20%
Net asset growth = 0%
Profit before tax growth = +19%

ROCE = 16%
Operating margin = 4%
Working capital/sales = 4X

How Have These Major Players Performed Over The Last Three Years. (continued)

(Source: Matheson Securities).

AVNET.

Sales growth = 1.4%
Net asset growth = Nil
Profit before tax growth = +5.7%

ROCE = 12.5%
Operating margin = 5.5% and rising.
Working capital/sales = 2X

FARNELL ELECTRONIC COMPONENTS (Pre ESD acquisition).

Sales growth = 8%
Net asset growth = 0%
Profit before tax growth = 12%

ROCE = 29.5% (Group)
Operating margin = 23%
Working capital/sales = 1.7X

Component Distributors Are Polarising

Catalogue Distributors.

Examples:

FARNELL

ESD

RS

NEWARK

FEATURES.

Generally profitable above the industry norm.

Growing by both Greenfield start-up and acquisition.

Moving into new markets.

Component Distributors Are Polarising

Broad Liners.

Examples:

FEATURES.

Examples	Features
AVNET	Having a tough time on the profit front.
ARROW	Major players in the "buy or be bought" scene.
LEX	Developing worldwide businesses.
TEKELEK	

Component Distributors Are Polarising

Niche Players

Examples:

FEATURES.

Examples	Features
MEMEC (Raab Karcher)	Generally profitable in excess of industry norm.
ACAL	Steady growth.
	Limited geographic expansion.

Mergers And Acquisitions

- Lex sell European and North American Distribution activities to Arrow.
- Northern Telecom sell ESD to Farnell.
- Diploma sells Access to Avnet.
- Arrow buy stake in Silverstar/Lasi/Celdis.
- MMD buy Rapid Recall.
- Elbatex buy Jermyn France and Germany.
- And more and more ....

Some Single Market Implications:-

- Service Differentiators.
- Cross-boarder dealing.
- Ship and Debit vs commodity.

LOGISTICS

The arrival of "integrated operators" in Europe, eg UPS.

Huge cost variations with "traditional" services:-
eg. A 3 kg shipment from Manchester to Munich costs

* $192 if sent as a single IATA shipment.
* $138 if sent as a consolidated shipment (approx)
* $53 if sent via an "integrator" door-to-door service.

and ... much less for a comparable distance shipment in the USA, so there is still scope for big cost reductions.

Controlled 24, 48, or 72 hour services by either air or ground.

Value added taxes still a problem - who collects them ?

Integrated operators will also offer service of collecting the cash by the end of this year.

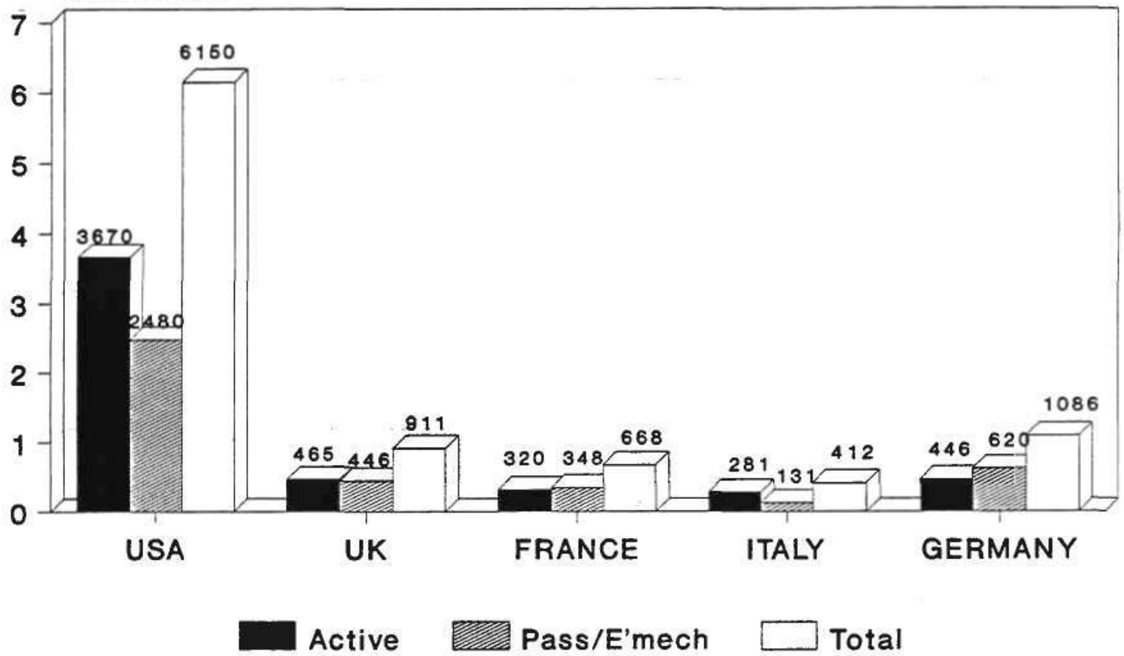
ELECTRONIC TRADING

* Emergence of Edifice (within Edifact) as an international standard.
* Simple "EDI" now just a small part of an electronic trading environment which now includes:-
    * On-line databases/order status.
    * Bulletin boards.
    * Inventory visibility programmes.
    * E-mail.

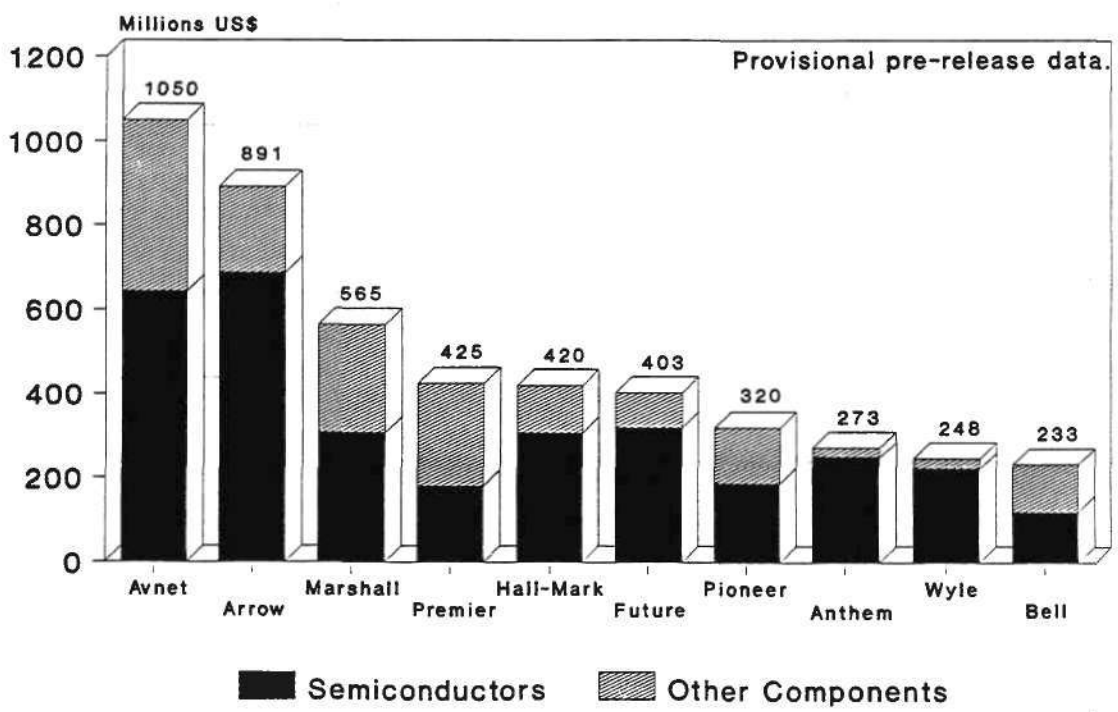
as well as the "traditional EDI" functions relating to standard business forms:-

* Invoices - Acknowledgements - Orders - etc. etc.

Distribution Total Available Market
USA vs Major European Country Market.
1990.



Electronic Component Distribution
USA 1991 - Sales of Top 10 Groups



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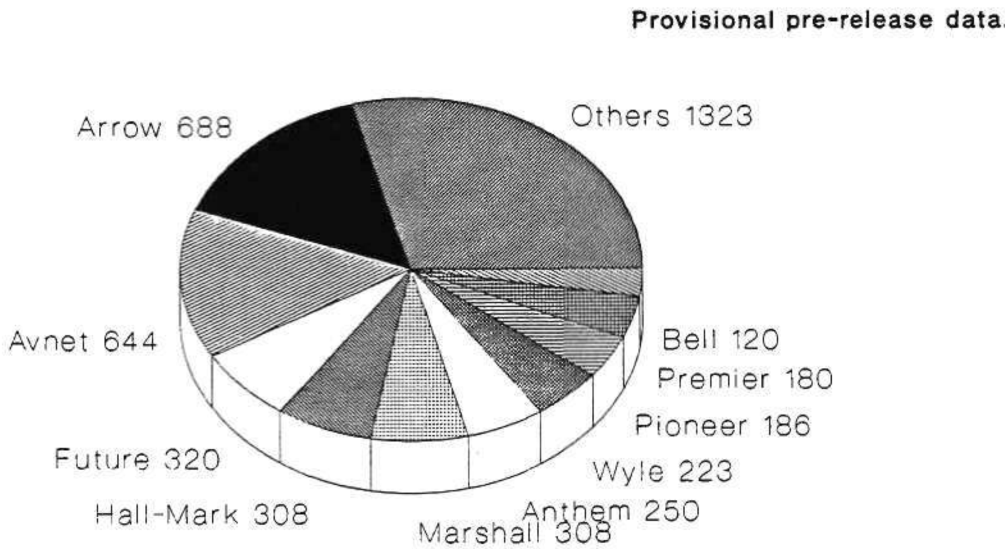
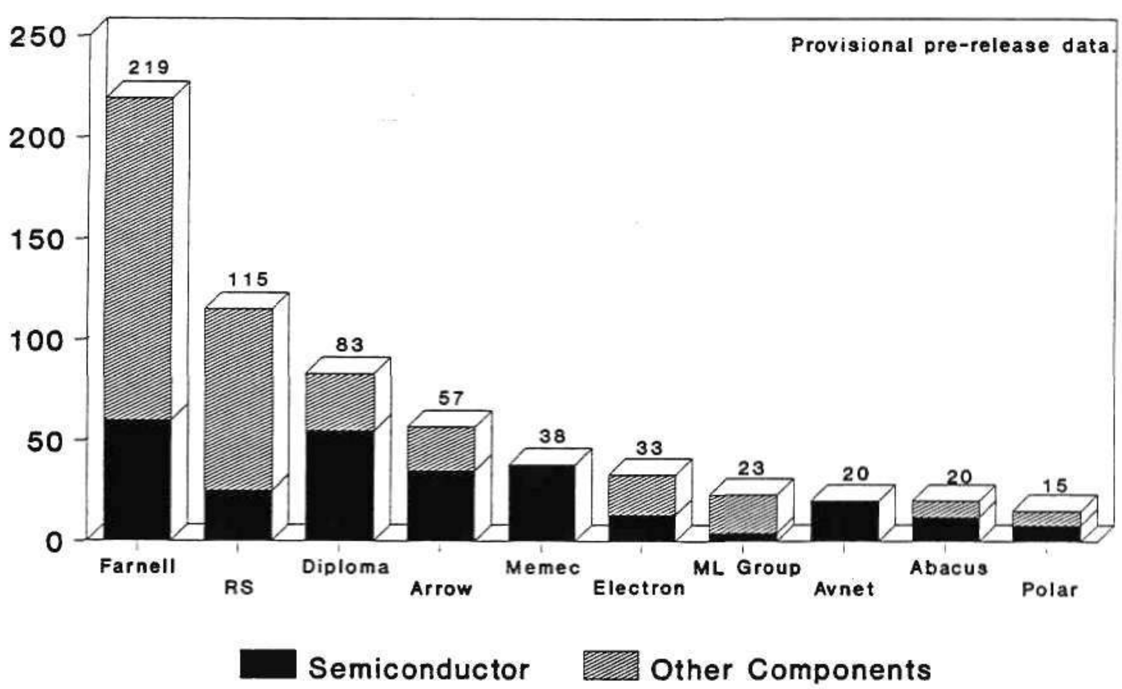
Semiconductor Distribution
USA 1991 - Total Market $4550 Million



Total Component Distribution
U.K. - 1991 Sales of Top 10 Groups.



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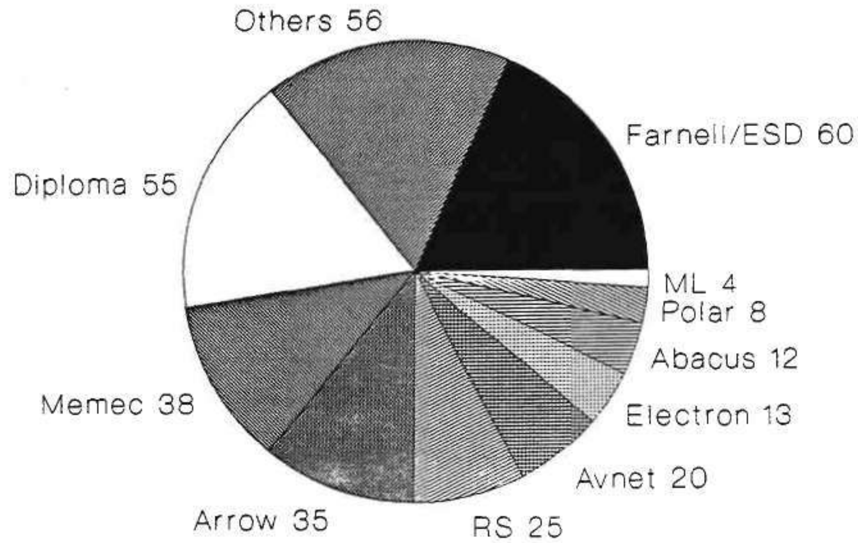
Semiconductor Distribution
U.K. 1991 - Total market £326 million.

Provisional pre-release data.



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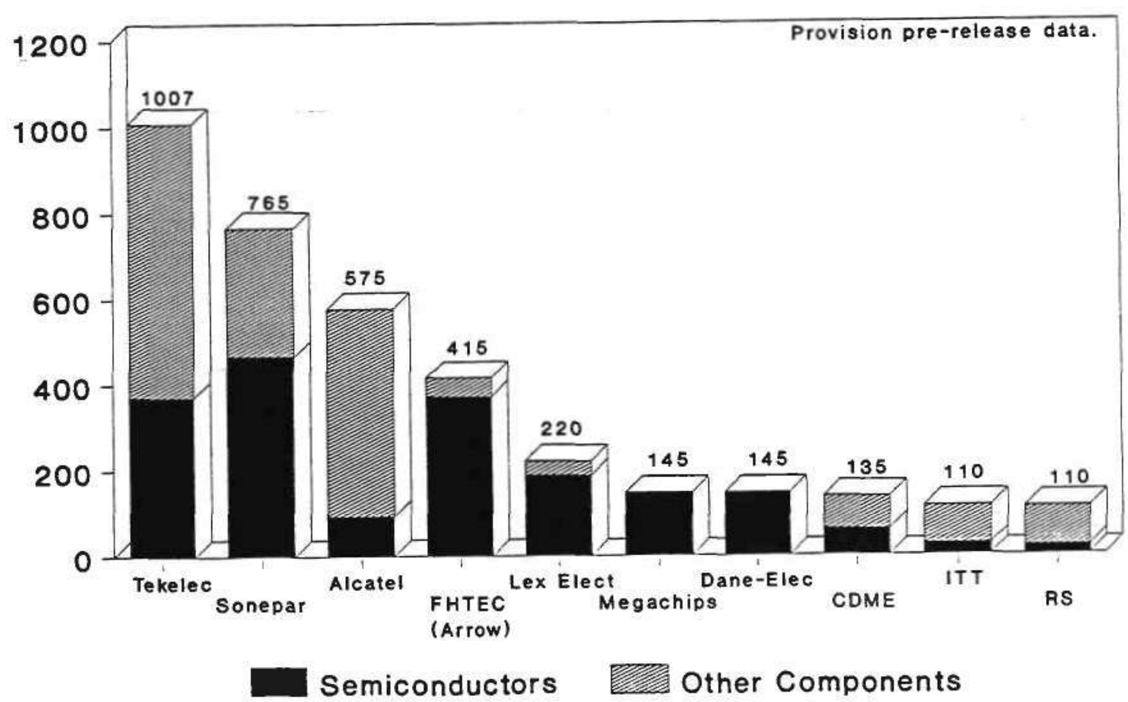
Total Component Distribution
France - 1991 Sales of Top 10 Groups



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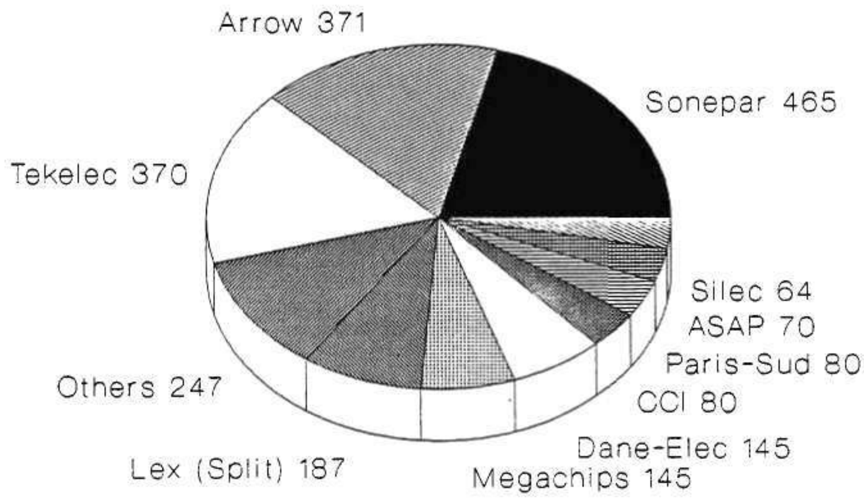
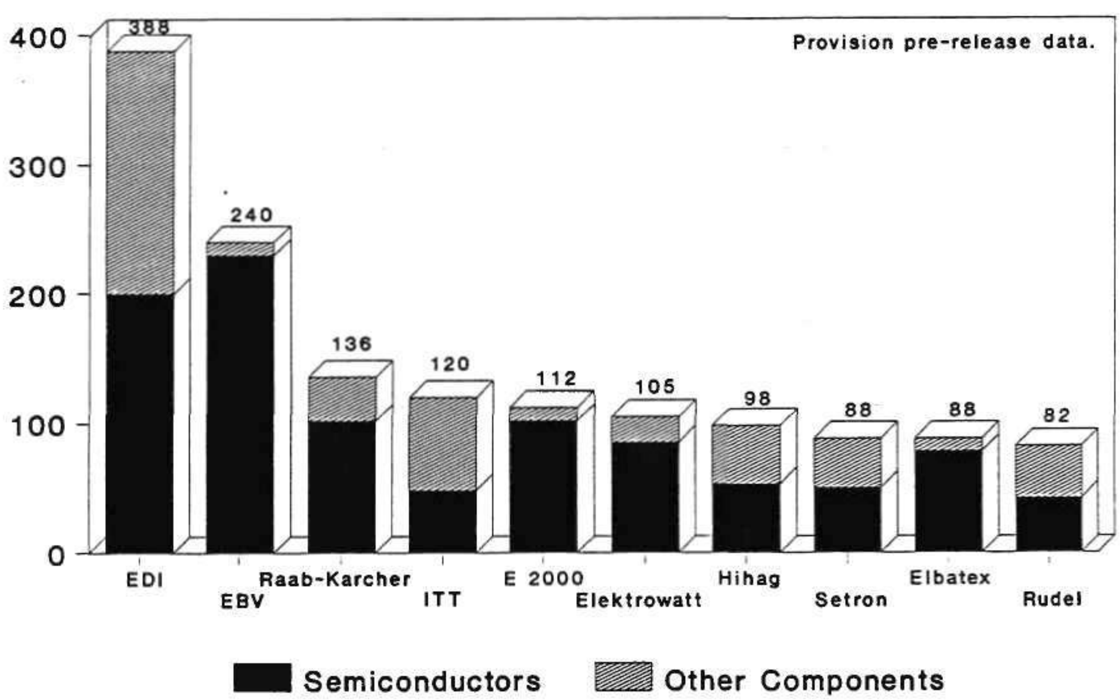
Semiconductor Distribution
France 1991 - Total Market 2224m f.f

Provisional pre-release data.



Electronic Component Distribution
Germany 1991 - Sales of top 10 Groups.



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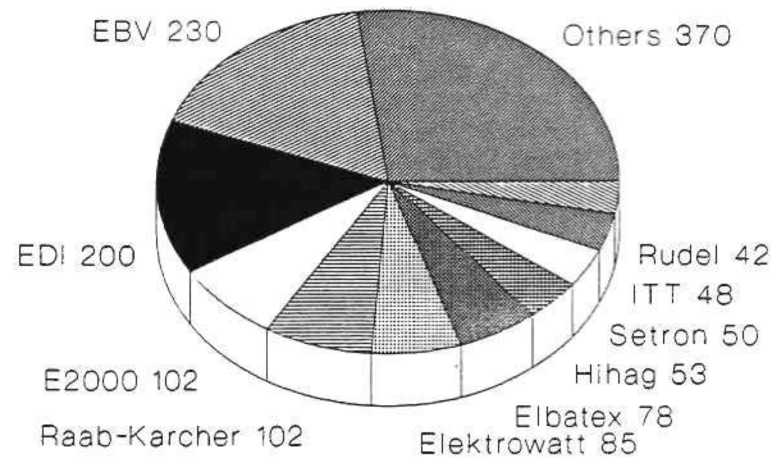
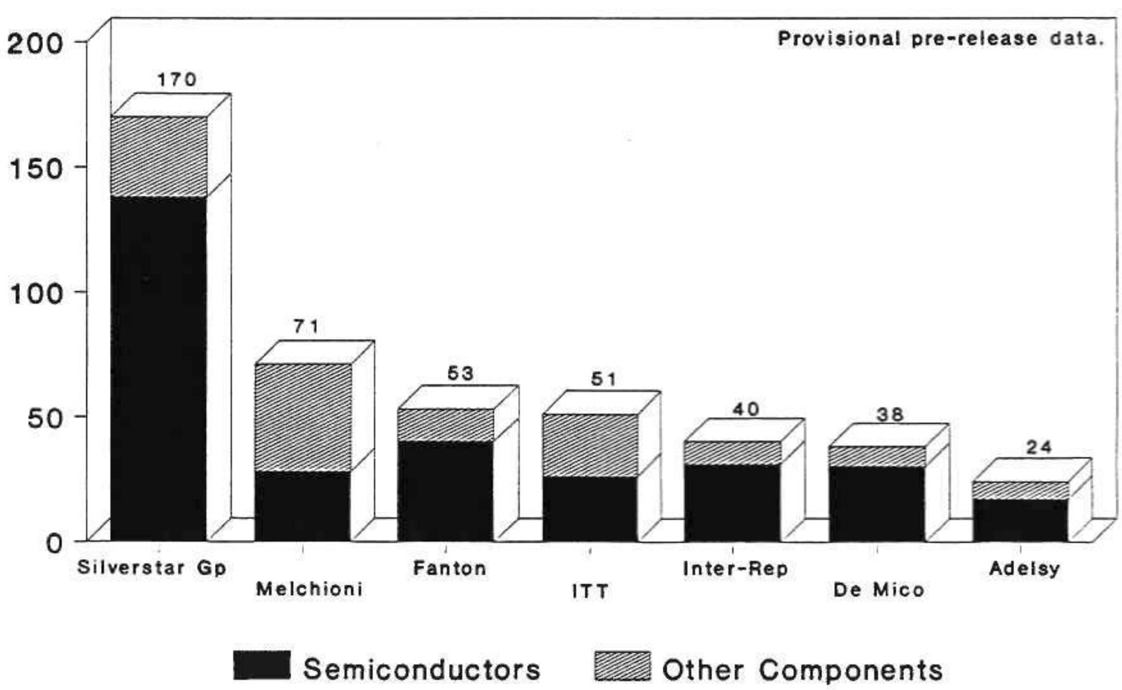
Semiconductor Distribution Market
Germany 1991 - Total Market 1360m DM.

Provisional pre-release data.



Electronic Component Distribution
Italy 1991 - Sales of Top 7 Groups



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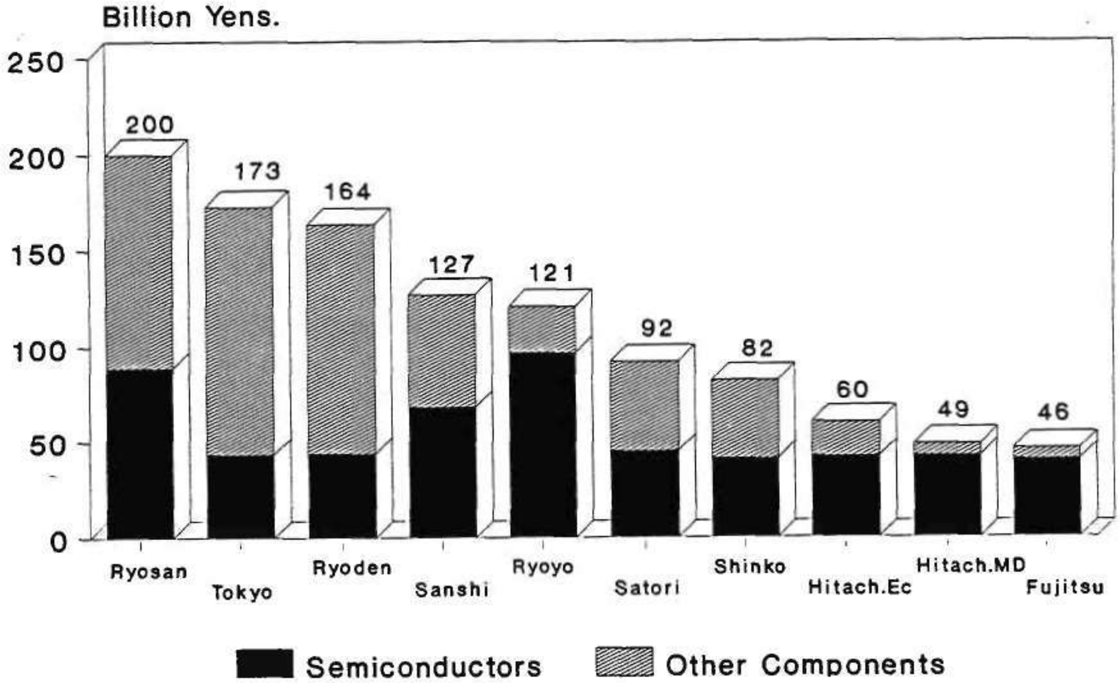
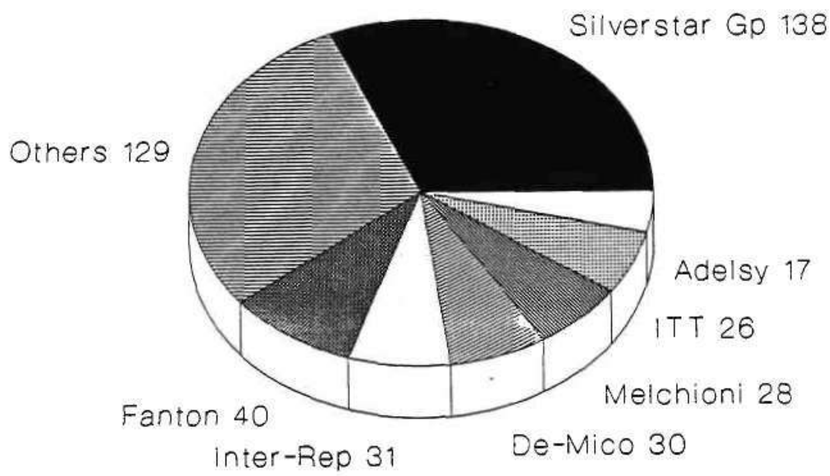
Electronic Component Distribution
Japan 1990 - Sales Of Top 10 Disti.



Semiconductor Distribution
Italy 1991 - Total Market 439 b.lira.

Provision pre-release data



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SEMICONDUCTOR DISTRIBUTION IN THE '90s

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SEMICONDUCTOR DISTRIBUTION IN THE '90s

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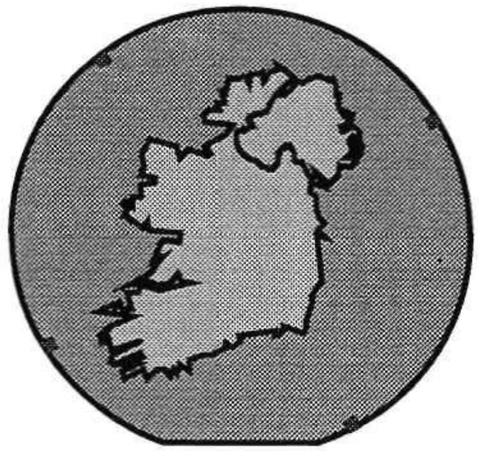
Managing Director
Europartners Consultancy

Mr. Kibblewhite is Managing Director of Europartners Consultancy with partners throughout Europe and associates in the United States and Japan. In addition he is a consultant for Dataquest Europe Ltd., Chairman of the Association of Franchised Distributors of Electronic Components in the United Kingdom, and the first Chairman for the newly formed International Distribution of Electronics Association. He is also the European partner for Fleck International, the major US-based connector market research organization, and a Director of the Abacus Distribution Group. Mr. Kibblewhite has been in senior positions in the electronic components industry in Europe for over 30 years, and has been awarded the Institute of Directors' Diploma in Company Direction.

Dataquest Europe Limited
EUROPEAN SEMICONDUCTOR INDUSTRY CONFERENCE
June 3–5, 1992
Dublin, Ireland

This presentation was not available

at the time of publication



STRATEGIC END-USER TRENDS

Bipin Parmar
Group Director European Semiconductors
and Conference Chairman
Dataquest Europe Limited

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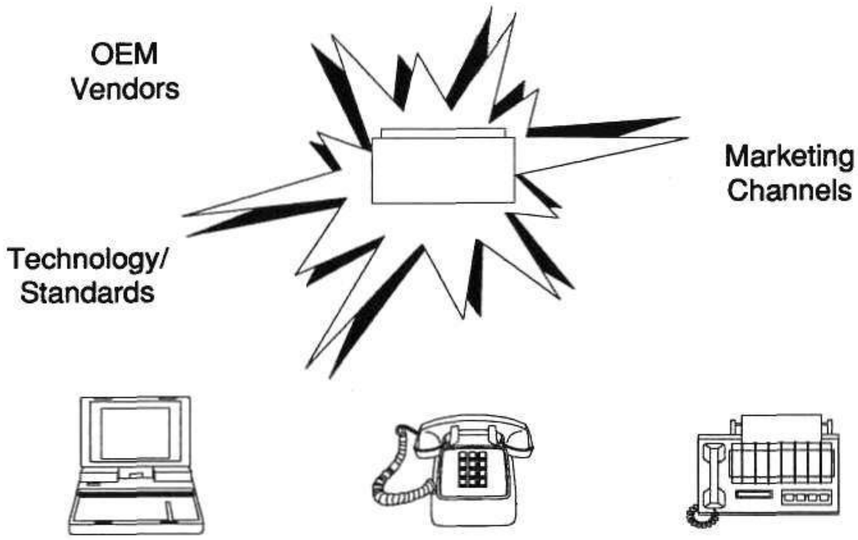
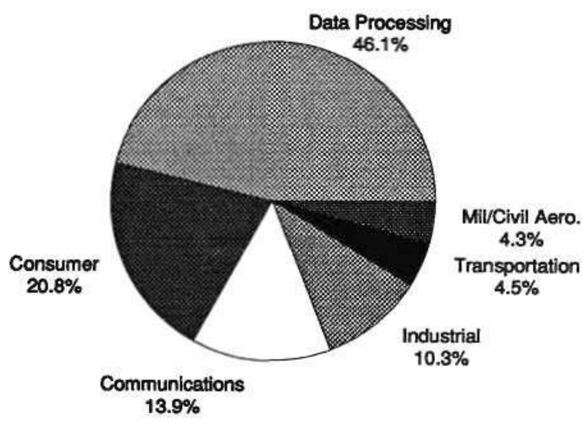
END-USER
STRATEGIC TRENDS



WORLDWIDE SEMICONDUCTOR CONSUMPTION
BY APPLICATION SEGMENT



Source: Dataquest

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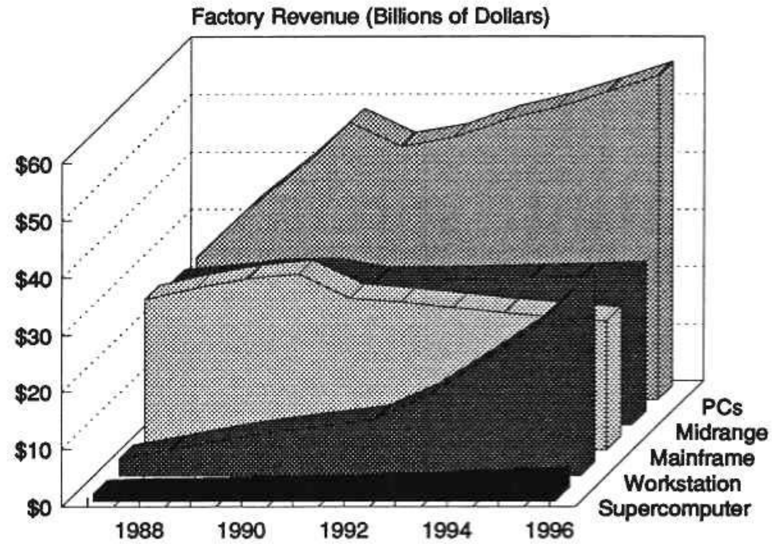
WORLDWIDE COMPUTER SYSTEMS
PRODUCT SEGMENTATION



Source: Dataquest

TOP SEMICONDUCTOR USERS IN EUROPE

(1991 Estimates)

1. IBM
2. Siemens
3. Philips
4. Bosch
5. Alcatel
6. Olivetti
7. Grundig
8. Nokia
9. Matsushita
10. Ericsson

Top 50 are available in your ESAM binders

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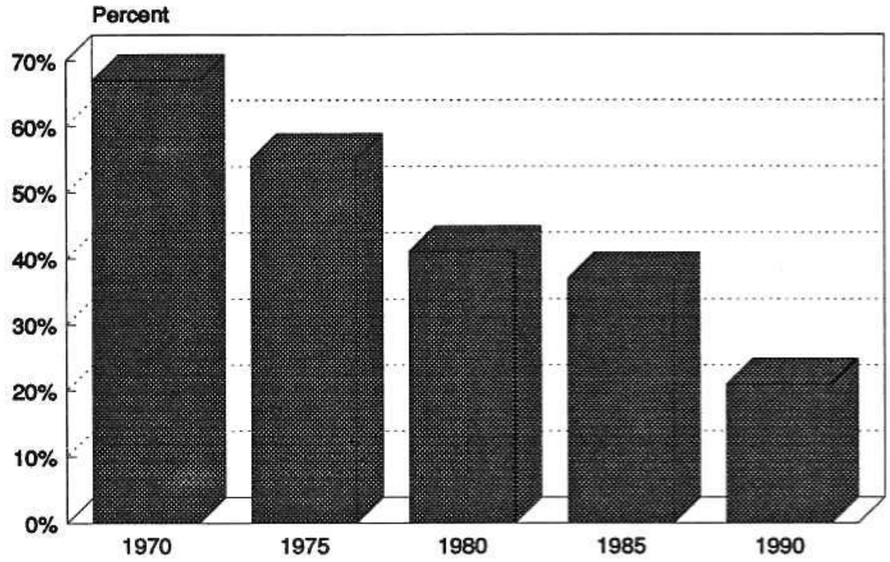
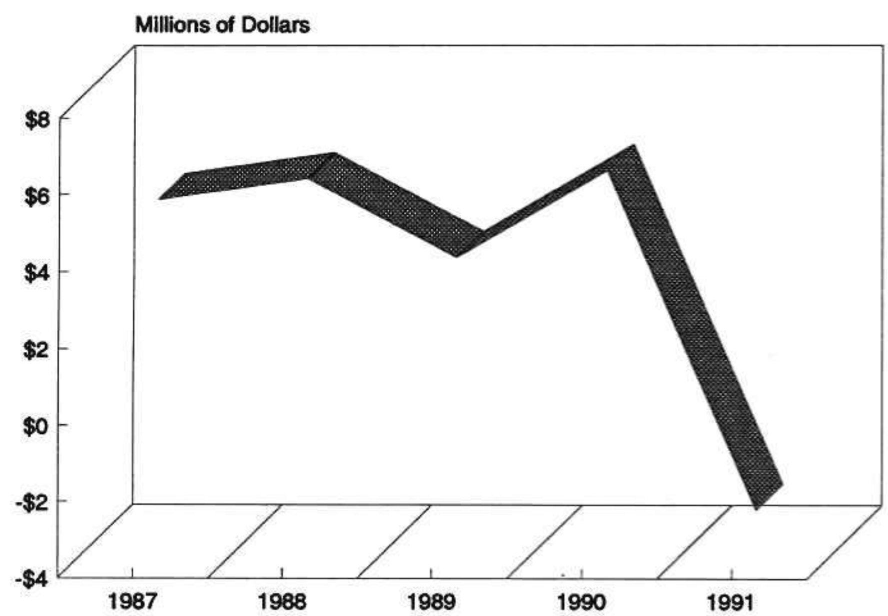
IBM MARKET SHARE OF COMPUTER SYSTEMS WORLDWIDE



Source: Dataquest

IBM NET EARNINGS



Source: Dataquest

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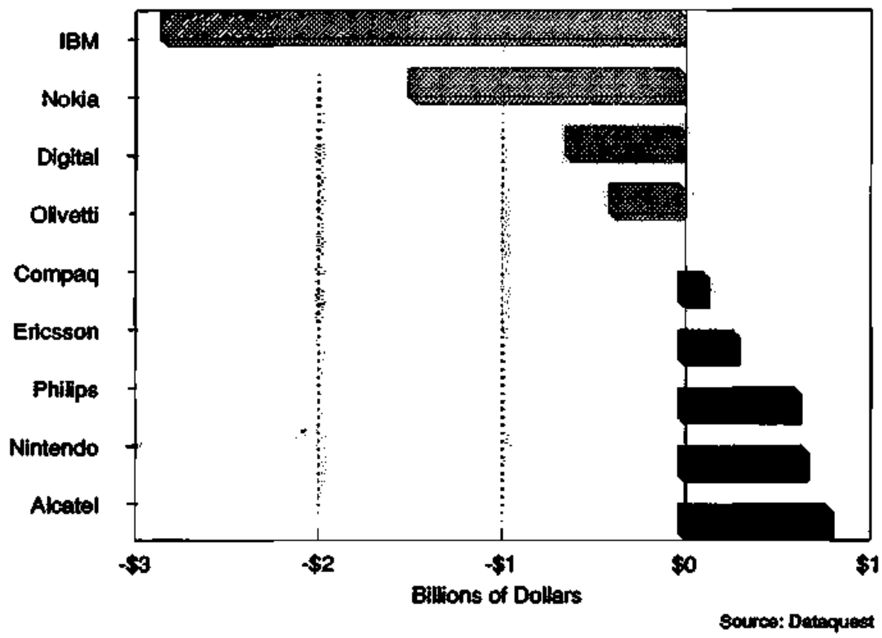
1991 SELECTED COMPANIES PROFIT MARGINS



TOP EFFECTIVE PC MANUFACTURERS IN EUROPE

1. IBM
2. Olivetti
3. Apple
4. Bull
5. Commodore
6. Siemens Nixdorf
7. Victor
8. Tulip
9. Acorn
10. Nokia Data Systems

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UNIT PC MARKET SHARE BY MAIN MARKETS

UNITED KINGDOM

1. Commodore
2. IBM
3. Compaq
4. Atari
5. Apple

GERMANY

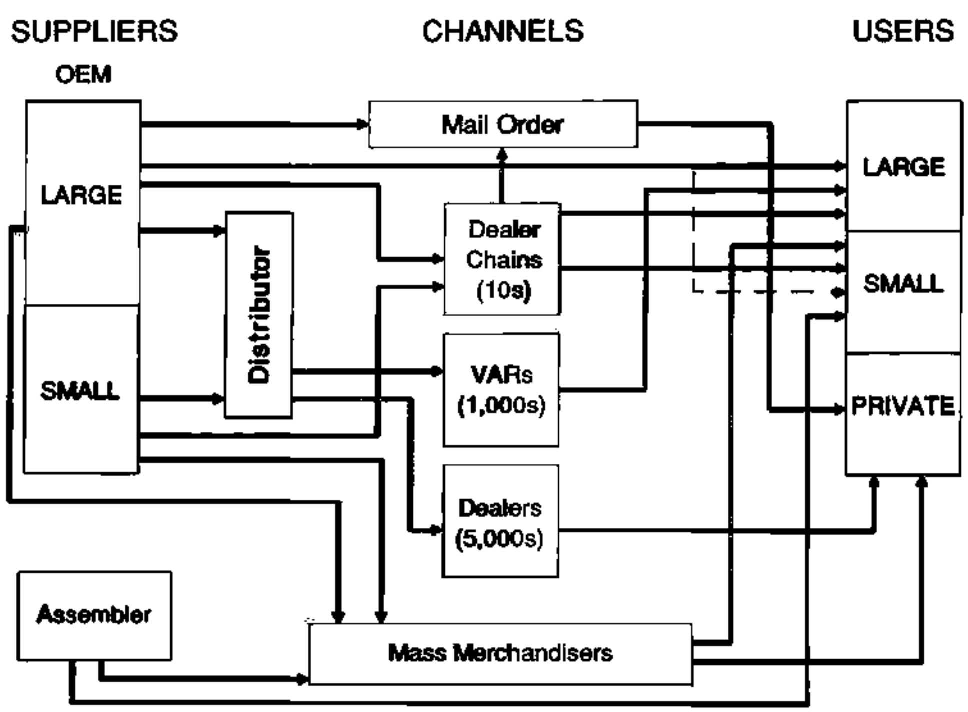
1. Commodore
2. Vobis
3. IBM
4. Atari
5. Siemens-Nixdorf

FRANCE

1. IBM
2. Apple
3. Compaq
4. Commodore
5. Atari

ITALY

1. Olivetti
2. IBM
3. Commodore
4. Apple
5. Zenith Data Systems



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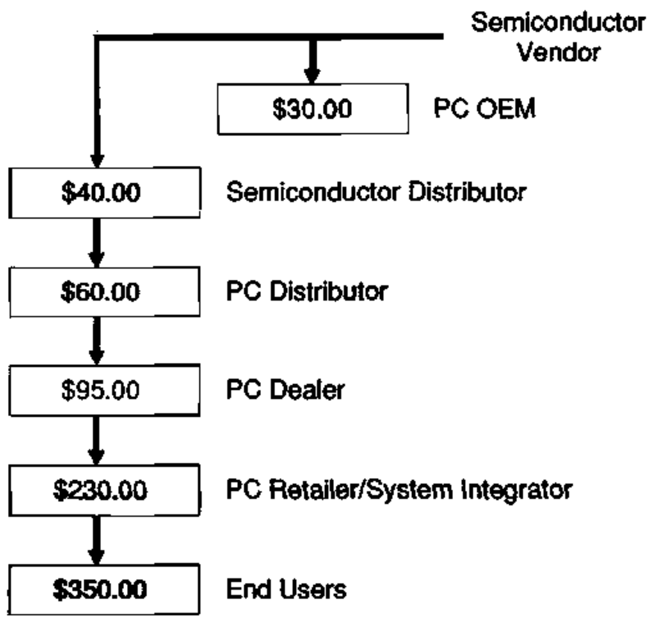
1MBx9 SIMM (MEMORY MODULE)



THE BIRTH OF A NEW SET OF CUSTOMERS

UNITED KINGDOM

1. Computercenter
2. Dixons
3. Centre File
4. Specialist Computers
5. Businessland UK

GERMANY

1. Component Computer Gruppe
2. Computerland Deutschland
3. Taylorix
4. House of Computers
5. Metro

FRANCE

1. Agena
2. ISTA
3. Random
4. Asystel Conseil et Service
5. ECS Diffusion

ITALY

1. Metos
2. Asystel Sirio
3. TC Sistema
4. Winline
5. Systex Informatica

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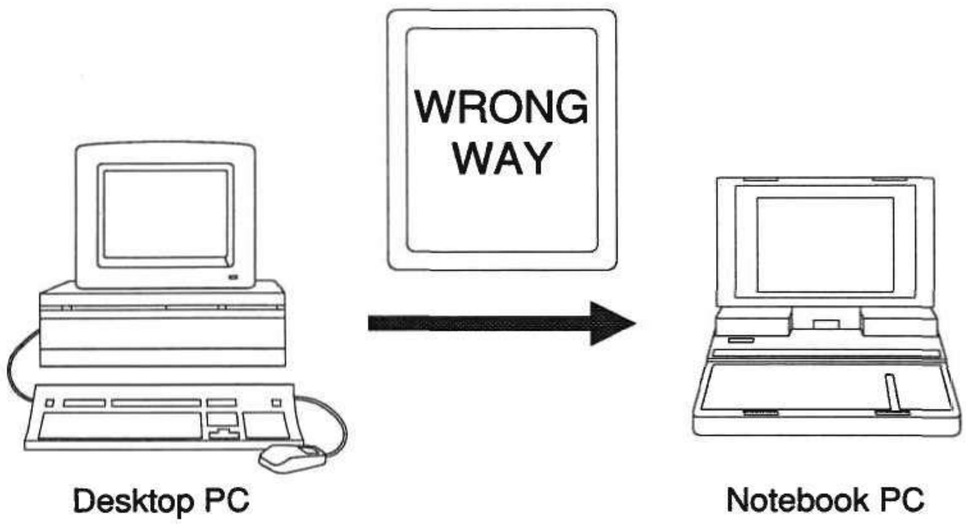
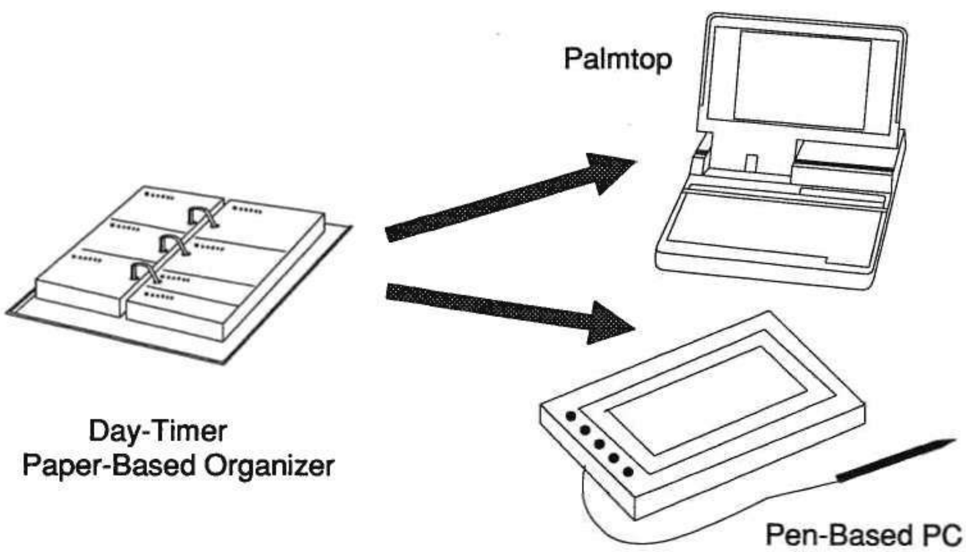
DOWNSIZING



EMULATION OF FUNCTION



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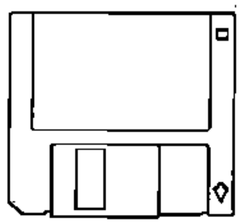
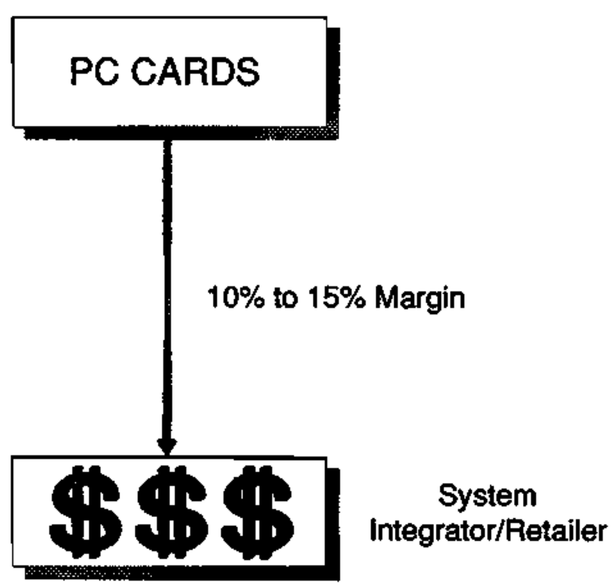
THE COST OF USING INFORMATION



	Cost		Cost
Floppy:	$1	Memory Card:	$300
Notebook:	$3,000	Palmtop:	$600
Total	$3,001	Total	$900

The Floppy Is More Expensive!

PC CARDS



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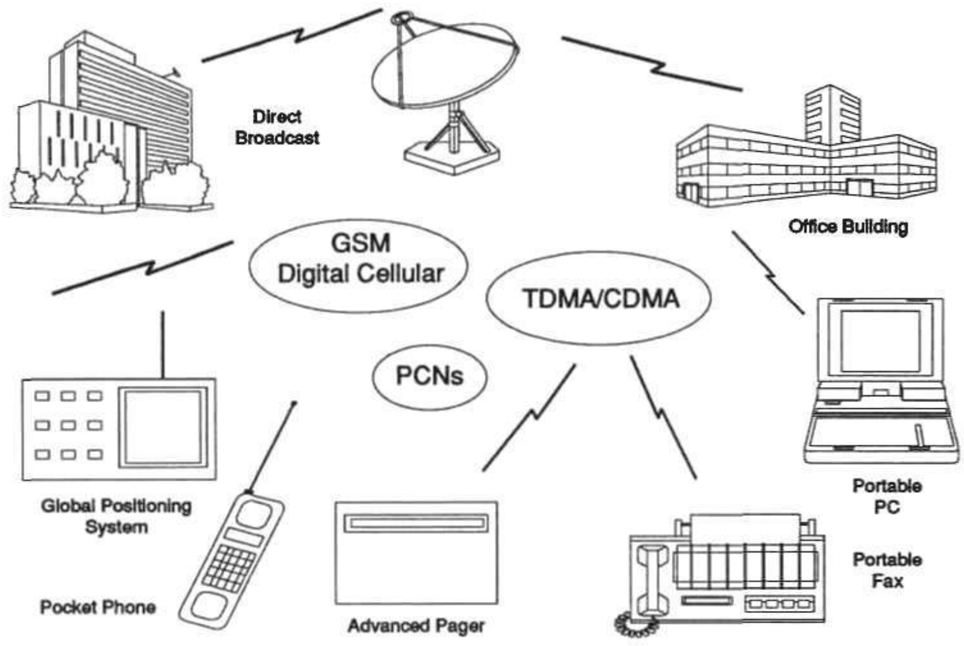
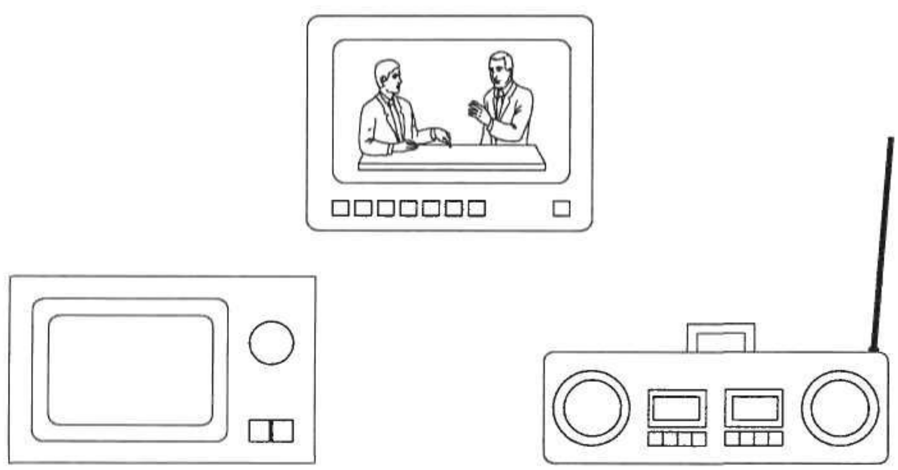
GOING WIRELESS (AND DIGITAL)



CONSUMER ELECTRONICS



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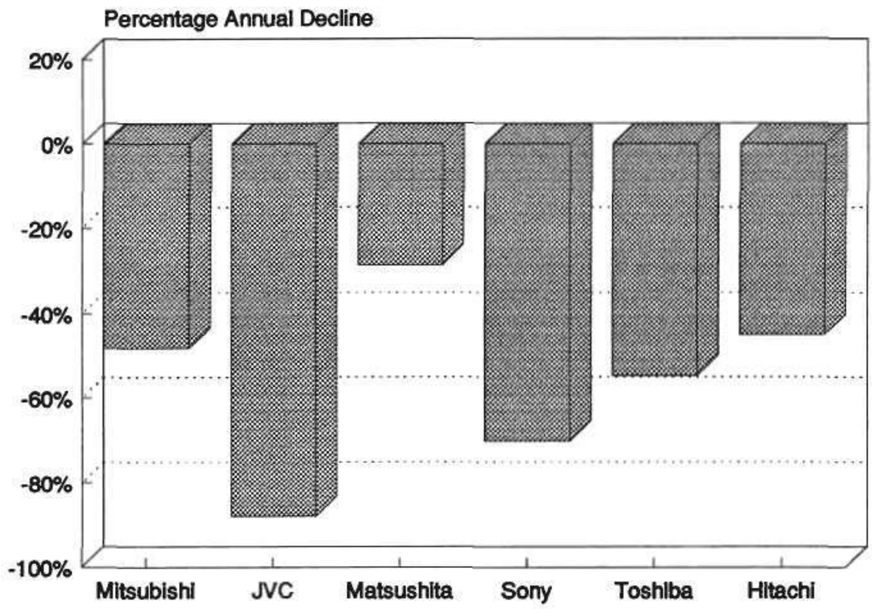
1990-1991 CONSUMER PROFIT DECLINES



Source: Yomiuri-Shimbun

TOP 5 BANKS

(by Capital)

1980	1990
1. Crédit Agricole (France)	1. Somitomo (Japan)
2. National Westminster (UK)	2. Dai-Ichi Kangyo (Japan)
3. Barclays (UK)	3. Fuji (Japan)
4. Bank America (US)	4. Sanawa (Japan)
5. Citicorp (US)	5. Union Bank of Switzerland

Source: The Banker

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JAPANESE BANKS FACE $9,635M LOSS

Bank Losses on Securities ($M)

Sanawa Bank	1,077
Industrial Bank of Japan	732
Fuji Bank	716
Sumitomo Bank	655
Tokai Bank	629
Sakura Bank	586
Diawa Bank	540
Dai-Ichi Bank	535

Source: Financial Times

TRENDS IN JAPANESE COMPANIES

- Squeeze for higher returns
- Less frequent product cycles
- Slowdown on foreign investments
- Retrench to core products
- Alliances within Japan

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THE BIRTH OF EUROPEAN ZIABATSU/KEIRETSU

(Banks/Industrial/Electronics/Construction/Services)

Daimler-Benz

Siemens

Alcatel

Thomson

Bosch

Philips

France Telecom

POSSIBLE STRATEGIES FOR OEMs

- Outsource manufacturing
- Concentrate on channels/mail order/ mass merchandisers
- Application-specific PCs, PBX, telephones
- Retrench to core activities
- Software and professional services

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STRATEGIES OF SEMICONDUCTOR VENDORS

- Continuously monitor customers' strategic directions
- High-growth areas may not return the best margins
- Create new organizations to address/develop new customers
- Subcontract for customer product development
- Enter the service business: training, consultancy, standards setting

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EMERGING APPLICATIONS AND TECHNOLOGIES: INTRODUCTION

Byron Harding
Industry Analyst
European Semiconductor Group
Dataquest Europe Limited

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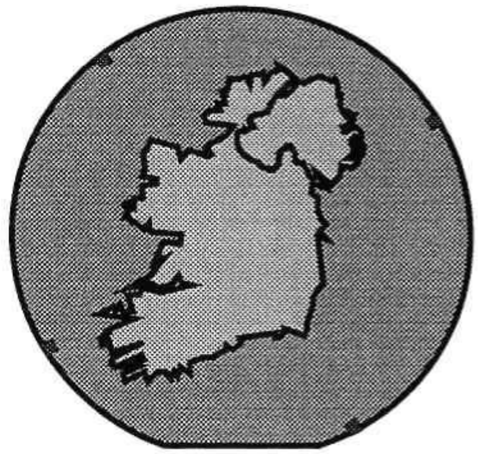

PC CARDS

John Reimer
Chairman and President
Personal Computer Memory Card International Association

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PC CARDS

John Reimer
Chairman and President
Personal Computer Memory
Card International Association

Mr. Reimer is Vice President of Marketing for SunDisk Corporation, a start-up company based in Santa Clara, California, which specializes in flash memory technology and systems. He joined SunDisk from Fujitsu Microelectronics, where he managed the IC Memory Card business unit. Mr. Reimer pioneered the formation of the Personal Computer Memory Card International Association (PCMIA) and is currently Chairman and President of the organization. Prior to this he managed Fujitsu's Microcomputer and Communication Products group before starting the IC Memory Card business unit in 1989. Prior to Fujitsu, he held various engineering and management positions in Texas Instruments. Mr. Reimer has a BSEE from the University of Illinois, United States.

Dataquest Europe Limited
EUROPEAN SEMICONDUCTOR INDUSTRY CONFERENCE
June 3–5, 1992
Dublin, Ireland

1 4/92 - Mobile Computing Overview

PCMCIA INDUSTRY FORUM

Mobile Computing Opportunities Sparked by PC Cards

John Reimer
SunDisk Corporation
PCMCIA President & Chairman

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Objectives

- ▼ **Market Demands**
- ▼ **Motivation for PC Cards**
- ▼ **Market Opportunities**
- ▼ **PCMCIA Accomplishments**
- ▼ **PCMCIA Future Direction**

PCMCIA Industry Forum

Mobiles are Experiencing Explosive Growth

- ▼ **1 in 3 Computers Sold Worldwide in 1995 will be Mobile**

Source: Forrester Research

PCMCIA INDUSTRY FORUM

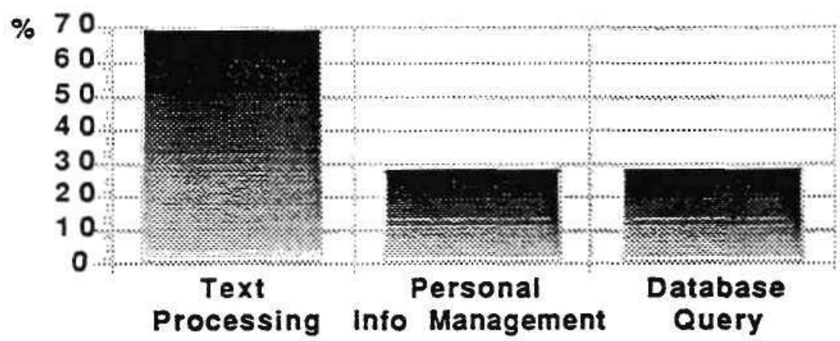
Today's Mobile Computer User Critical Buying Factors

- Physical Size
- Weight
- Battery Run-Time
- Display Quality
- Application Compatibility
- Keyboard
- CPU Performance
- Communications Capability
- Cost

Source: Venture Development Corporation

PCMCIA INDUSTRY FORUM

Most Important Applications for a Mobile Computer



Note: Percentage Totals Over 100% Due to Multiple Responses

Source: Venture Development Corporation

PCMCIA INDUSTRY FORUM

Impact of Solid-State Storage

- A New Generation of Mobile Computers Will Use PC Cards to Better Meet End User's Critical Buying Factors
- First Generation PC Card Products Have Been Introduced

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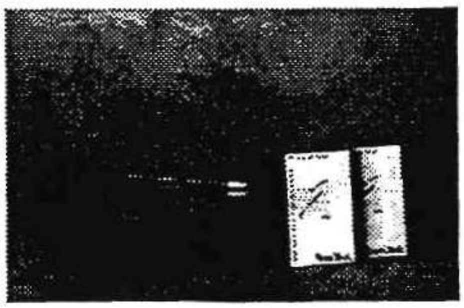
PCMCIA INDUSTRY FORUM

Next Generation PC Card Products

- Pen-Based Products
  - Ruggedness
  - High Capacity Removable Media
  - Low Power Consumption
  - Size
  - Weight



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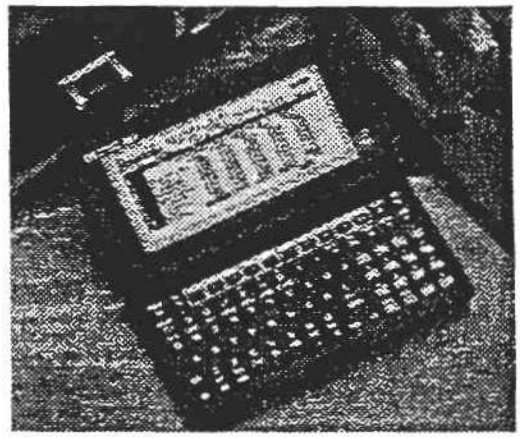
PCMCIA INDUSTRY FORUM

Next Generation PC Card Products

- ▼ **Palmtop Computers**
  - Size
  - Low Power
  - High Capacity Removable Media
  - Weight
  - Ruggedness



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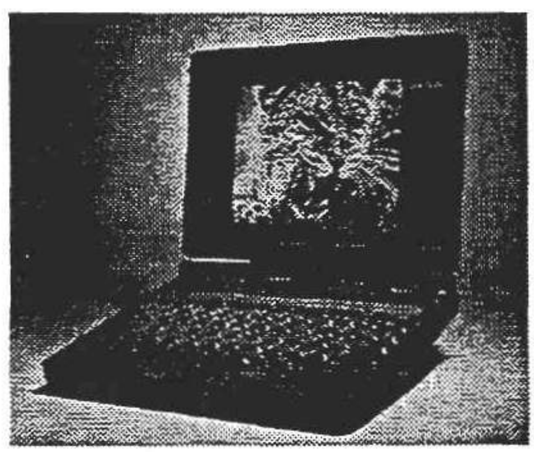
PCMCIA INDUSTRY FORUM

Next Generation PC Card Products

- ▼ **Sub-Notebook**
  - Size
  - Low Power
  - OS Compatibility
  - Ruggedness
  - Weight
  - High Capacity Removable Media



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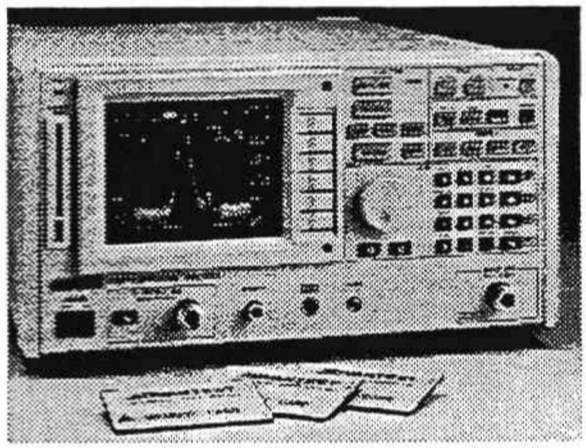
PCMCIA INDUSTRY FORUM

Next Generation PC Card Products

- Application Specific Computers
  - Removability
  - Size
  - Weight
  - Low Power



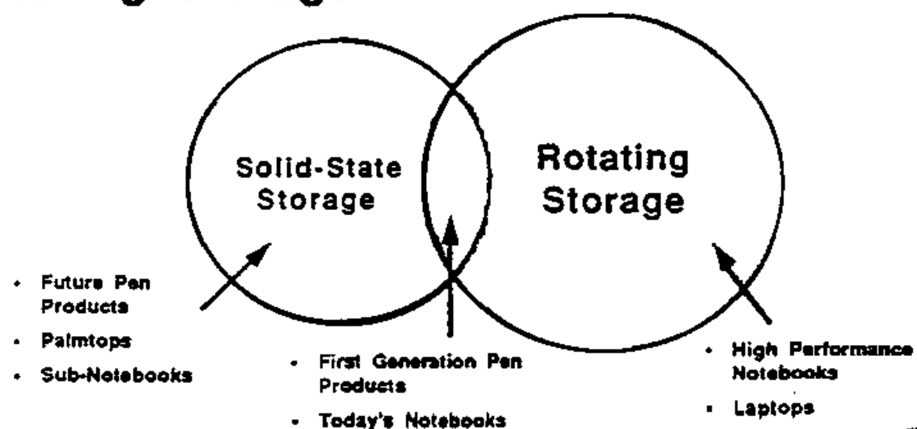
PCMCIA INDUSTRY FORUM

Notebook Market

- Sub-Notebook
  - Mobility
  - Connectivity
- Notebook
  - Performance
  - Maximum Storage Capacity

PCMCIA INDUSTRY FORUM

Solid-State Storage will Coexist with Rotating Storage



PC Card

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PCMCIA INDUSTRY FORUM

Standards Accelerate Adoption of New Technologies

- ▼ **Reduce Risk**
- ▼ **Increase Component Supply base**
- ▼ **Lower Cost**
- ▼ **Increase Market Size**

PC Card

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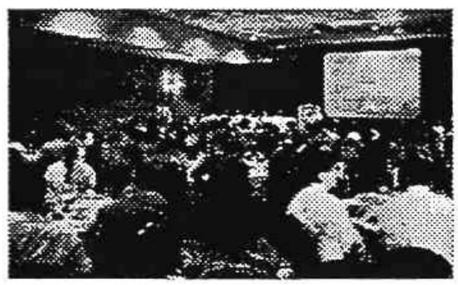
PCMCIA Industry Forum

PCMCIA 2.0 Release

"Mobile Computing Market Opportunities Sparked by Solid State PC Cards"

- **September 16, 1991**
- **Key Industry Leaders Gave Vision for the Future**
- **Over 200 Attendees (30 Press)**



PC Card

PCMCIA Industry Forum

Opportunities Created By PC Cards - Hardware Companies

- **Unprecedented Mobility**
- **New Classes of Mobile Computer Enabled**
  - Palmtop, Pen-Based, Sub-Notebook
  - Imaging Systems
  - Application Specific

PC Card

PCMCIA Industry Forum

Opportunities Created By PC Cards - Hardware Companies (Continued)

- Supporting Hardware
  - Reader/Writers
  - Programmers
  - Test Equipment
  - Data loggers

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Opportunities Created By PC Cards - Software Companies

- New Class of Applications for Mobile Users
- Early Market Entry Critical to Secure Market Position

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PCMCIA INDUSTRY FORUM

Opportunities Created By PC Cards - End Users

- **The Functionality of Next Generation Mobile Computers Combined with New Applications, Will give their Users a Competitive Advantage**

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PCMCIA INDUSTRY FORUM

Future Direction

- **Continue to be Market Driven**
  - Identify and Respond to New Marketing Needs
  - Respond to Activity in Communications Area
- **Focus on Educating Software Developers**
- **Focus on Educating Users**

20 4/92 - Mobile Computing Overview

1 4/92 - Marketing Overview

PCMCIA INDUSTRY FORUM

PCMCIA Marketing Overview

Kathy Kriner
Memory Card Systems & Design
PCMCIA Marketing Committee Chairman

2 4/92 - Marketing Overview

PCMCIA INDUSTRY FORUM

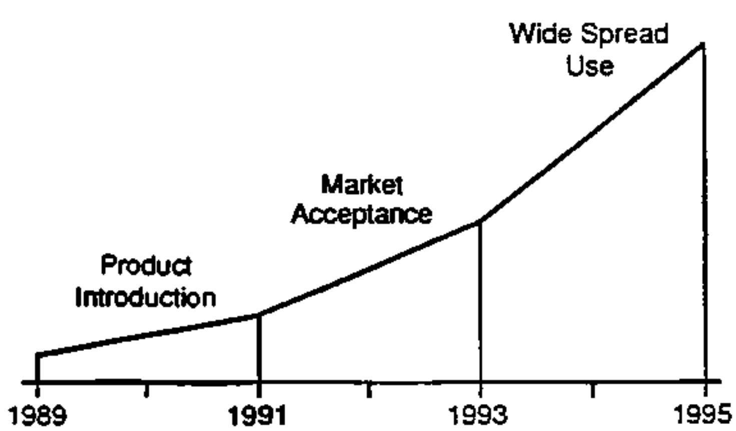
Objectives

- Indicate Size of the Current Market
- Provide Exposure to Variety of Application Areas
- Review Factors Effecting Growth
- Accomplishments
- Future Tasks

PC Card

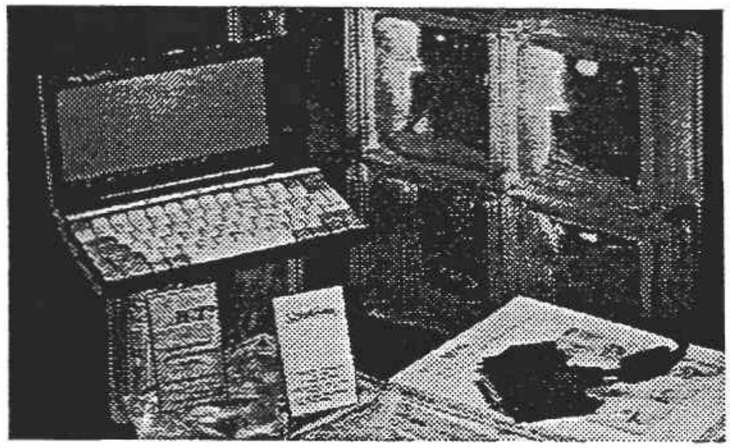
PCMCIA INDUSTRY FORUM

PC Card Market Trend



PC Card

PCMCIA INDUSTRY FORUM



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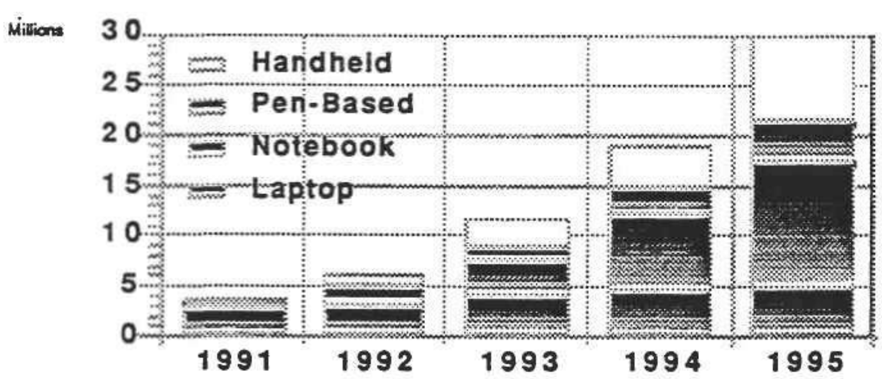
PCMCIA INDUSTRY FORUM

Worldwide Portable PC Forecast



Source: Dataquest January 1992

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PCMCIA INDUSTRY FORUM

Example: HP

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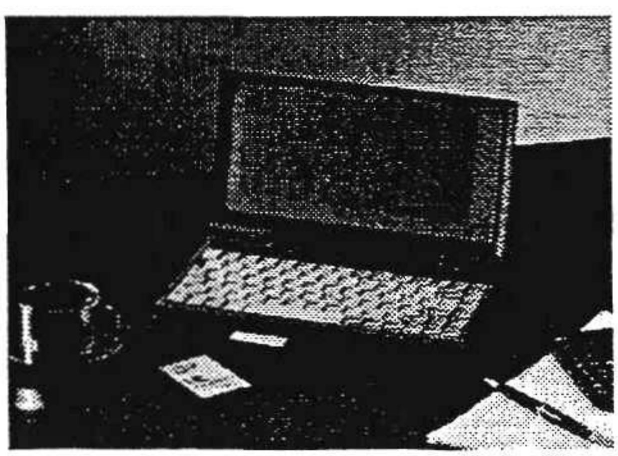
PCMCIA INDUSTRY FORUM

Example: SCM



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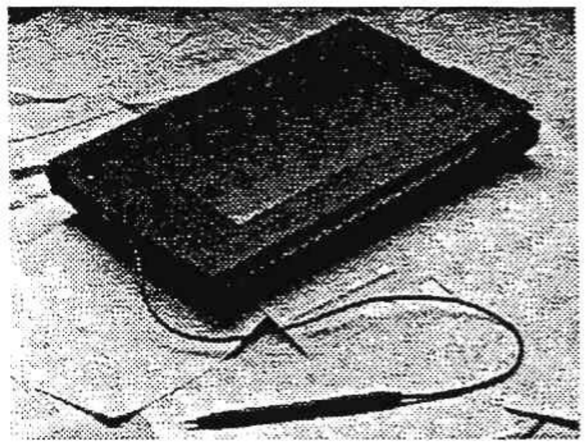
Example: Grid



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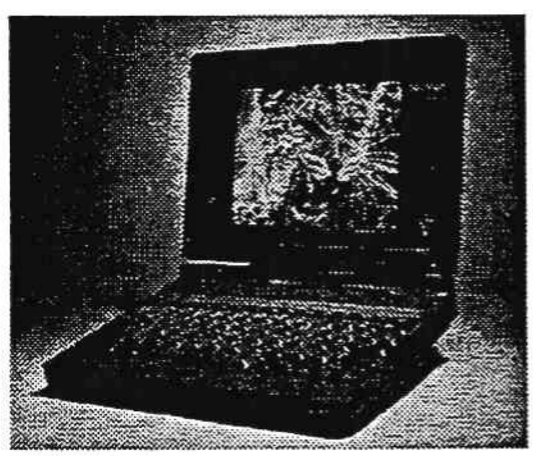
Example: Sharp Notebook



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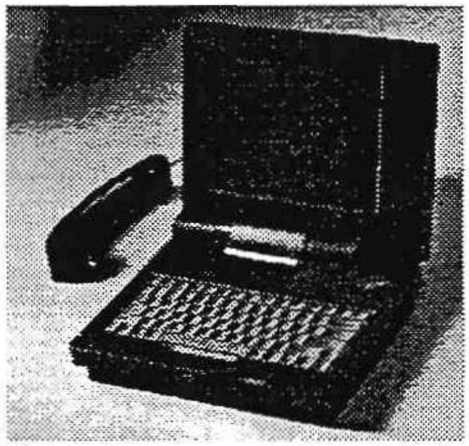
Example: IBM PCradio



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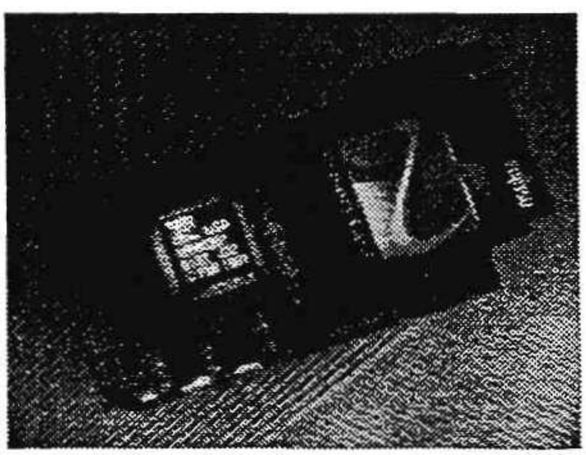
PC Card

PCMCIA Industry Forum

Fujitsu MB86301



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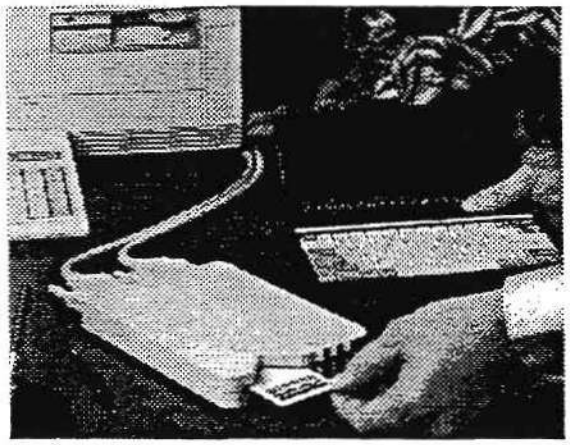
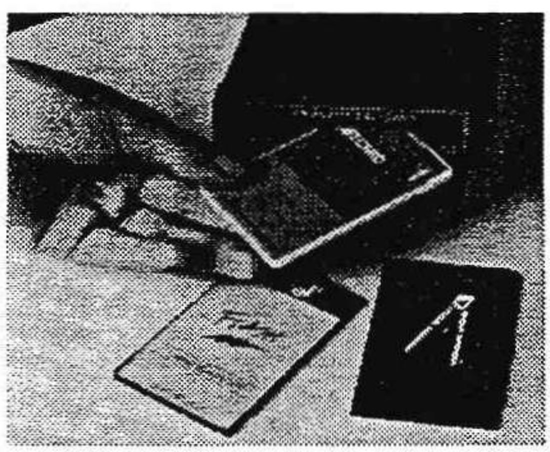
PC Card

Databook Programmer



PCMCIA INDUSTRY FORUM

Adtron Programmer



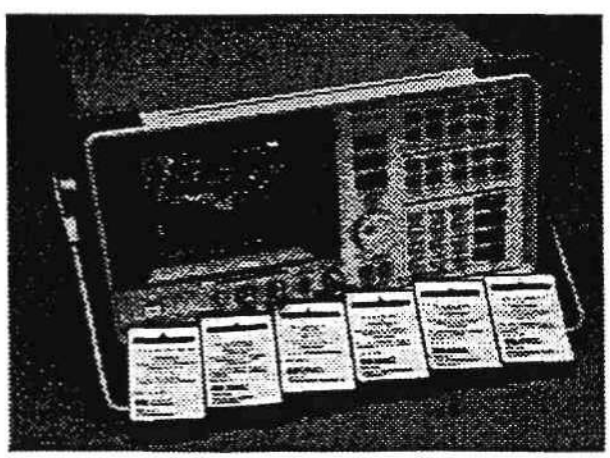
PCMCIA Industry Forum

Environments and Application Areas

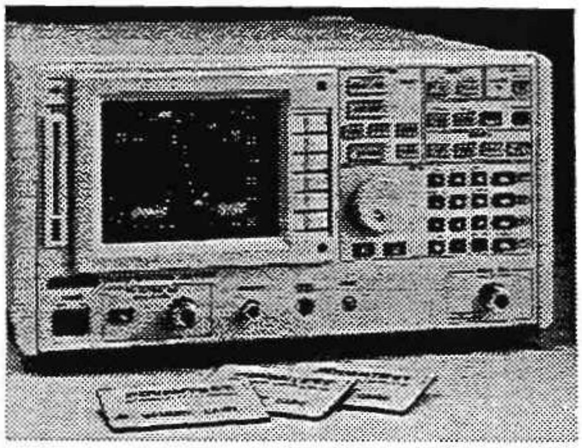
- PC Market
- System Design and Prototyping
- Manufacturing/Industrial
  - Test Equipment
  - Industrial Control Systems
  - Robotics
- Commercial Retail
  - Office Automation
  - Digitized Music
  - Multimedia Systems
  - Data Applications

PCMCIA Industry Forum

HP Spectrum Analyzer



Advantest Spectrum Analyzer

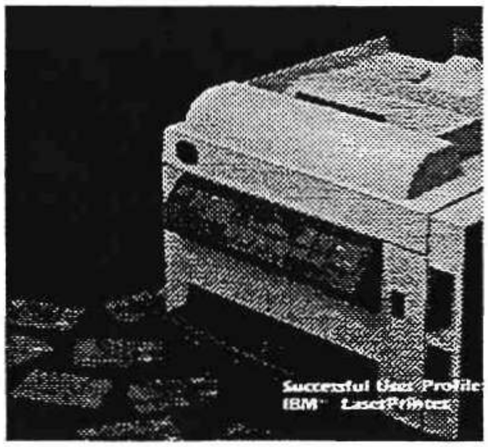


PCMCIA Industry Forum

MIDI

PCMCIA INDUSTRY FORUM

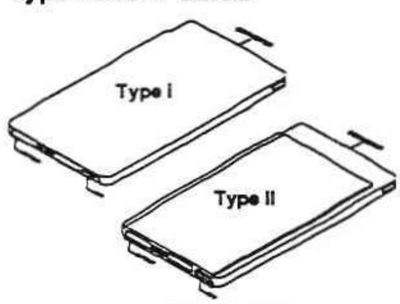
IBM Laser Printer



19 4/92 - Marketing Overview

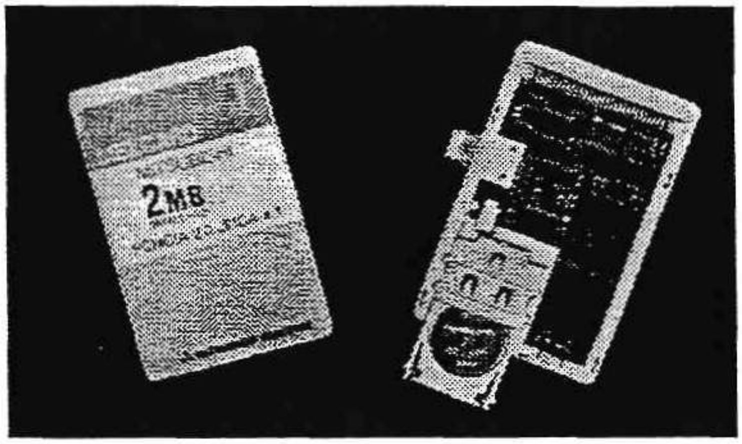
PCMCIA INDUSTRY FORUM

Standard Card Configurations

Standard Card Configurations	Implementations	
Type I and II Cards	Memory PC Cards	I/O PC Cards
	SRAM ROM EPROM EERPOM FLASH	AIMS Solid-State Mass Storage Fax/Modem

20 4/92 - Marketing Overview

Mitsubishi Cards



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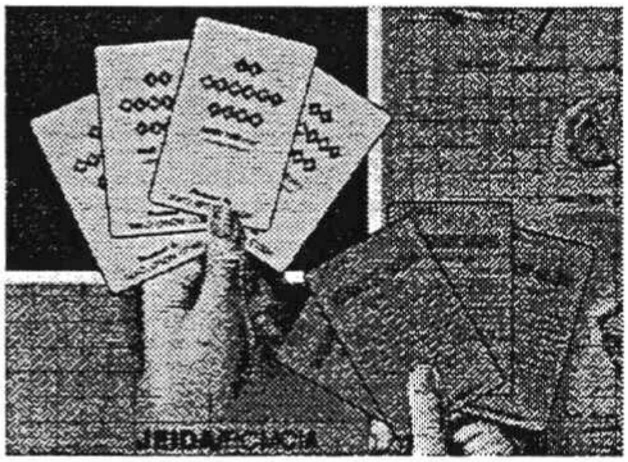
MIPs Cards

PCMCIA INDUSTRY FORUM

Epson Cards



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Maxell Cards

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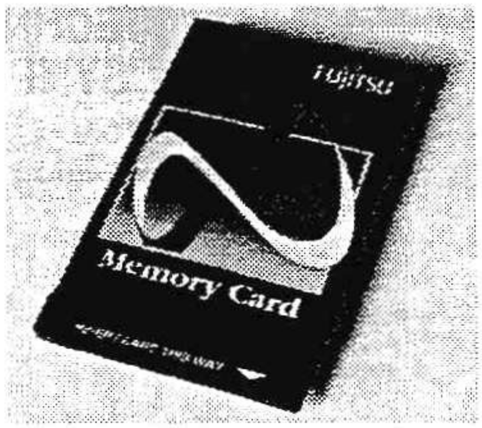
Fujitsu Cards



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Micron Cards

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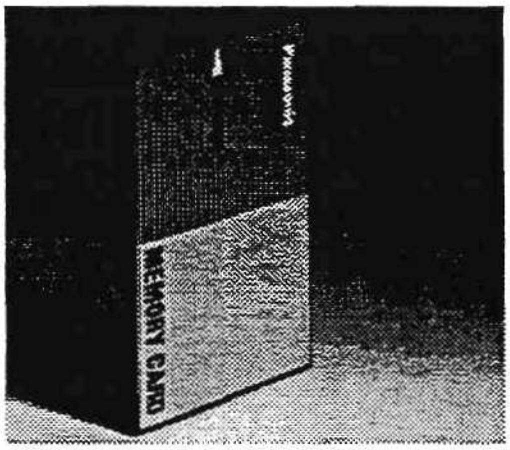
Panasonic Cards



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Standard Card Configurations

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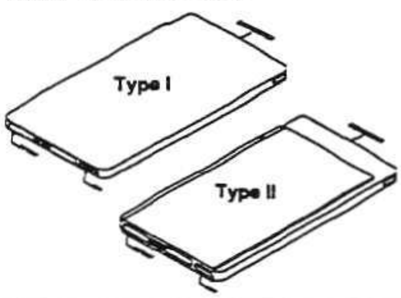	SRAM ROM EPROM EERPOM FLASH	AIMS Solid-State Mass Storage Fax/Modem

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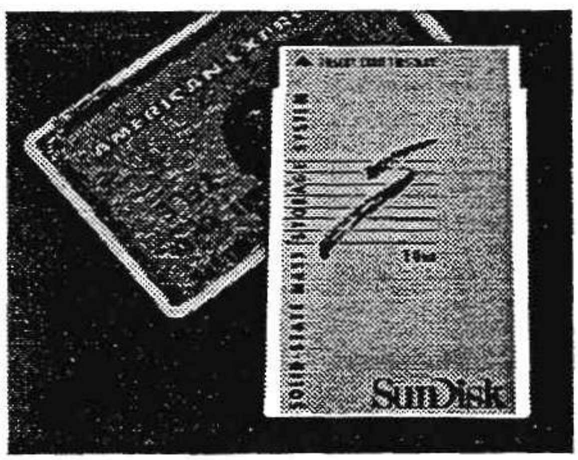
Intel EXCA Card

PCMCIA INDUSTRY FORUM

Sundisk Card



Intel Modem Card

Market Growth Factors

- Benefits of the Technology
- Development of Standards
- Expansion of Applications

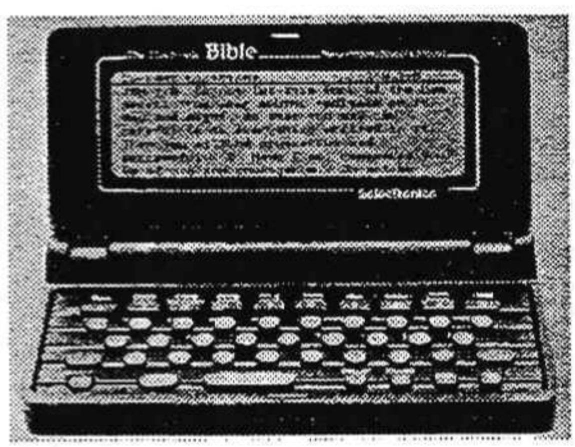
Laptop Computer World Market Forecast

CPU Type	1989	1990	1991	1992	1993	1994	1990 - 1994 Compounded Growth Rate
8088 / 86	658	504	499	364	194	82	-36.45%
80286	677	898	581	474	254	0	-100.00%
80386SX	60	257	782	1215	997	457	15.43%
80386DX	46	80	180	292	1191	2285	131.26%
80486	0	0	0	0	14	61	—
TOTAL	1141	1739	2042	2345	2650	2885	14.46%

K Units

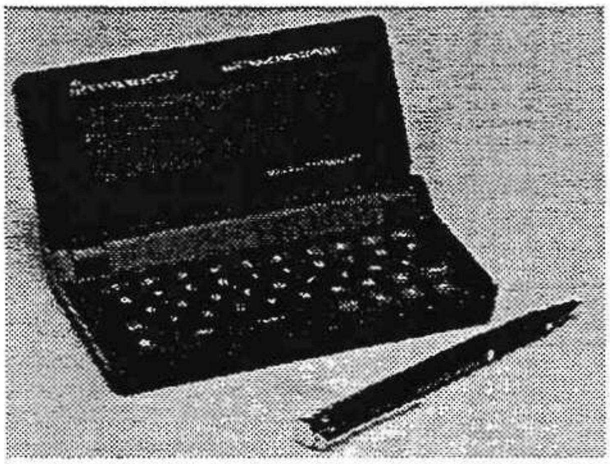
Source: Dataquest, October 1990

Selectronics Bible



PCMCIA INDUSTRY FORUM

Selectronics Encyclopedia



PCMCIA INDUSTRY FORUM

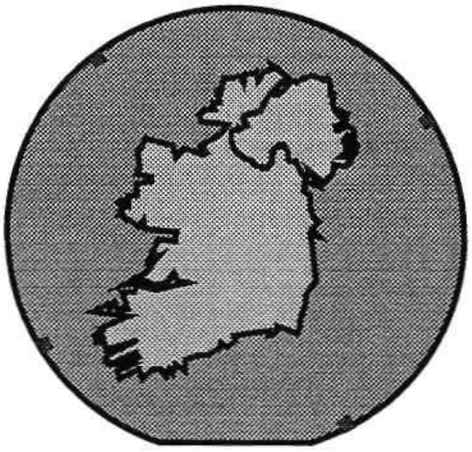
Environments and Application Areas

- PC Market
- System Design and Prototyping
- Manufacturing/Industrial
  - Test Equipment
  - Industrial Control Systems
  - Robotics
- Commercial Retail
  - Office Automation
  - Digitized Music
  - Multimedia Systems
  - Data Applications

PCMCIA INDUSTRY FORUM

Future Tasks

- **Continue to Promote PC Card Technology**
  - Symposium
  - Trade Show Participation
  - Press Relations
- **Provide a Strong Marketing Orientation**
- **Develop "Sales Collateral"**
  - Research and Survey Work



PERSONAL COMMUNICATIONS

Dean Eyers
Industry Analyst
European Telecommunications Group
Dataquest Europe Limited

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PERSONAL COMMUNICATIONS

Dean Eyers
Industry Analyst
European Telecommunications Group
Dataquest Europe Limited

Mr. Eyers is an Industry Analyst for Dataquest's European Telecommunications Group (ETG) and is located in Denham, England. He is responsible for research in the mobile communications area. Prior to joining Dataquest, Mr. Eyers worked in market research, following a Business Management course at Sunderland Polytechnic Business School. Mr. Eyers received a B.Sc. honours degree in Psychology from the University of Newcastle upon Tyne.

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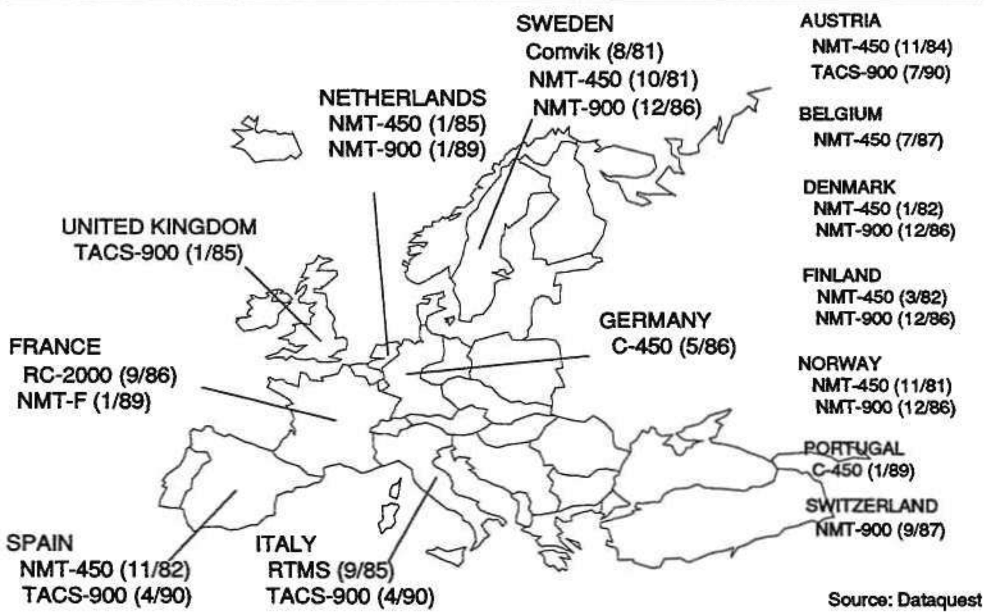
June 3–5, 1992
Dublin, Ireland

PERSONAL COMMUNICATIONS IN EUROPE

AGENDA

- Analog Cellular
- GSM Digital Cellular
- DCS 1800
- Digital Cordless Telephony

ANALOG CELLULAR SYSTEMS
IMPLEMENTATION BY COUNTRY



Source: Dataquest

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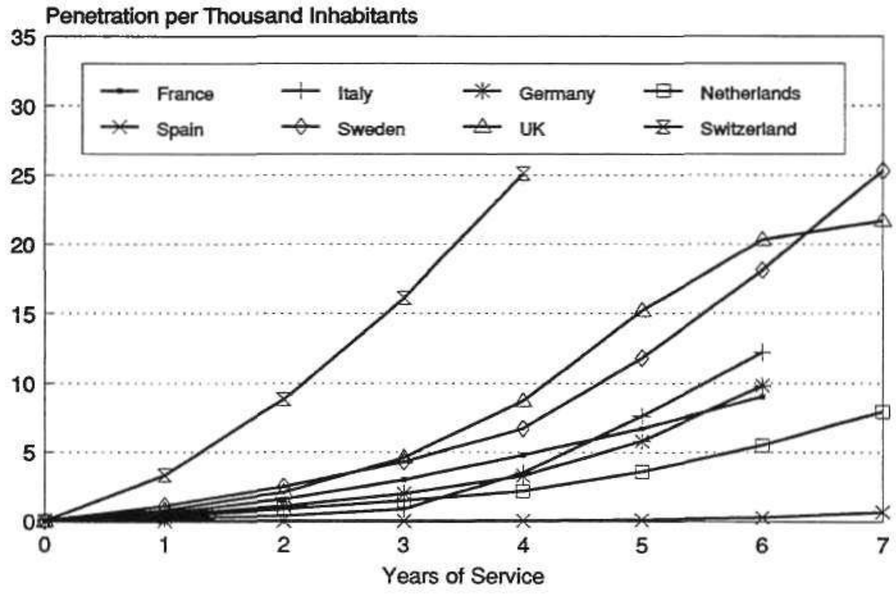
PENETRATION BY MAJOR COUNTRY BY YEAR



Source: Dataquest

KEY FACTORS IN CELLULAR MARKETS

- Pricing
  - Equipment
  - Tariffs
- Coverage
- Capacity
- Service/quality
- Equipment features/availability
- Demographics/economics

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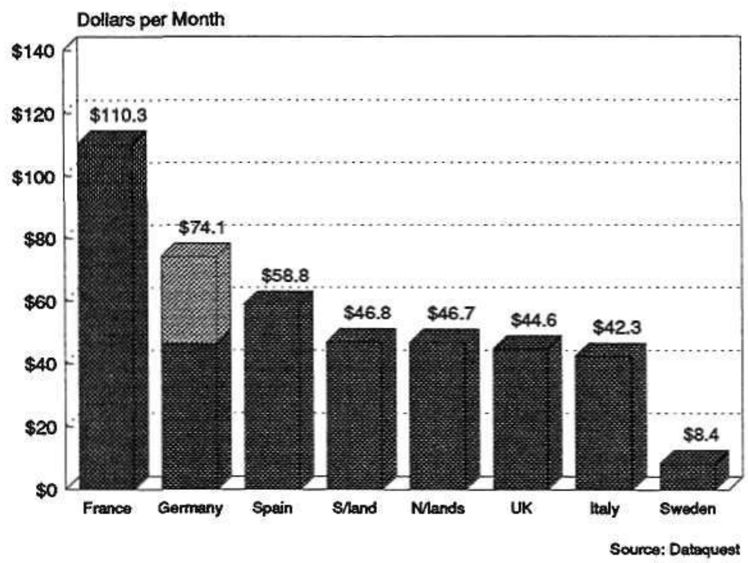
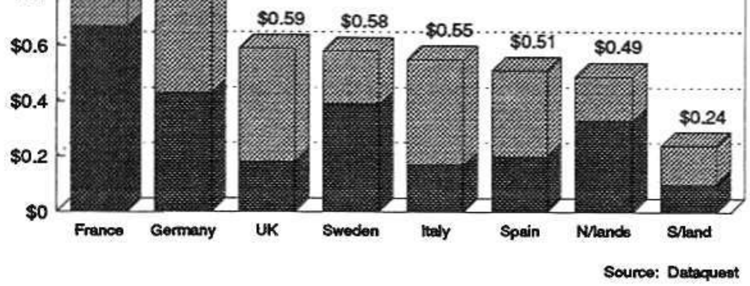
EUROPEAN CELLULAR SUBSCRIPTION FEES



EUROPEAN CELLULAR CALL CHARGES



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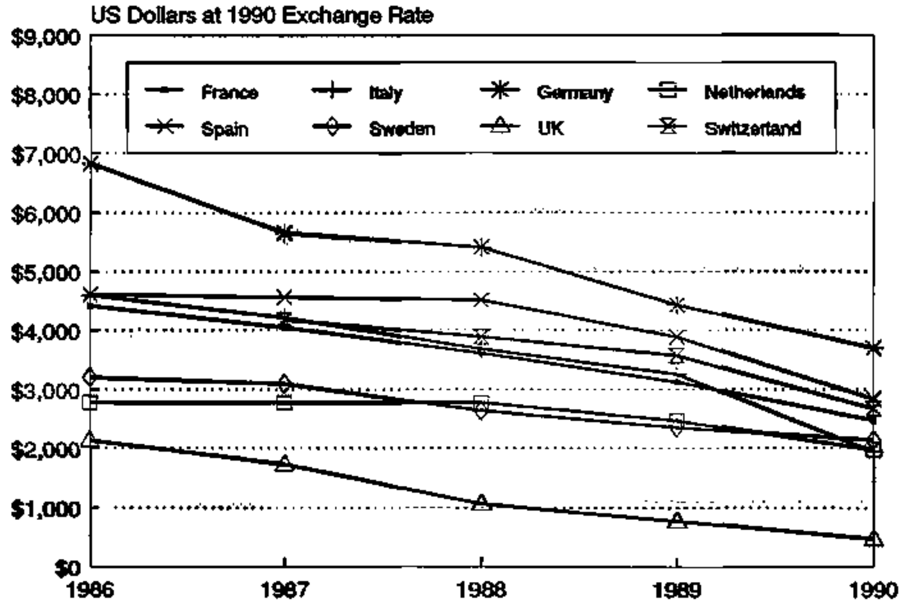
CELLULAR TELEPHONES - END-USER PRICES



Source: Dataquest

ANALOG CELLULAR MARKET TRENDS

- Still predominantly business market
- Recession leading to slowdown
- Interim analog networks supporting growth
- Capacity available on many systems
- New tariff packages in Nordic countries

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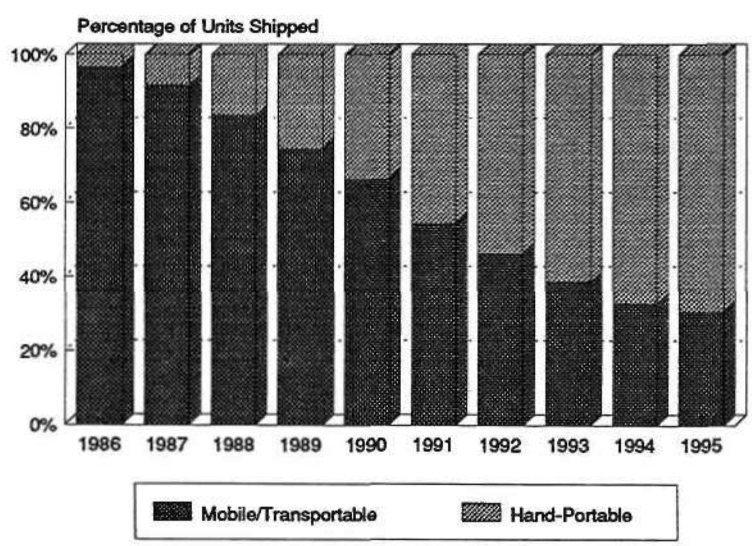
ANALOG CELLULAR MARKET TRENDS

- Strongest growth in hand-portable sector
- Major players cover Europe
- Many early specialists acquired
- Some new entrants

EUROPEAN ANALOG CELLULAR SHIPMENTS



Source: Dataquest

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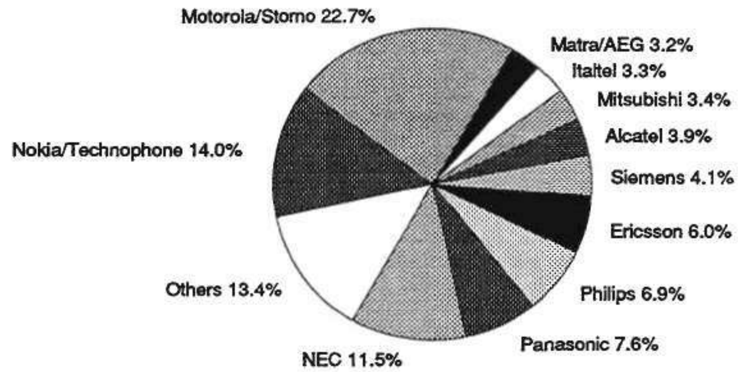
EUROPEAN CELLULAR TELEPHONE MARKET



Total 1990 Shipments
1.26 Million Units

Source: Dataquest

ANALOG CELLULAR LIMITATIONS

- Spectrum availability limits capacity
- Economies of scale for infrastructure and terminal suppliers limited by fragmented market
- Tariffs and terminal prices relatively high
- Scope for further growth is generally limited to business users
- Congestion in areas of high-user density
- Potential new competitors deterred from entry

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REASONS FOR GSM

- Realization of spectrum limitation
- Harmonized system in all CEPT countries
- Digital Technology
- Gives Europe a leading edge

KEY FACTORS FOR GSM - PRICING

Handsets

- Components more expensive
- Heavy cost of research & development
- Economies of scale potentially greater
- Greater competition

Initially higher price than analog, significant erosion once critical market size attained

KEY FACTORS FOR GSM - PRICING

Service Tariffs

- Competing operators
  - Existing operators want smooth migration
  - New operators want fast growth, max. ROI
- Service providers in major territories
- Greater competition for infrastructure supply
- Innately higher spectrum efficiency
- Ultimately, lower cost per subscriber

Tariffs/package price to drop with competition

KEY FACTORS FOR GSM

Coverage - Initially limited compared to analog

Capacity - More spectrum available - EC directive
- More spectrum efficient

Quality - Better speech quality, more reliable

Features - More sophisticated services available
- Product differentiation stimulated by competition

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DELAYS IN GSM

- Specifications set late, incomplete
  - Still changing
  - Some features delayed until phase II
  - Ongoing problems with type approval
- Operators still have capacity on analog networks
- Inter-country roaming arrangements to be agreed
- Second operators licensed late, more to come

Market development largely dependent on level of support from operators and manufacturers

GSM - MARKET PROSPECTS

- GSM has slipped but not fallen
- Growth will begin in earnest next year, driven by majors with unexploited potential - Germany and France
- Competition will be fierce - expect second wave of terminal suppliers during 1993
- GSM terminal shipments to overtake combined analog in 1994/5
- Terminal market to grow to $2.3 billion by 1995

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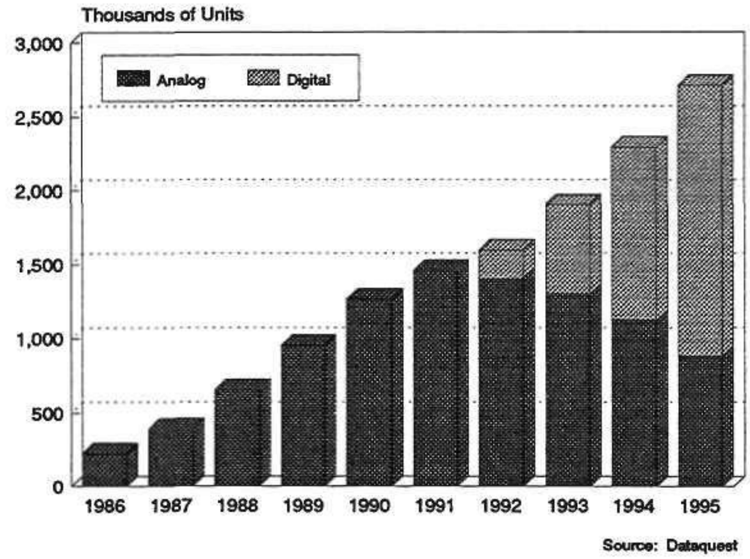

DCS 1800 IN EUROPE

- PCN concepts of UK's DTI
- GSM specification at 1.8 GHz
- Microcellular applications
- Three licenses in UK - down to two
- License to be issued in Germany

DCS 1800 IN EUROPE

- Main advantage over GSM is extra capacity
- Disadvantage is network investment
- PSTN competition demands political will and long-term investment
- Possible application in underdeveloped territories
- Western Europe - focus is mobility

DIGITAL CORDLESS TELEPHONY

- Two major standards:
  - DECT
  - CT2/CAI
- Three major applications:
  - Office System - cordless PBX platform
  - Telepoint - portable PSTN access service
  - Residential - home base station
- Possible future applications:
  - Local loop - Telepoint to the home
  - Personal Communications Network

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TELEPOINT STATUS IN EUROPE

- UK failure - not a valid test
- Services to launch this year in France, Netherlands and UK - others watching
- Success will depend on positioning and operator support in national market
- Critical mass of business terminals would provide major boost
- CT2 still has window of opportunity

CORDLESS PBX ENVIRONMENT

- Products must meet general price/feature criteria
- Competition between standards and with analog cordless alternative
- Standards/approvals bodies play key role
- Telepoint may be a differentiator
- Related technologies may influence market

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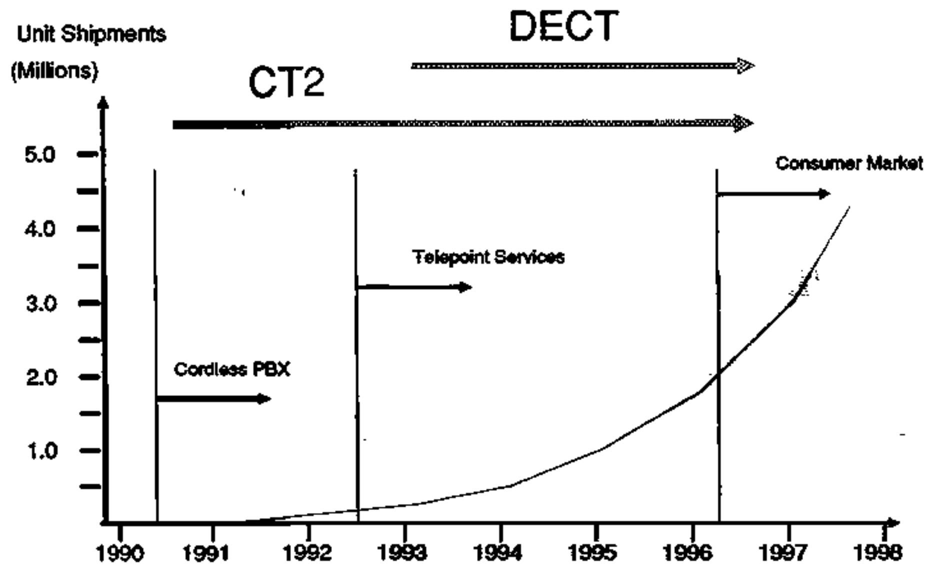
EUROPEAN DIGITAL CORDLESS TELEPHONY
(TECHNOLOGY APPLICATION TRENDS)



Source: Dataquest

PERSONAL COMMUNICATIONS IN EUROPE

- A pan-European market
- Technologies in competition
- A realistic dream?
- Leading the world

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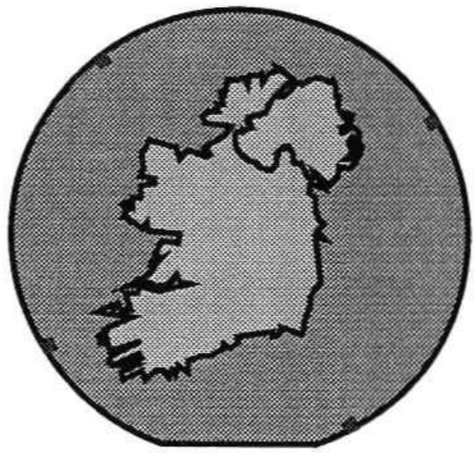

VIDEOPHONES

Jeffrey Goldberg
Industry Analyst
European Document Management Group
Dataquest Europe Limited

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VIDEOPHONES

Jeffrey Goldberg
Industry Analyst
European Document Management Group
Dataquest Europe Limited

Mr. Goldberg is an Industry Analyst for Dataquest's European Document Management Group (EDMG) specializing in facsimile and software related to document management technology. He has more than 10 years' experience in the microcomputer industry, most recently working for Psion plc as a Senior Software Engineer managing the development of the MC600 notebook computer. Prior to this, he worked for Borland International in the United Kingdom, Denmark and the United States as European Development Manager for Future Development, focusing on products such as SideKick Plus and SideKick for Presentation Manager. Mr. Goldberg received a B.Sc. in Electrical and Electronic Engineering from City University, London.

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June 3–5, 1992
Dublin, Ireland

WHAT IS VIDEO TELEPHONY?

- Videophones
- PC Videophones
- Video Conferencing

WHO WANTS IT?

- 60 percent of message = non verbal
- Phone familiar object
- Video obvious extension
- Clear cost savings

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TECHNOLOGY

- Why does it not exist today?
- Bandwidth, Bandwidth...
- Image compression

STANDARDS

- Why important?
- CCITT H.261
- Problems...

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ANALOG versus DIGITAL

- ISDN or PSTN
- Coverage
- Cost
- Quality

WHAT'S INSIDE THE BOX?

- Camera (CCD)
- LCD and drivers
- Keyboard/mini display
- CPU
- Audio codec
- Video codec
- ISDN interface/PSTN modem

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H.261 VIDEO CODEC

- DCT
- Motion estimation and compensation
- Quantization
- Loop filtering
- Variable length coding/decoding

QUALITY

- VGA (640 pixels by 480 lines)
- CIF (352 pixels by 288 lines)
- QCIF (176 pixels by 144 lines)
- Analog (128 pixels by 96 lines)

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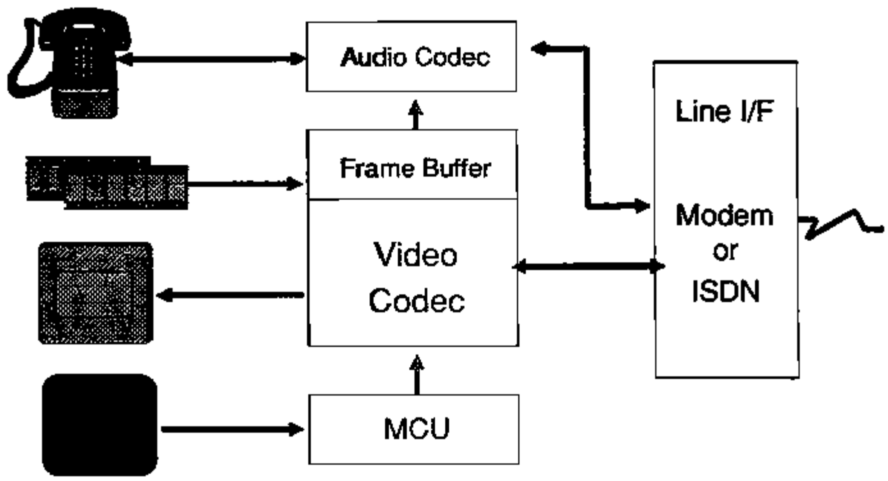
A VIDEOPHONE IS...



DATAQUEST VIEW OF THE VIDEOPHONE MARKET

- Similar to facsimile
- Slow to start until price/quality acceptable
- Strong growth
- 1995-2000 timeframe
- Potential of vast market

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IMPLEMENTATION OF VIDEO CODEC

- 16-bit DSPs (TI 320C30)
- Hardwired ICs
- Peripheral chips also required

KEY PLAYERS

- Hitachi
- BT (and partners)
- CLI/IIT
- PictureTel/Intel
- GEC-Marconi (and partners)
- AT&T

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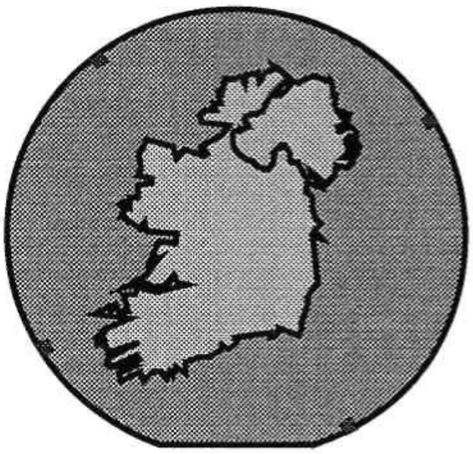

FLASH MEMORY REVOLUTIONIZES PORTABLE COMPUTING

Anthony G. Barre
Director of Strategic Planning
Memory Components Division
Intel Corporation

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FLASH MEMORY REVOLUTIONIZES PORTABLE COMPUTING

Anthony G. Barre
Director of Strategic Planning
Memory Components Division
Intel Corporation

Mr. Barre is based in Folsom, California, and directs all of the strategic planning for Intel's Flash-based components, cards, systems and software. Prior to this assignment, he served in several general management and marketing roles in Intel's Microprocessor and Memory Business units. Mr. Barre gained a Masters degree in Engineering Science at the California Institute of Technology and a B.Sc. degree in Engineering from the United States Military Academy at West Point, New York.

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This presentation was not available

at the time of publication

FUZZY LOGIC

Professor A. J. van der Wal
Manager
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FUZZY LOGIC

Professor A. J. van der Wal
Manager
European Technical Centre
Omron Electronics Europe BV

Mr. van der Wal is Manager of the European Technical Centre (ETC) of Omron Electronics Europe BV in the Netherlands. This R&D centre is active in developing fuzzy logic applications and consulting in the area of fuzzy technology. Prior to this he was an advisor with this company and a consultant with Berenschot Informatica. He was a professor of physics at Eindhoven University. His research involved user-friendly interfaces, fast data acquisition and real-time data analysis, distributed processing, neural networks and expert systems. Mr. van der Wal worked in industrial research with Philips NatLab and in the medium energy facility of SIN. He studied Physics at the University of Utrecht and received a Ph.D. in Solid-State Physics.

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FUZZY LOGIC:

A quantitative way to model qualitative information

Ariën J. van der Wal
Omron Electronics Europe
R&D Centre

European Semiconductor Conference
June 4, 1992 Dublin
Dataquest

Session:
New Technologies

OMRON ETC

Agenda

- Fuzzy Logic Basics
- Merits of Fuzzy Logic
- Application areas
- Example: Fuzzy Control
- How Fuzzy Logic can be implemented in products

OMRON ETC

Why Fuzzy Logic ?

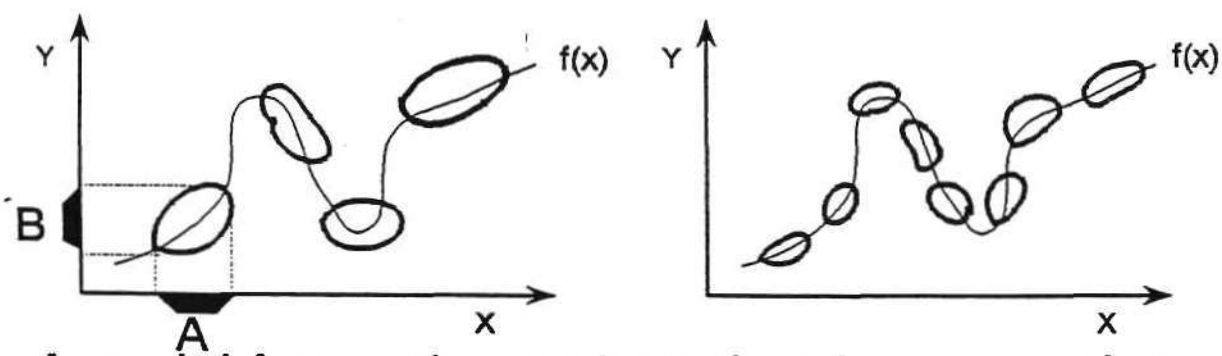
Precision is costly

- Uncertainty is inherent to physical observations (Heisenberg)
- Tradeoff between accuracy and
  - Complexity
  - Computabliity
  - Significance (Zadeh)
- "So far as the laws of mathematics refer to reality, they are not certain. And so far as they are certain, they do not refer to reality"

Albert Einstein

OMRON ETC

Approximation of functions

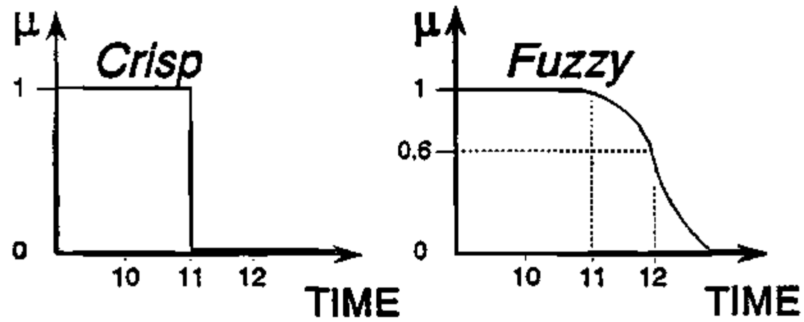


A model-free estimator based on fuzzy coverings
Finer covering → Better approximation

"Rule" ≡ Association (A,B)
$A \subset X \quad B \subset Y \Rightarrow$ Patch ($A \times B$) in state space
IF X is A THEN Y is B ⇒ Rule

OMRON ETC

Fuzzy set theory introduces "Elasticy of meaning"



CHECKOUT TIME IS 11 A.M.

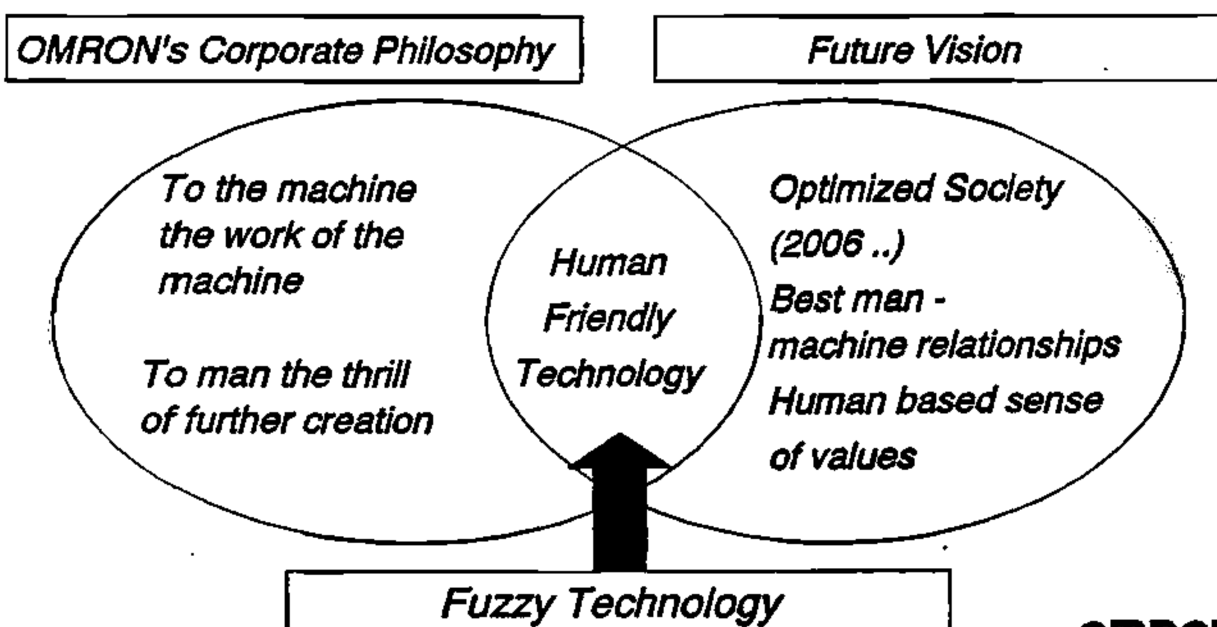
The meaning of ' 11 a.m. ' is context dependent.

$\mu_{11\ am}(hour) \equiv$ membership function

OMRON ETC

FUZZY and OMRON

Fuzzy is one of the basic technologies at OMRON



OMRON ETC

Fuzzy Technology: Omron's View

1. A paradigm to utilize fuzziness as valuable information
2. A methodology for modeling and utilizing human knowledge and senses

Human-friendly machines

Higher level of automation

OMRON ETC

Taxonomy of model-free estimators

Type of knowledge	Representation: *Symbolic*	Representation: *Numerical*
Structured	AI EXPERT SYSTEMS	FUZZY SYSTEMS
Unstructured		NEURAL SYSTEMS

OMRON ETC

Chronology

1983 Began fuzzy technology research

1984 Submitted the first patent on fuzzy logic

1987 Presented OMRON's fuzzy controller at the 2nd IFSA, initiated the "fuzzy boom"

1988 Marketed worlds first super-high speed FUZZY controller, FZ-1000

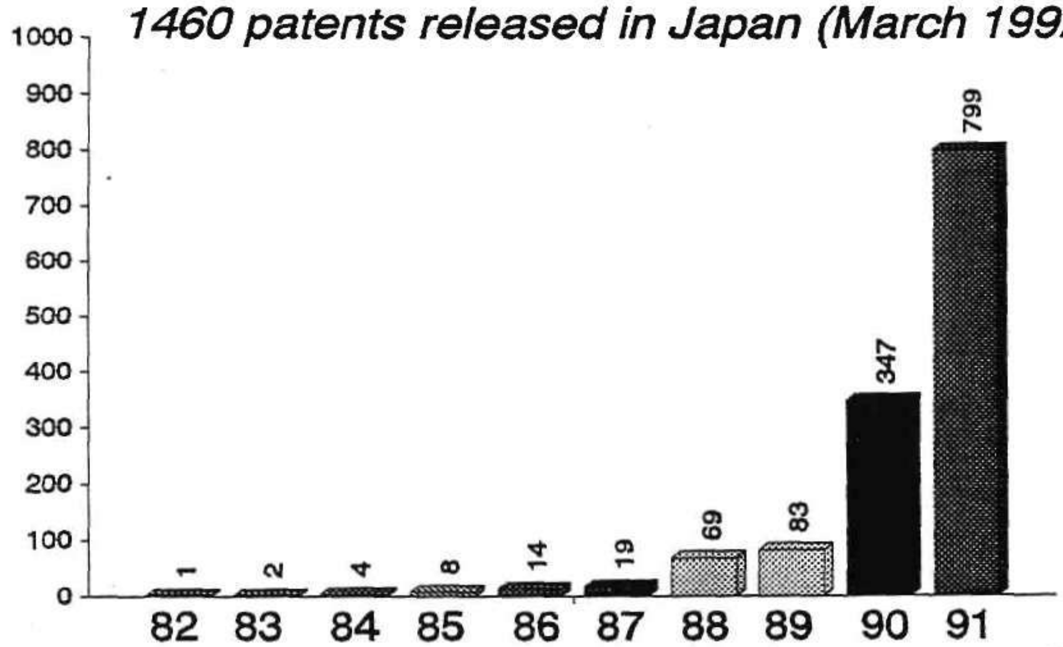
1989 Established Fuzzy Technology Business Promotion Center
Welcomed Prof. Zadeh to OMRON as senior adviser

1992 Complete serie of FUZZY (co)processors: FP1000, FP3000, FP5000, FP7000
Fuzzy Inference Board FB-30AT for PC
Fuzzy Unit for PLC C200H-FZ001
Total number of patents applied reached 1460

OMRON ETC

Number of Fuzzy patents

1460 patents released in Japan (March 1992)



OMRON ETC

Merits of Fuzzy tecnnology

User-oriented Features:

- Reduction of overshoot
- Reduction of settling time
- Multiple objective control possible
- Accurately following setpoint changes
- Feature extraction
- Reduction of maintenance
- Reduction of power consumption
- User-friendly man-machine interface
- Reduction of error ratio

OMRON ETC

Merits of Fuzzy technology

Developer - oriented Features

- Short development time
- Easy to cover a complete multiple input domain
- Straightforward to include operator experience
- Trade-off between different design characteristics is possible
- Hybrid control possible
- Strong interpolative properties
- Same rule base can be used for wide range of model parameters

OMRON ETC

Application areas of Fuzzy Technology

- Expert Systems
- Control
- Data analysis and pattern recognition

OMRON ETC

Application examples of Fuzzy Logic

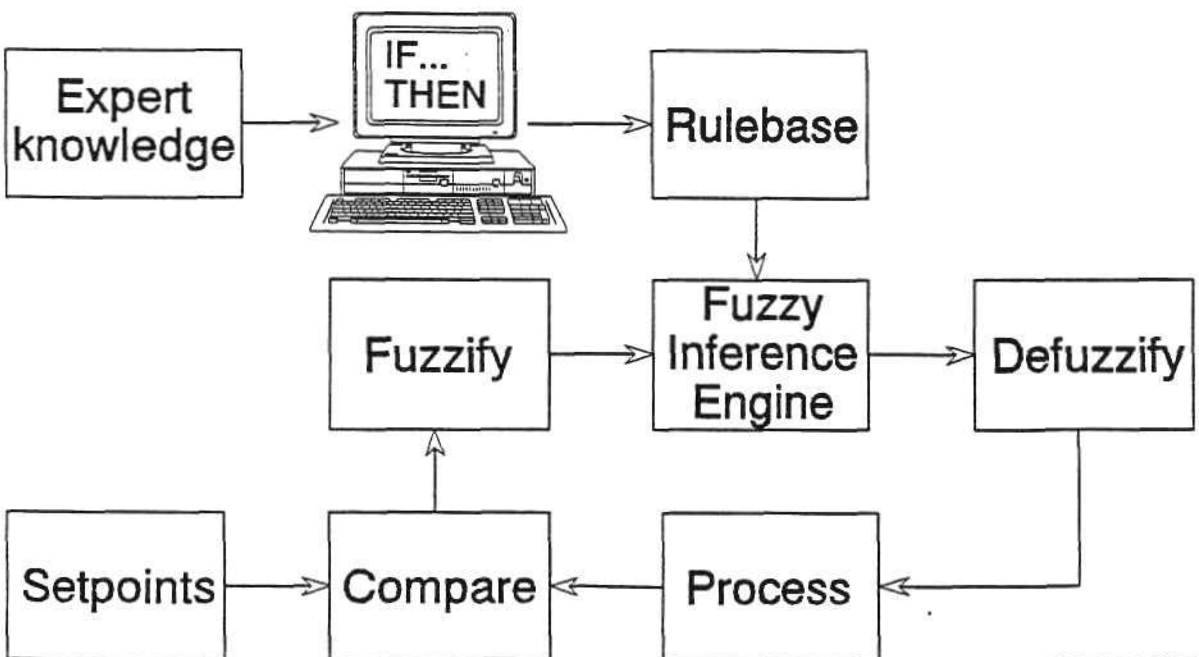
- Expert systems for medical diagnoses, scheduling and control, sales, economics, marketing research and stock performance prediction.
- Automotive systems for automatic transmission control, fuel injection, active suspension control and anti-skid braking (ASB).
- Control systems for consumer electronics products: still video and camcorders, airconditioners, microwave ovens.

OMRON ETC

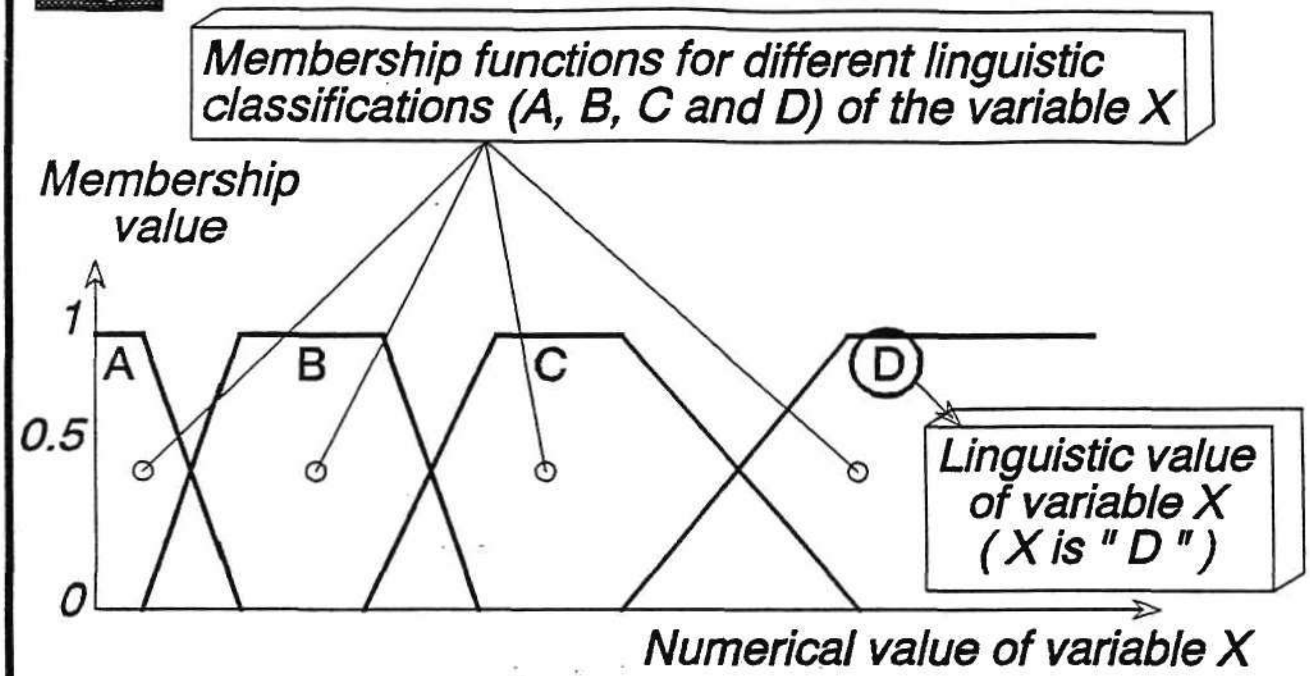
Application examples of Fuzzy Logic

- Industrial systems for elevator, rail system, robot and motor control.
- Industrial manufacturing, process industry and environmental processing.
- Pattern recognition systems, e.g. access control and security systems and smart sensors.

Structure of a Fuzzy controller



Fuzzification of variables



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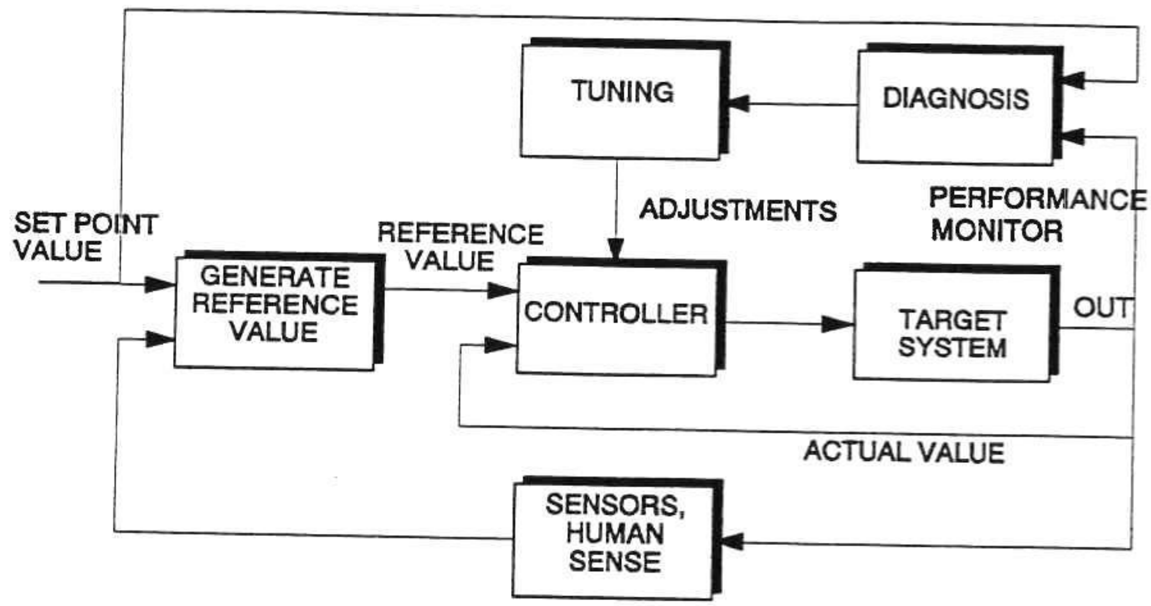
Fuzzy control ⇔ Conventional control

- Conventional controllers rely strongly on a good mathematical model description of the process
- Conventional methods of control have come to rely exclusively on linear mathematical control methods
- Strong dependence on changes in workpoint and on parameter scaling

OMRON ETC

Where to employ Fuzzy Logic



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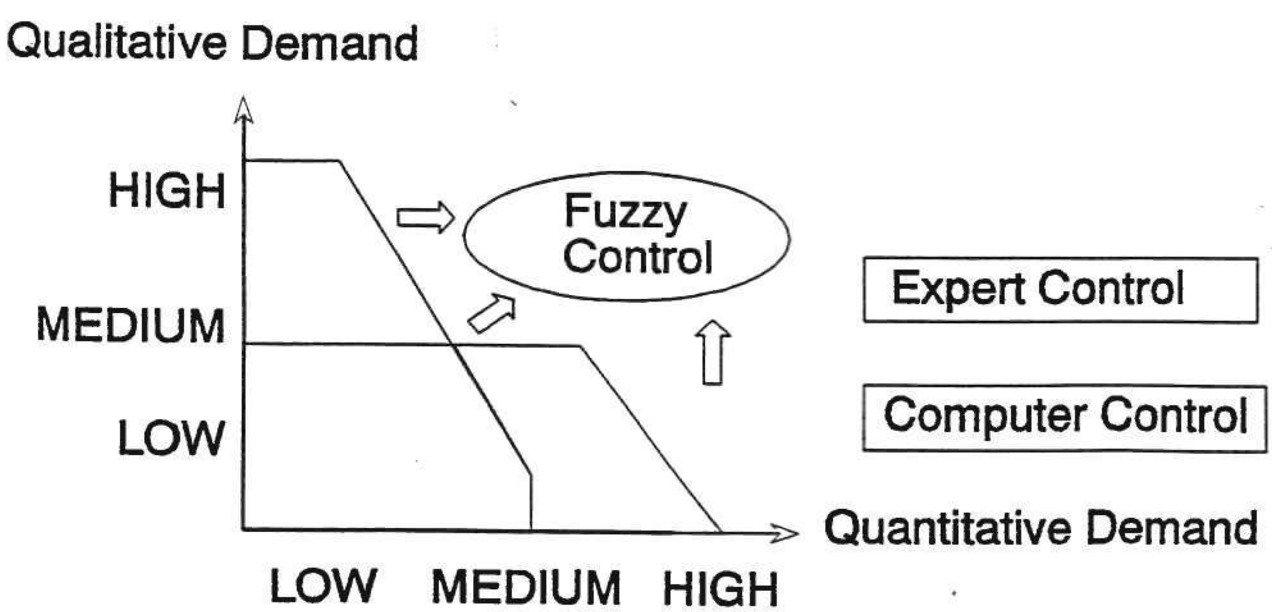
Quantitative/Qualitative demand



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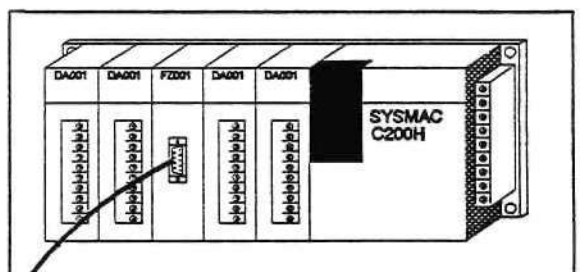
OMRON Fuzzy Products

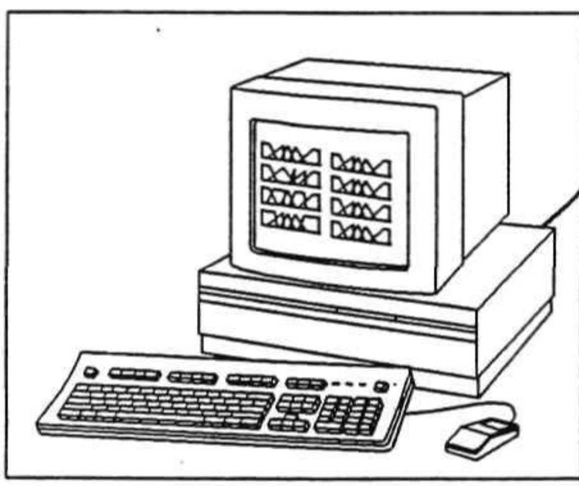
1. Fuzzy Processors: FP 1000, FP 3000, FP 5000
2. Software Development Tools: FS 10-AT, FS 50-AT
3. Fuzzy Inference Board: FB 30-AT
4. Programmable Fuzzy Logic Controller: C200H-FZ001
5. Fuzzy Temperature Controller: E5AF
6. Consultancy in Applications of Fuzzy Logic Technology e.g. in Factory Automation

OMRON ETC

FZ001 - Sysmate FSS

Fuzzy Support Software

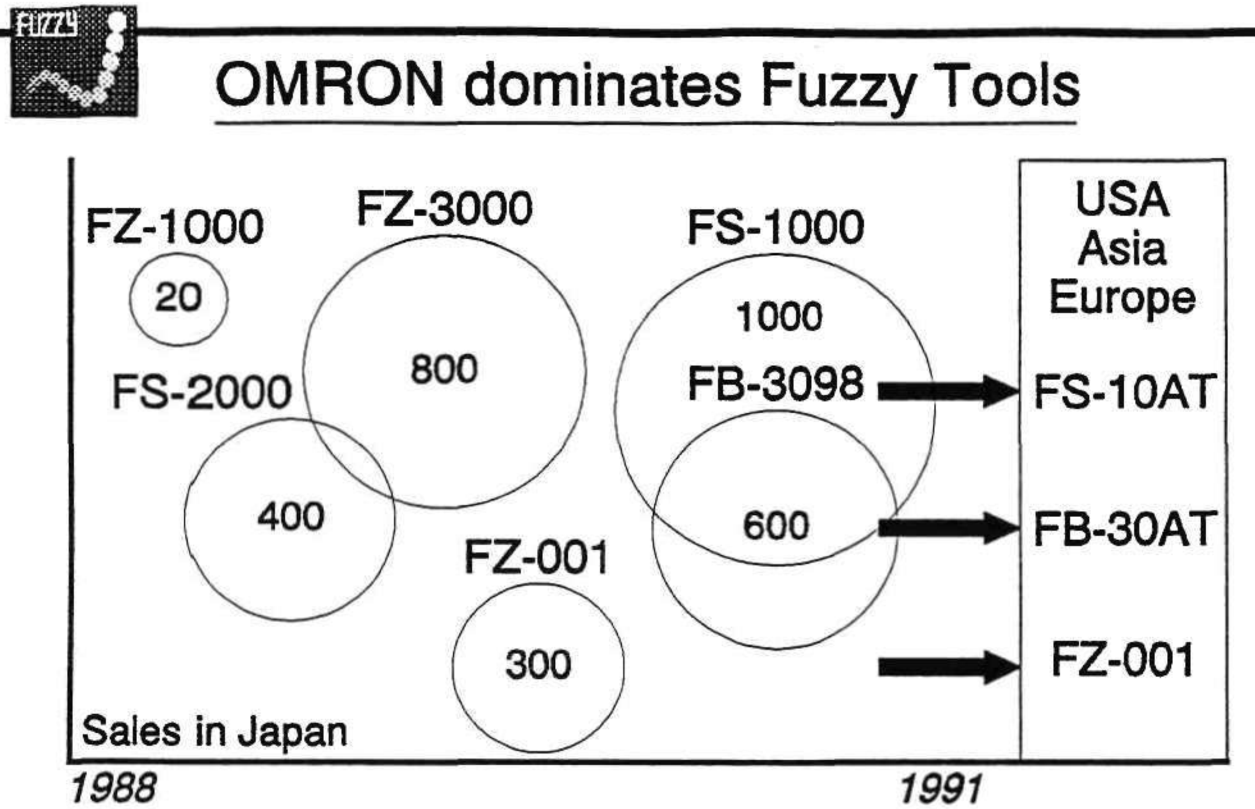




- Creation of rules / MF's
- Rule consistency check
- File load/save on disk
- Documentation printout
- Up-/download FZ001 data
- I/O + Inference monitoring
- Save log file for analysis

OMRON ETC

OMRON dominates Fuzzy Tools



omron
ETC

PRODUCTS MARKETS ANALYSIS—LOGIC: INTRODUCTION

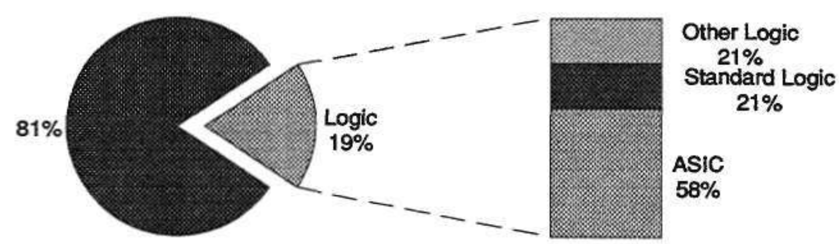
Mike Glennon
Senior Industry Analyst
European Semiconductor Group
Dataquest Europe Limited

Dataquest Europe Limited, a company of The Dun & Bradstreet Corporation
Roussel House, Broadwater Park, Denham, Uxbridge, Middx UB9 5HP / 0895 835050 / Tlx 266195 / Fax 0895 835260

PRODUCTS MARKET ANALYSIS - LOGIC

- Logic market trends and analysis
- Is standard logic dead?
- Future trends in general purpose logic

EUROPEAN LOGIC MARKET
SHARE OF SEMICONDUCTOR MARKET



1991 Logic Share
Total Semiconductor $11,283M

1991 Logic Segments
Logic - $2,129M

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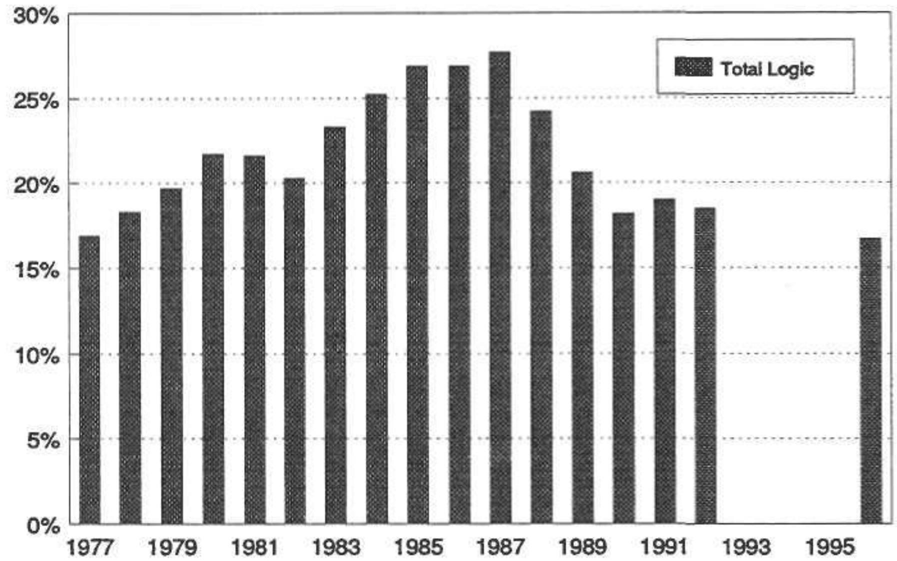
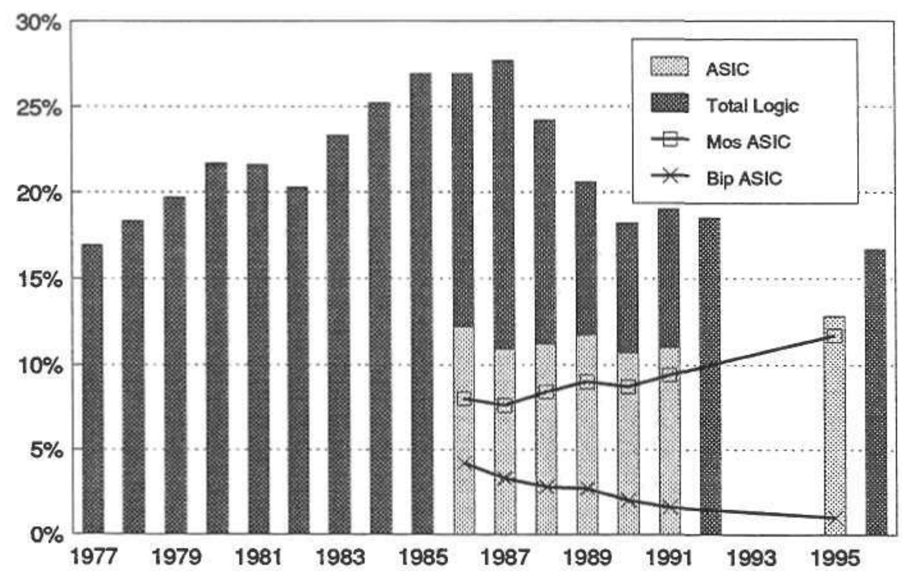
EUROPEAN LOGIC MARKET
SHARE OF TOTAL SEMICONDUCTOR



Source: Dataquest (June 1992)

EUROPEAN LOGIC MARKET
SHARE OF TOTAL SEMICONDUCTOR



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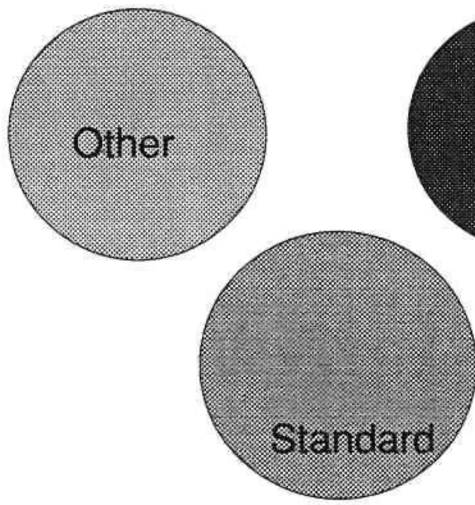
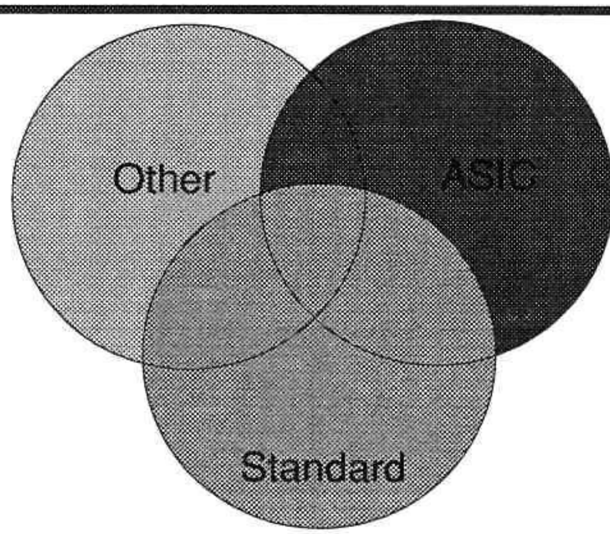
PRODUCTS - LOGIC



PRODUCTS - LOGIC



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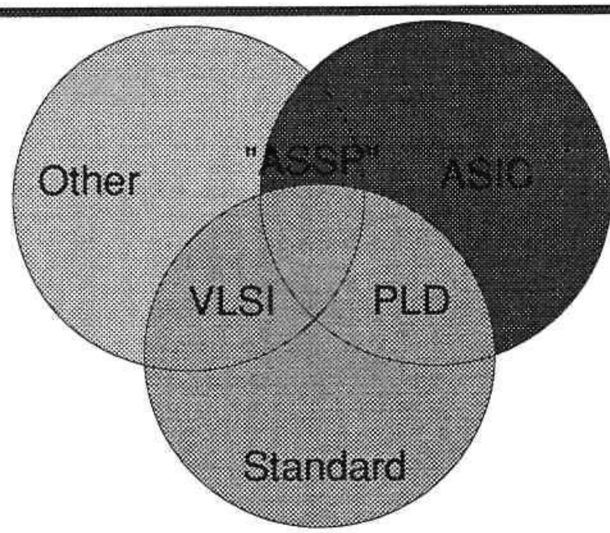
PRODUCTS - LOGIC



LOGIC OVERLAP PRODUCTS

- "ASSP" (Application Specific Standard Product)
  - PC chip sets
  - GSM chip sets
  - Image compression chip sets
- VLSI
  - Disk controllers
  - LAN products
- PLD products
  - Field programmable gate arrays
  - PLD/PLA products

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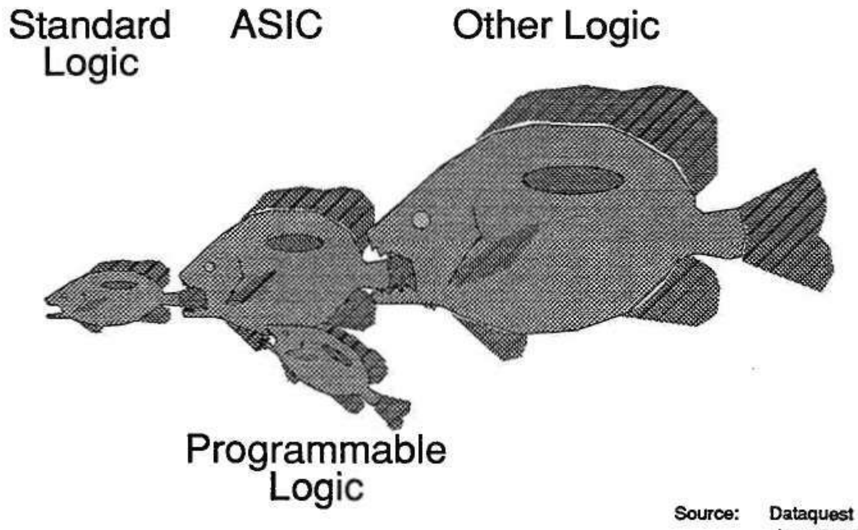
LOGIC MARKET CANNIBALIZATION



Source: Dataquest
June 1992

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IS STANDARD LOGIC DEAD?

Glenn Louch
Director
Standard Products Division
National Semiconductor Europe

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IS STANDARD LOGIC DEAD?

Glenn Louch
Director
Standard Products Division
National Semiconductor Europe

Mr. Louch is Director of the European Standard Products Division of National Semiconductor Europe covering logic, programmable logic, interface and MOS memory. He is based at the headquarters in Swindon, England. Mr. Louch has held management positions in both the United Kingdom and Germany. Prior to joining National Semiconductor Mr. Louch held a number of sales and sales management positions in distribution. He completed an electronic engineering apprenticeship with the Schlumberger group in Farnborough, England.

Dataquest Europe Limited
EUROPEAN SEMICONDUCTOR INDUSTRY CONFERENCE
June 3–5, 1992
Dublin, Ireland

IS LOGIC DEAD?

National Semiconductor
Digital Division

AGENDA

- 1967 - 1988 THE GLORY YEARS
- TO USE OR NOT TO USE?
- 1988 - 1992 ADAPTING TO SURVIVE
- THE ELDER STATESMAN
- THE NEXT FEW YEARS
- THE VERDICT - DEAD OR ALIVE?

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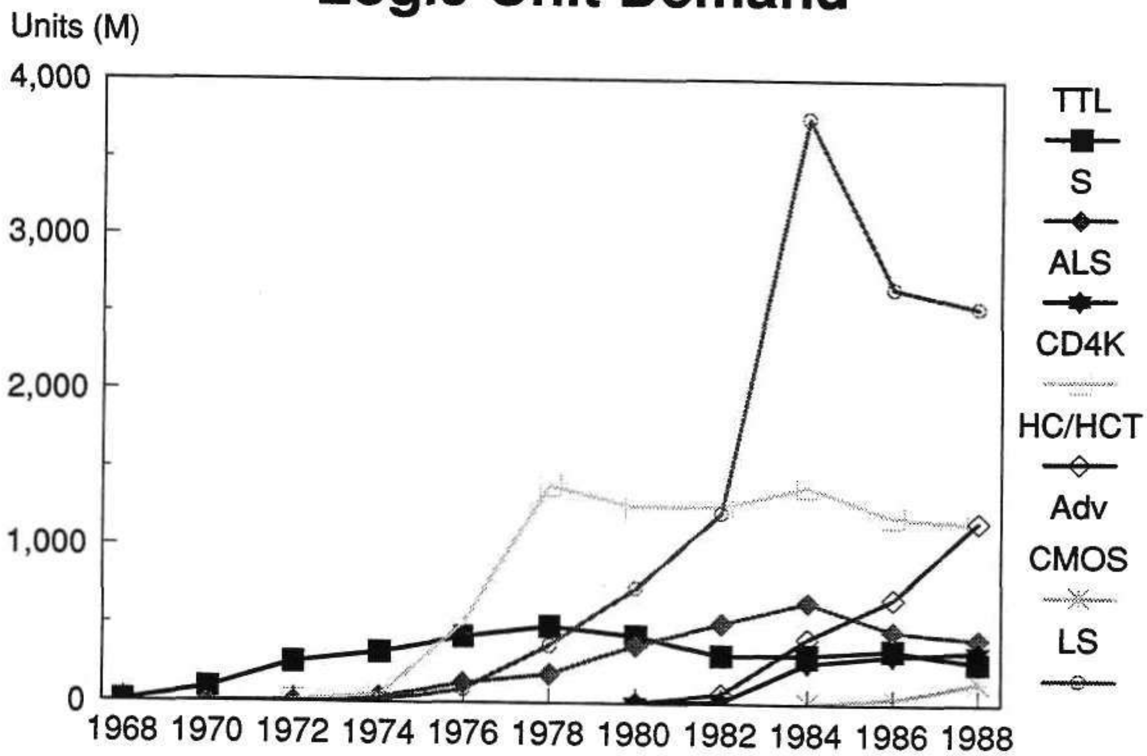
Logic Unit Demand



European TAM (M$)
Logic / PLD / ASIC

	1987	1988	1989	1990	1991	1992
CMOS Logic	229	287	263	230	224	232
BIPOLAR Logic	410	394	282	248	239	197
TOTAL Logic	639	681	545	478	463	429
PLD	82	118	127	150	191	264
ASIC	792	982	1182	1344	1465	1779

Source: Dataquest prelim May 92

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National Semiconductor Digital Division

Common Reasons to Use Logic

- It's the standard we are used to.
- Good designs last a long time ~ upgrades are "fine-tuned".
- System only has a low gate count.
- "Glue" for ASIC, PLD and other VLSI solutions.
- Time to market, multi-sourced, low risk.
- Translation - TTL / ECL ~ 5v / 3v.

National Semiconductor Digital Division

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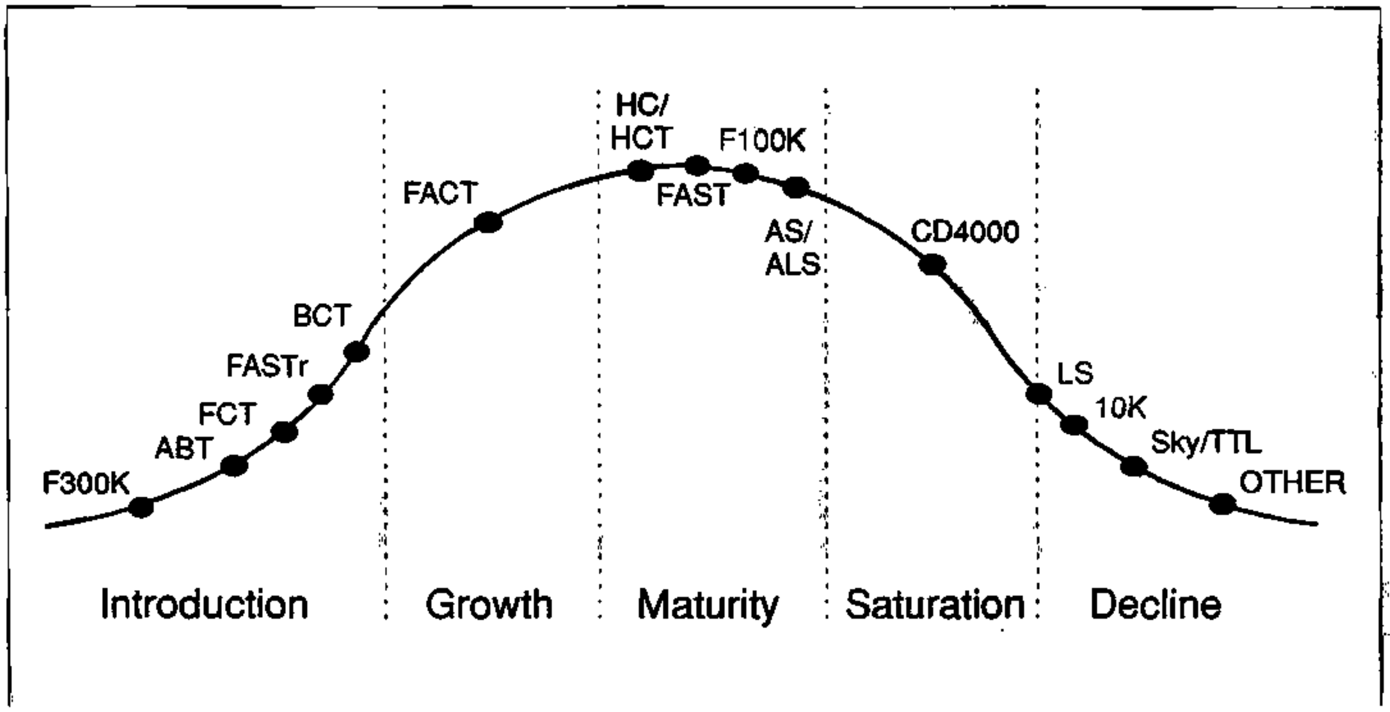
Product Life Cycle



National Semiconductor
Digital Division

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Logic ~ The Influencing Factors

- Cost Control
- Test Equipment & Methodology
- Supply & Demand Management
- EDI
- JTAG
- Cycletime
- Design Friendly specifications
- Design Modelling
- Packaging

National Semiconductor
Digital Division

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National Semiconductor

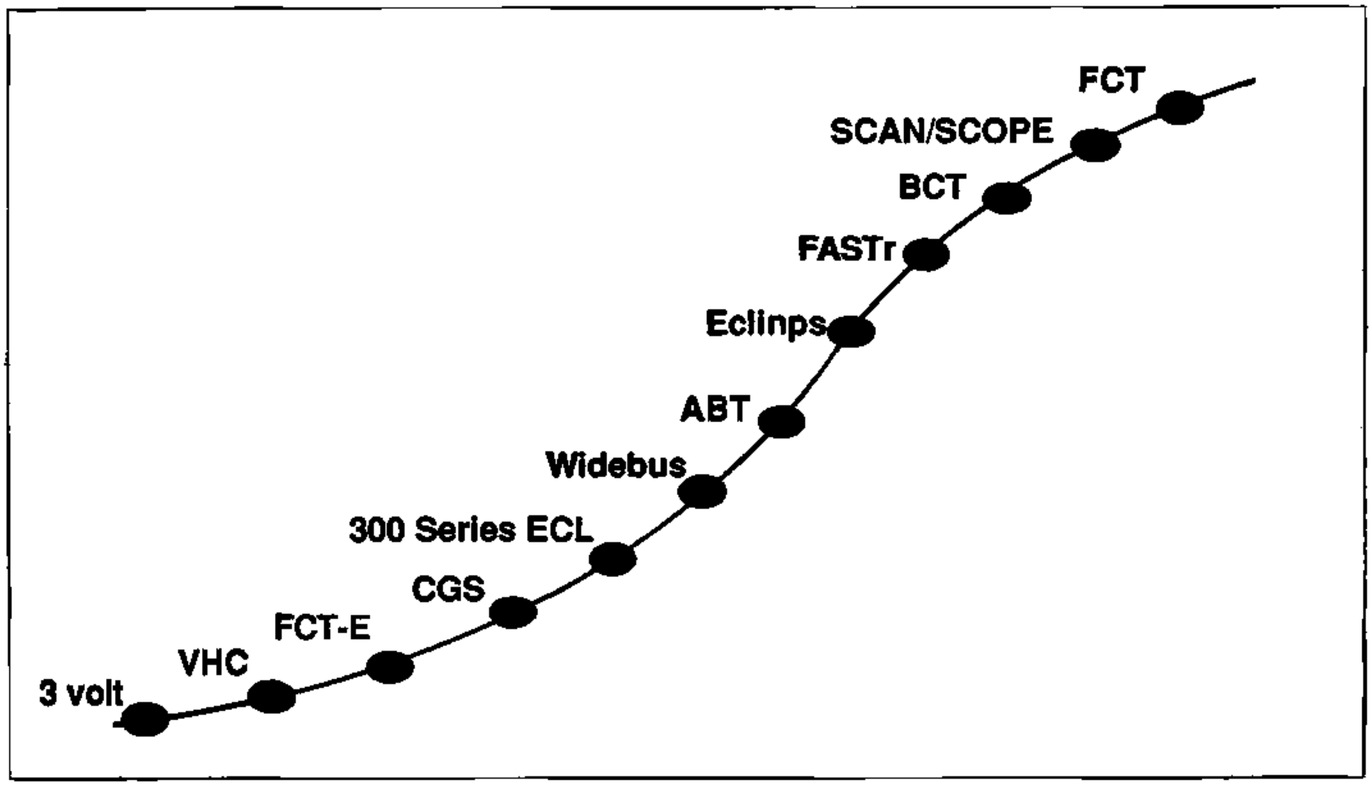
Digital Division

Logic European TAM

	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	CAGR 90-95
Total Logic	639	681	545	478	463	429	415	388	345	347	-5.6%
Bipolar Std Logic	410	394	282	248	239	197	167	148	122	112	-14.1%
TTL	362	347	246	217	210	172	145	126	101	92	-15.2%
LS	228	217	152	135	107	85	69	57	43	39	-18.3%
Standard	17	14	8	6	6	5	4	3	2	2	-19.7%
ALS	33	32	25	22	36	29	23	19	16	14	-17.2%
FAST	55	56	43	38	45	40	38	37	32	30	-7.8%
AS	13	14	10	9	9	8	7	7	6	5	-11.1%
S	16	14	8	7	7	5	4	3	2	2	-22.2%
ECL/Other	49	48	36	30	29	25	22	22	21	20	-7.2%
CMOS Std Logic	229	287	263	230	224	232	248	240	223	235	1.0%
4000/74C	120	129	100	79	71	62	62	50	36	34	-13.7%
HC/HCT	100	134	127	109	113	119	124	118	102	101	-2.2%
AC/ACT	8	22	33	38	20	38	45	51	60	70	18.5%
BC/BCT	1	2	3	4	10	13	17	21	25	30	24.6%

Source: Dataquest Prelim

INTRODUCTION PHASE



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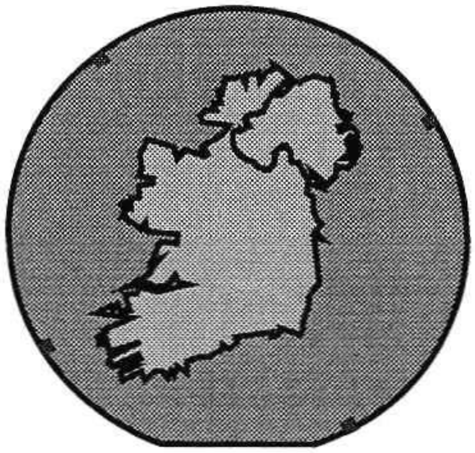
The Verdict

" Reports of my death are grossly exaggerated "

Mark Twain



FUTURE TRENDS IN GENERAL PURPOSE LOGIC

Peter Dennstedt
Manager
European General Purpose Logic
Texas Instruments Europe

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FUTURE TRENDS IN GENERAL PURPOSE LOGIC

Peter Dennstedt
Manager
European General Purpose Logic
Texas Instruments Europe

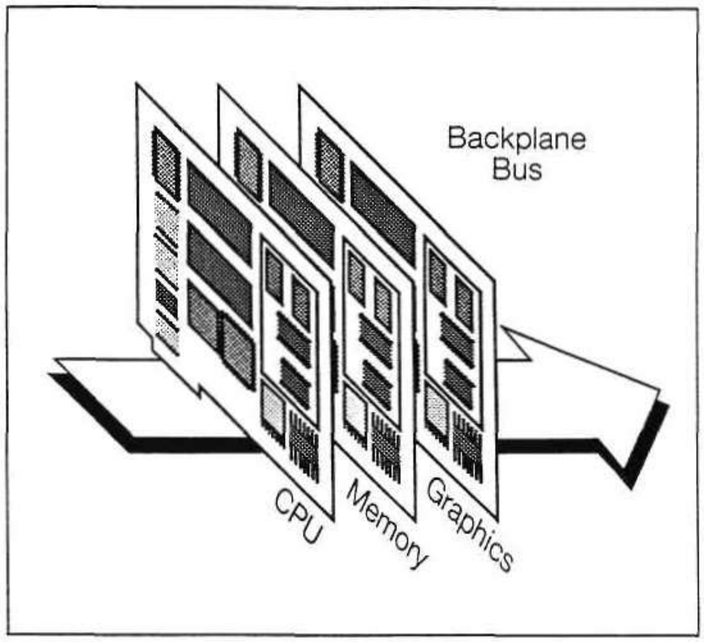
Mr. Dennstedt is Manager of Texas Instruments' (TI's) European General Purpose Logic Business facility. He is based in Freising, Germany at TI's German subsidiary and is responsible for the company's European general purpose logic business which also includes a major part of TI's design, engineering and characterization for Advanced Logic Products for worldwide sales. Mr. Dennstedt received an Industrial Engineering degree 1973 in Munich, Germany.

Dataquest Europe Limited
EUROPEAN SEMICONDUCTOR INDUSTRY CONFERENCE
June 3–5, 1992
Dublin, Ireland

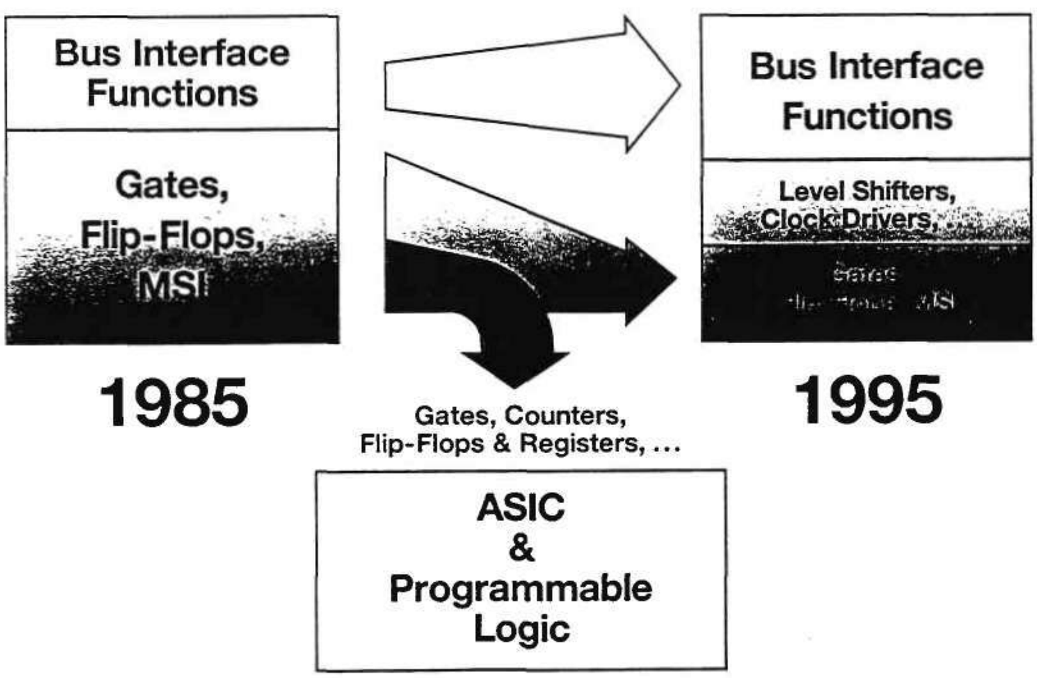
THE COMPUTER SYSTEM TRENDS

- **System Trends**
  - Higher complexity
  - Increased speed
  - Wider architecture
  - Higher density
  - Minimum power consumption

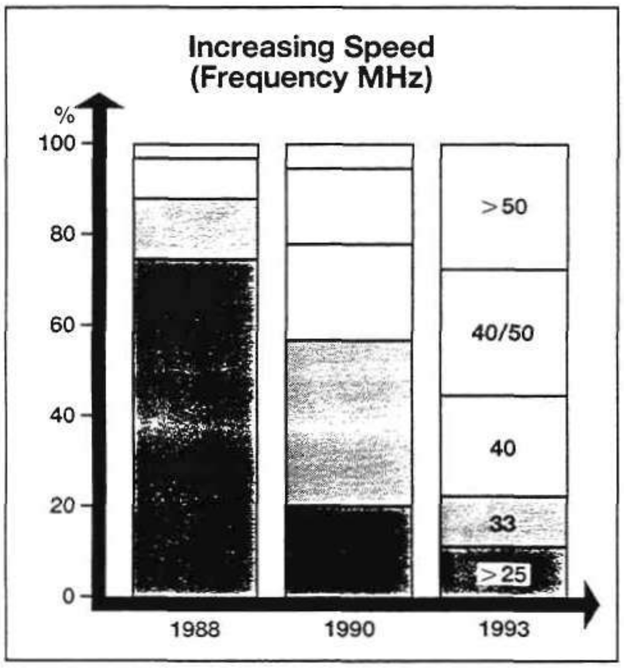
  Will drive a continuous high demand for advanced general purpose bus drivers

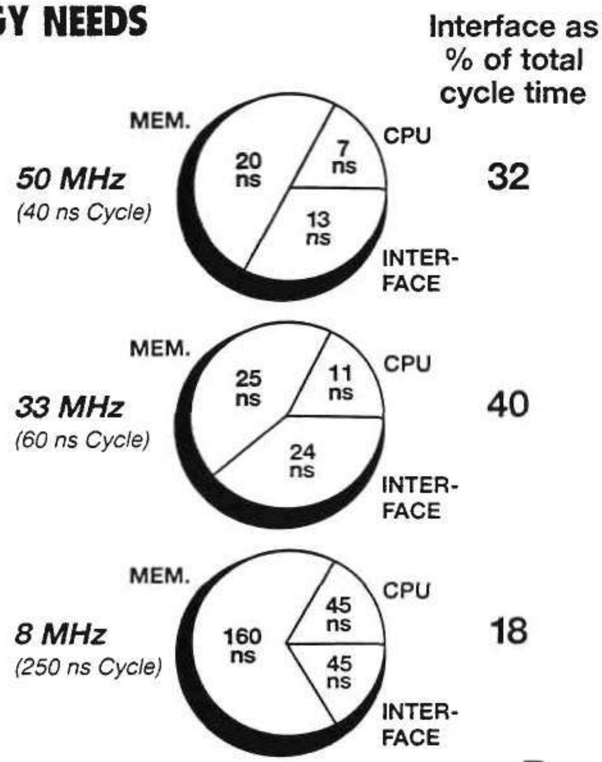


GENERAL PURPOSE LOGIC TRANSITION

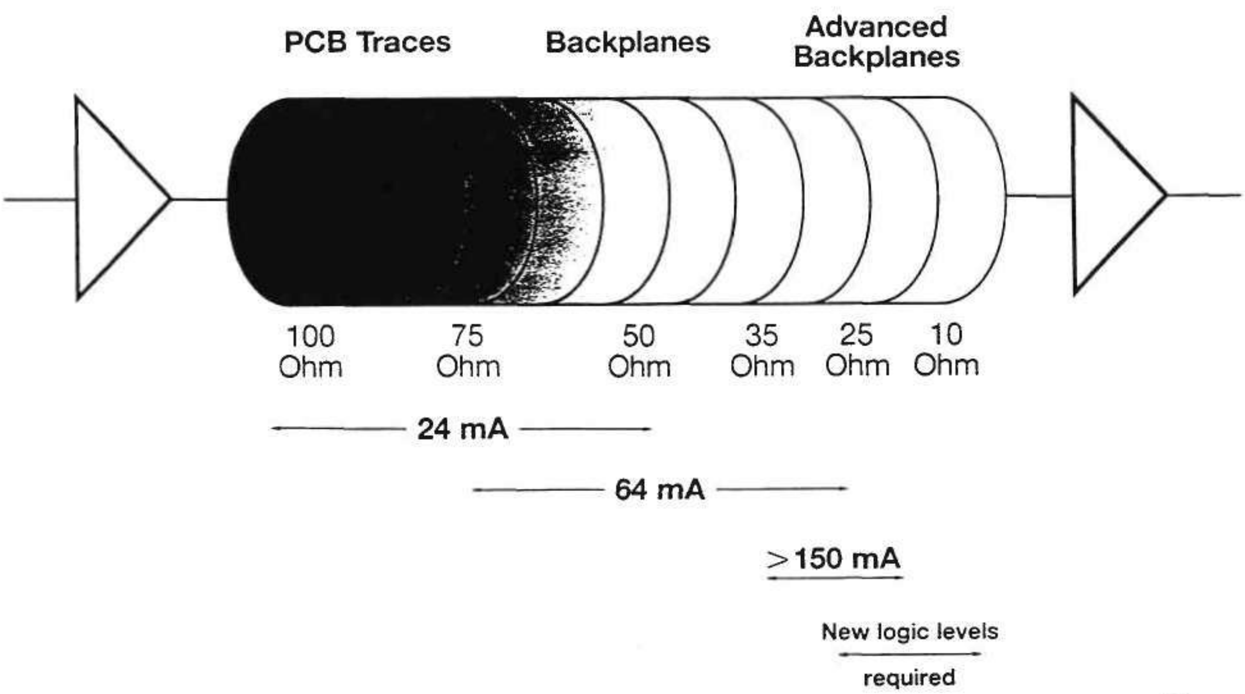


TECHNOLOGY NEEDS

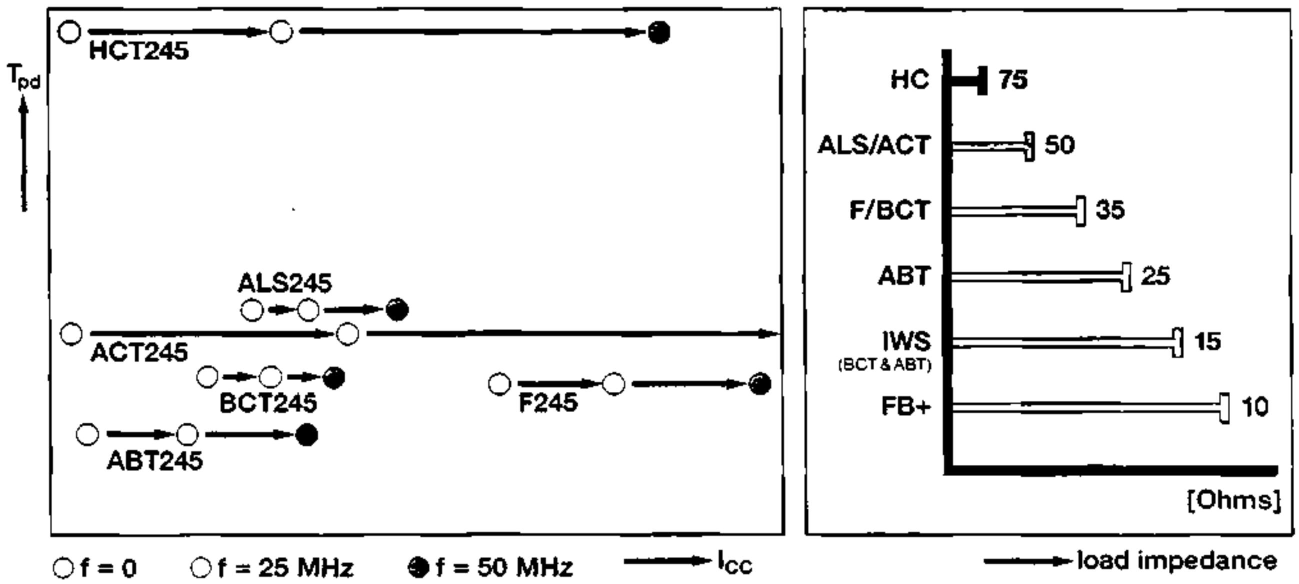




DRIVE CAPABILITY



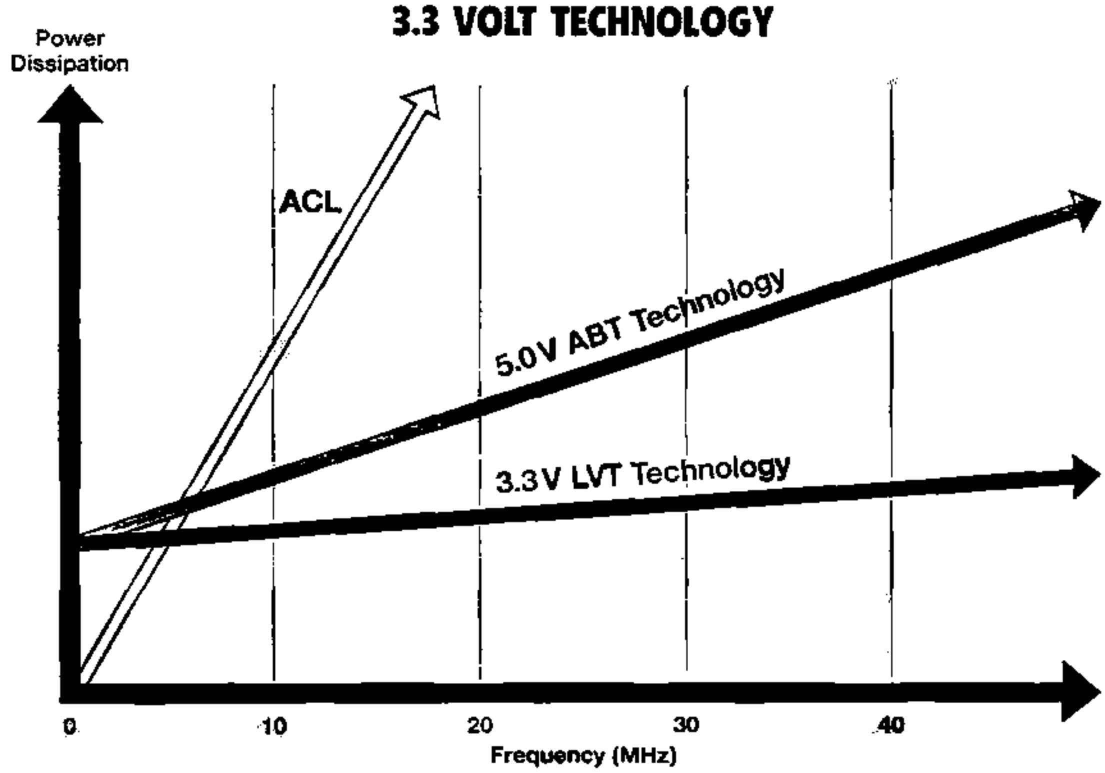
TECHNOLOGY COMPARISON: SPEED & DRIVE



TI offers 8-bit bus functions in BCT, ACL, and ABT, 16-bit functions in ACL and ABT, and 32-bit functions in ABT technologies

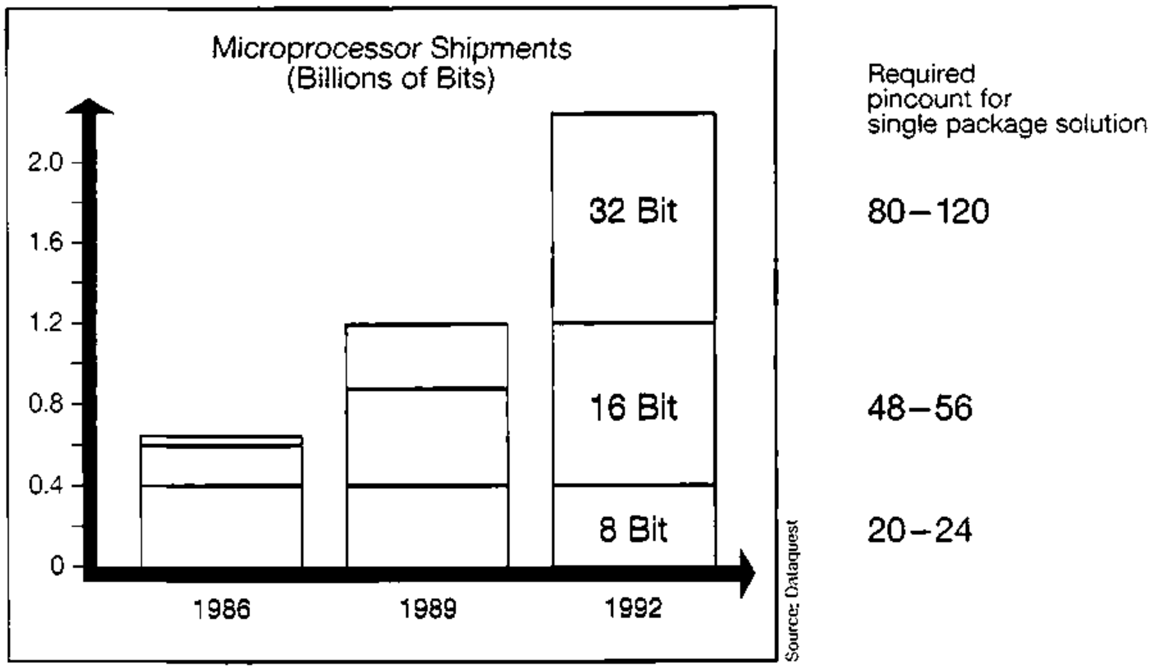
TEXAS INSTRUMENTS

3.3 VOLT TECHNOLOGY



TEXAS INSTRUMENTS

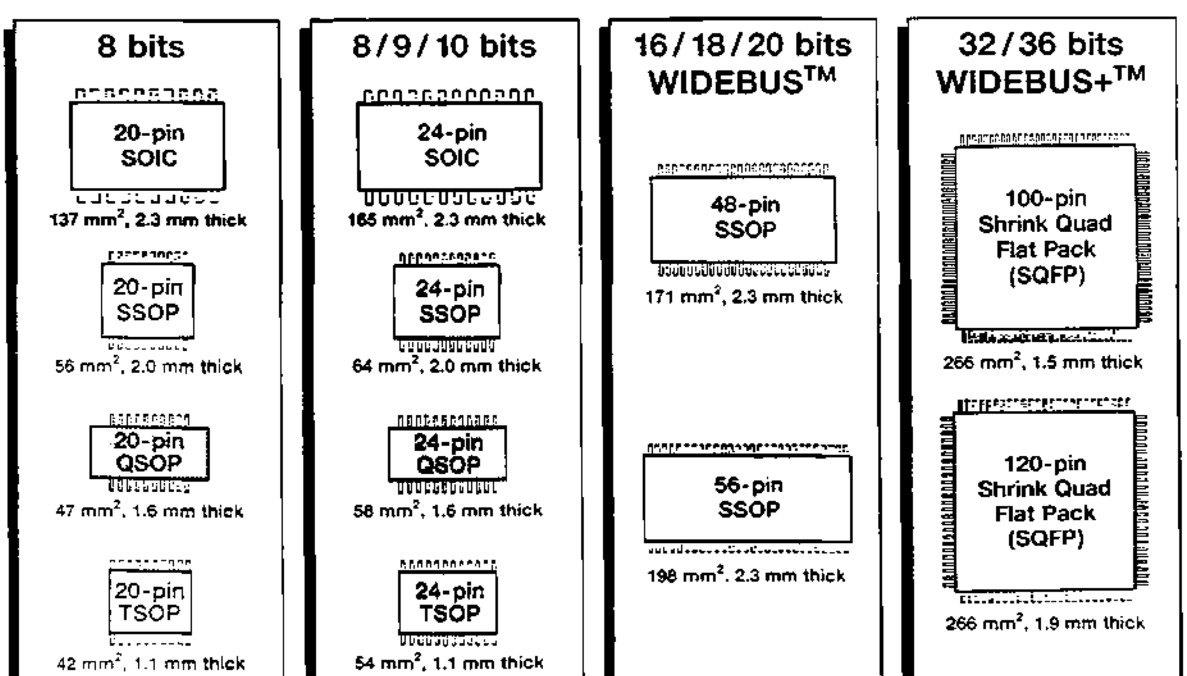
DESIGN TRENDS TOWARDS WIDER BUS WIDTH



Beyond 1992: Emergence of 64-bit and 128-bit architectures

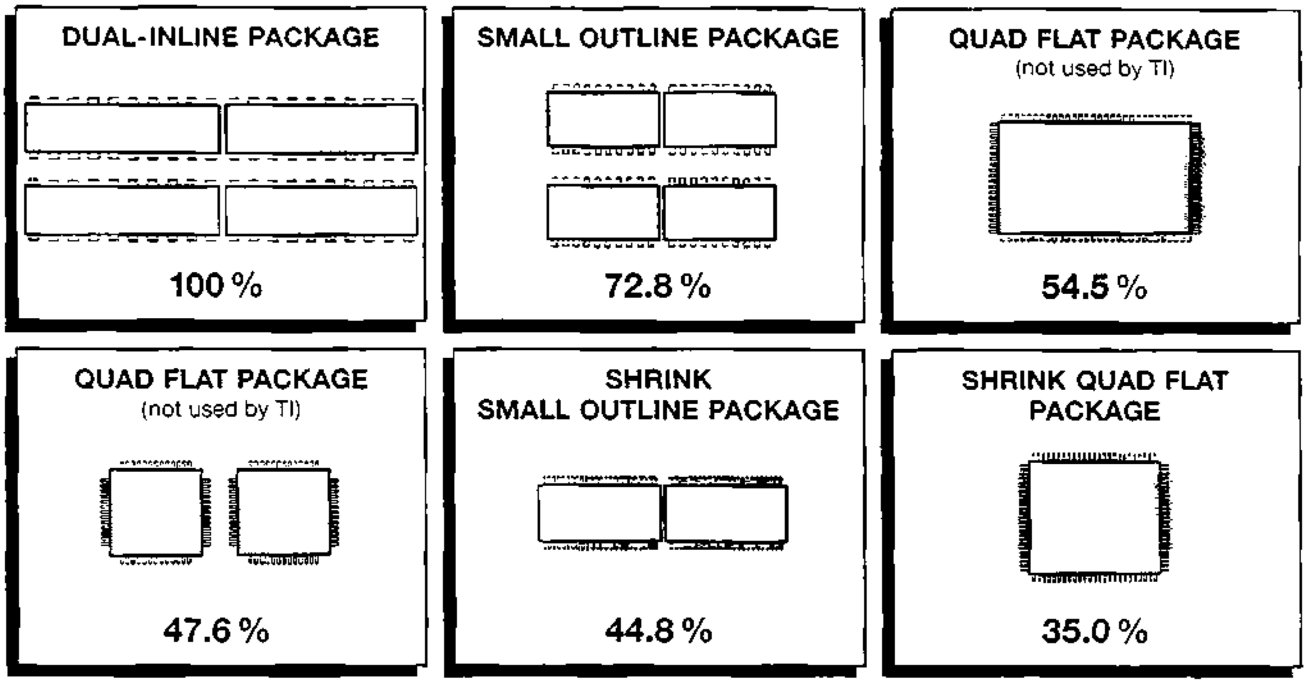
TEXAS INSTRUMENTS

ADVANCED BUS INTERFACE PACKAGING



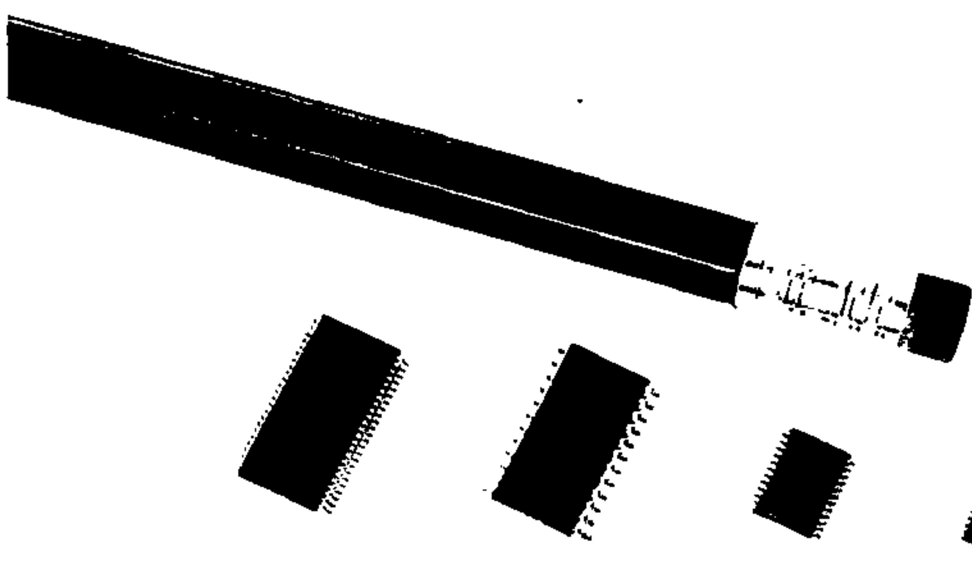
TEXAS INSTRUMENTS

32-BIT BUS INTERFACE BOARD AREA COMPARISON



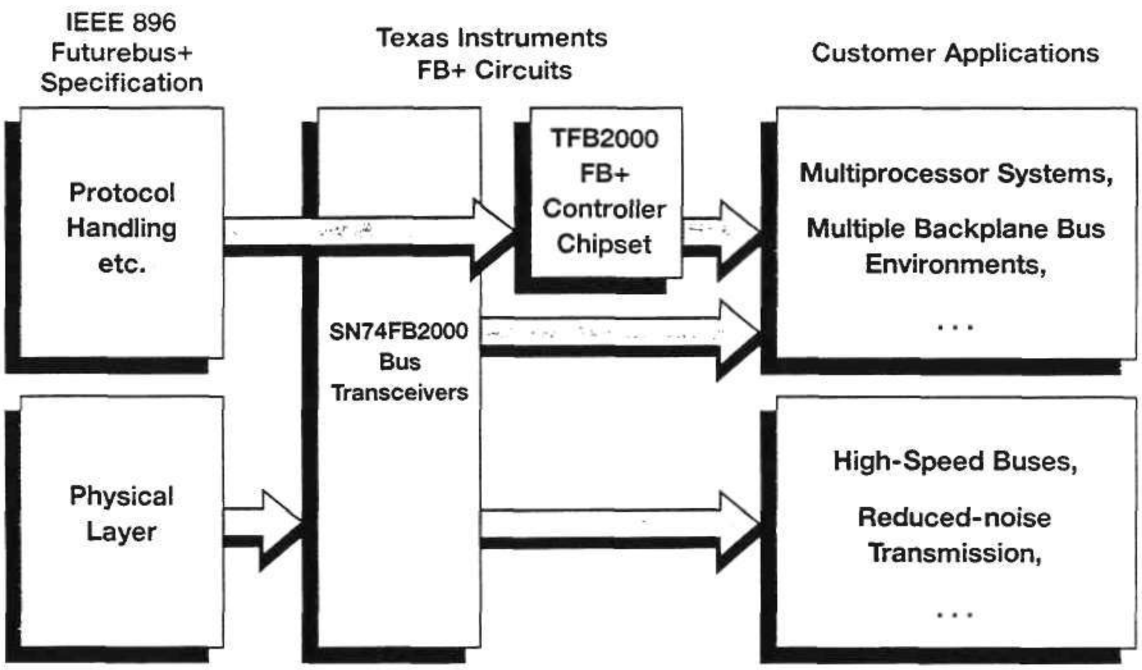
Comparison ignores space required for connecting lines

TEXAS INSTRUMENTS



TEXAS INSTRUMENTS

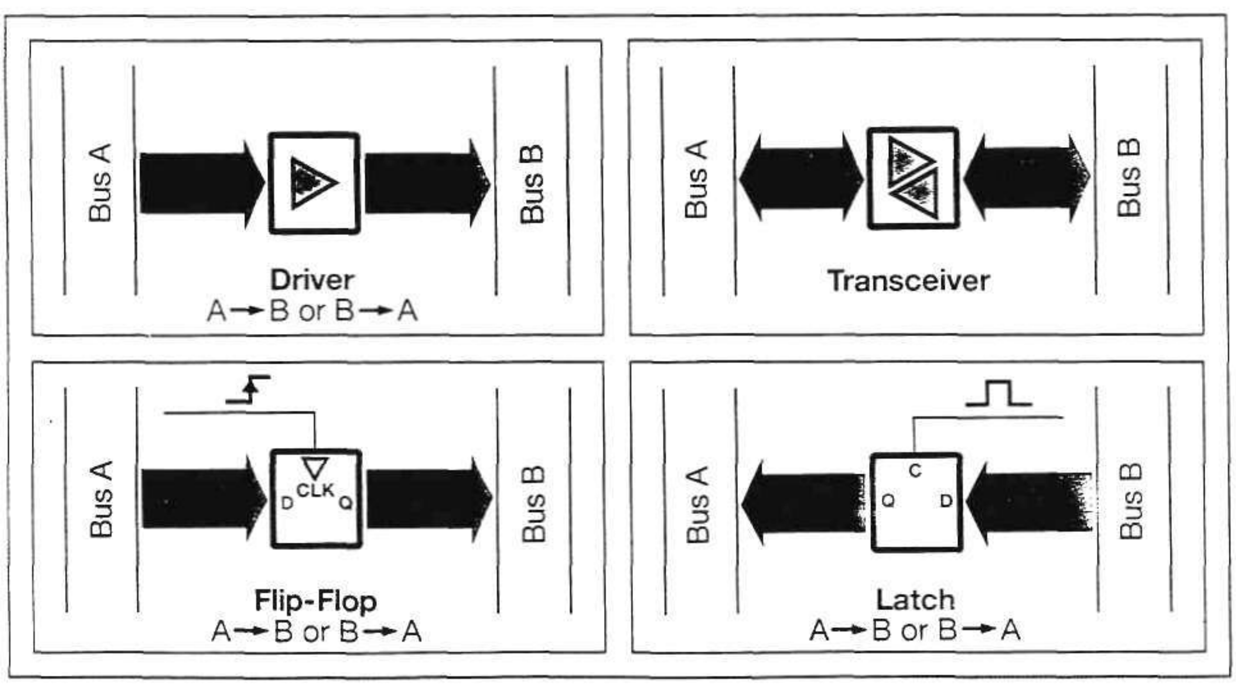
FB+: WIDENING THE SPEED BOTTLENECK



TI supports both the hardware and the protocol standard of Futurebus+

TEXAS INSTRUMENTS

THE 'UNIVERSAL BUS TRANSCEIVER' CONCEPT



18- and 36-bit UBT's available in Advanced BiCMOS

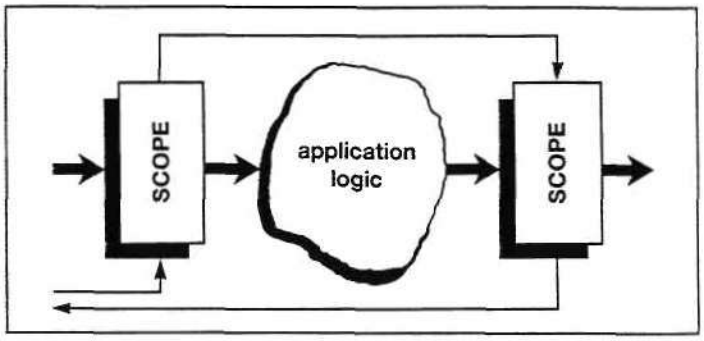
BUS DRIVERS INCORPORATE TESTABILITY

Growing system density and complexity lead to a lack of physical access.
Costs for detecting and identifying faults increase.

IEEE1149.1 (JTAG) boundary scan reduces test costs and adds flexibility.

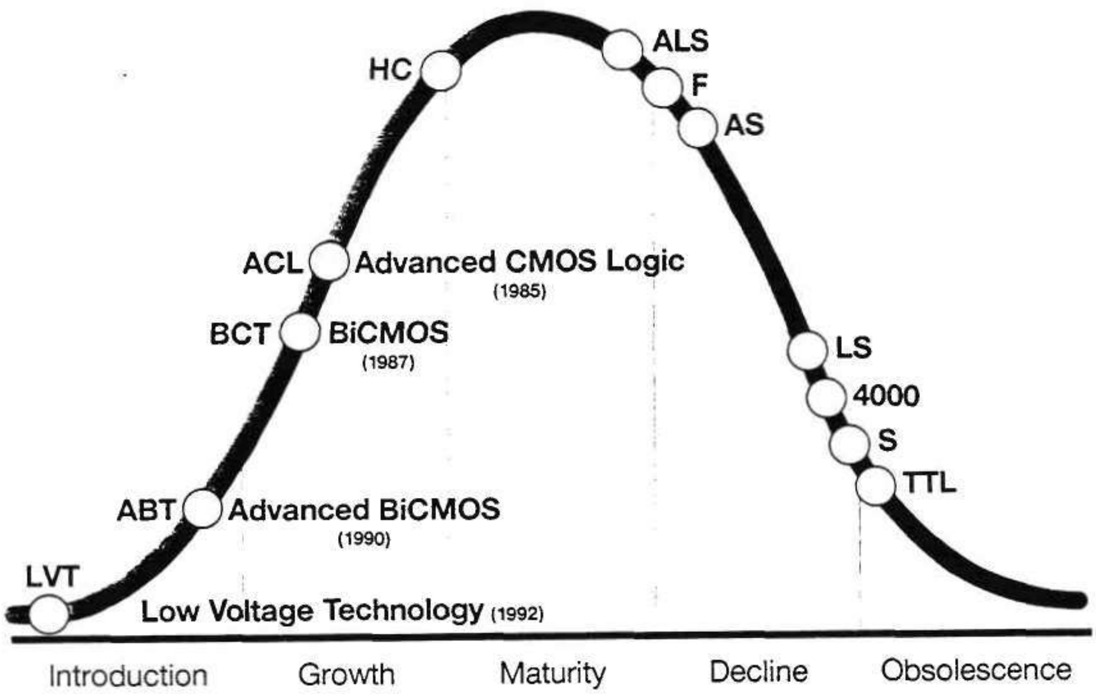
More than 30 TI SCOPE bus driver products support the IEEE1149.1 standard:

- 8-bit bus drivers / transceivers / flip-flops / latches / registered transceivers
- 16-bit WIDEBUS transceivers / registered transceivers / universal bus transceivers
- 32-bit WIDEBUS+ transceivers / registered transceivers / universal bus transceivers



TEXAS INSTRUMENTS

GROWING AND MATURING TECHNOLOGIES



ADVANCED BUS INTERFACE LOGIC MADE FOR COMPUTERS

PC, Workstation, Mini, Mainframe

ACL logic, BiCMOS drivers, BiCMOS IWS drivers,
MOS memory drivers, clock drivers, Bus Termination Arrays, . . .

. . . FINDS APPLICATIONS IN TELECOM, AUTOMOTIVE, INDUSTRY & CONSUMER

PABX:	**ACL Widebus, ABT drivers, BiCMOS drivers Bus Termination Arrays**
Cellular radio base station:	**IWS drivers, BiCMOS drivers**
Security phone handset:	**SSOP-packaged ACL logic**
Car phone:	**ACL Widebus**
Automotive motor control:	**ABt drivers**
Train communication link:	**ABT drivers, ABT Widebus**
Identification / access control:	**BiCMOS drivers, Bus Termination Arrays**
Textile machine control:	**JTAG octals & controllers, ABT drivers**
High-Definition TV:	**Bus Termination Arrays**

PANEL SESSION 1:
EVOLUTION OF SEMICONDUCTOR PROCUREMENT

Chaired by Mark Giudici
Dataquest Incorporated

John Hudson
Apple Computer Ltd.

Keith Williams
Avnet EMG

Earl Kitchen
GEC Plessey Telecoms

Klaus Wangerin
Sony Europa GmbH

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EVOLUTION OF SEMICONDUCTOR PROCUREMENT

Mark Giudici
Director and Principal Analyst
Semiconductor Procurement Service
Dataquest Incorporated

Mr. Giudici is Director and Principal Analyst, Semiconductor Procurement Service for Dataquest Incorporated. He is responsible for tracking and analysing emerging semiconductor procurement issues and trends. He also covers regional semiconductor prices and cost modeling issues. In addition, he has participated in various custom research projects involving procurement needs and regional price differentials. Prior to joining Dataquest, Mr. Giudici spent eight years in both the computer and semiconductor industries, where he held a variety of financial and marketing positions. Most recently, he was Product Marketing Engineer with Gould-American Microsystems, where he was responsible for cost modeling and marketing semicustom and foundry-custom semiconductor components. Mr. Giudici graduated from California State University, Chico with a BS in Business Administration, and from the University of Oregon with an MBA in Business Management.

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June 3–5, 1992
Dublin, Ireland

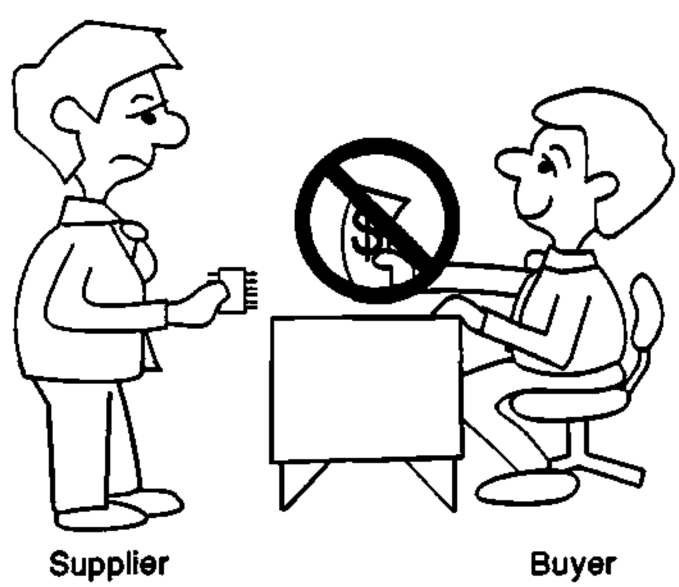
Evolution of Semiconductor Procurement

from
Order Placers
to
Supply Base Managers

SEMICONDUCTOR PROCUREMENT

Past focus on:

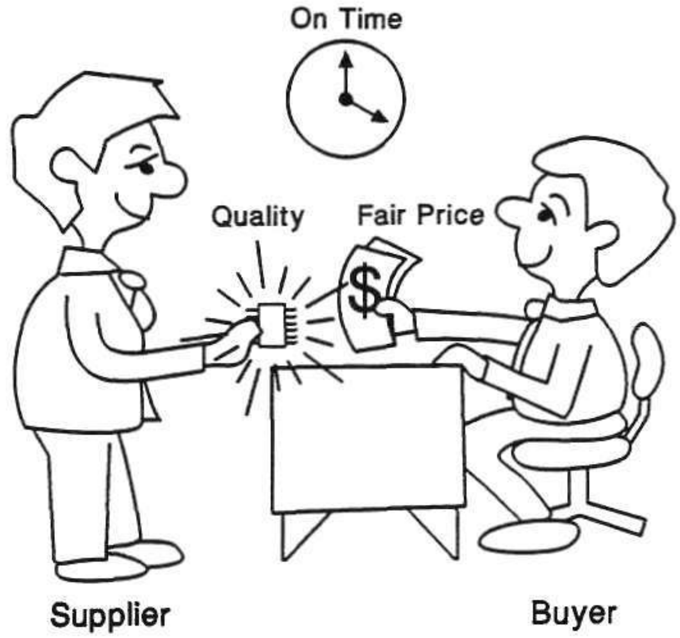
- Price
- Price
- Price



SEMICONDUCTOR PROCUREMENT

Current/future focus on:

- Quality
- Delivery
- Price



SEMICONDUCTOR PROCUREMENT

Issues

European Rank	Worldwide Rank
1. On-time delivery	1. Pricing
2. Quality/reliability	2. Quality/reliability
3. (Cost of) ownership	3. On-time delivery
4. Pricing	4. Availability
5. Vendor base relationships	5. Cost control

SEMICONDUCTOR PROCUREMENT

- Evolving from an afterthought
  (i.e., place the order at the lowest price)
- Becoming (is) an integral part of product design/manufacturing decision:
  - Supplier qualification
  - Delivery coordination with inventory levels
  - Contractual pricing
- Procurement focus due to:
  - Integration trends
  - Supplier reduction trend
  - Shorter time to market/life cycles of products

EVOLUTION OF SEMICONDUCTOR PROCUREMENT

John Hudson
European Regional Supply
Base Manager
Apple Computer Ltd.

Mr. Hudson is the European Regional Supply Base Manager for memory, microprocessor and microcontroller components. He is based at Apple Computer Ltd., where he is responsible for the development and implementation of semiconductor sourcing strategies in conjunction with the Worldwide Apple Semiconductor Team. Prior to this, Mr. Hudson was Commodity Manager for Memory and Microcontrollers for Western Digital Corporation in Irvine, California. He has also held component and vendor quality engineering roles for various companies includng Western Digital, CPT and Digital Equipment Corporation. Mr. Hudson holds a B.Sc. degree in Electronic Engineering from the University of Limerick, Ireland.

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Charter

"Never Fail to Deliver High Quality,

Cost Effective Personal Computing products

when our Customers want them. "

By building on our capabilities of:

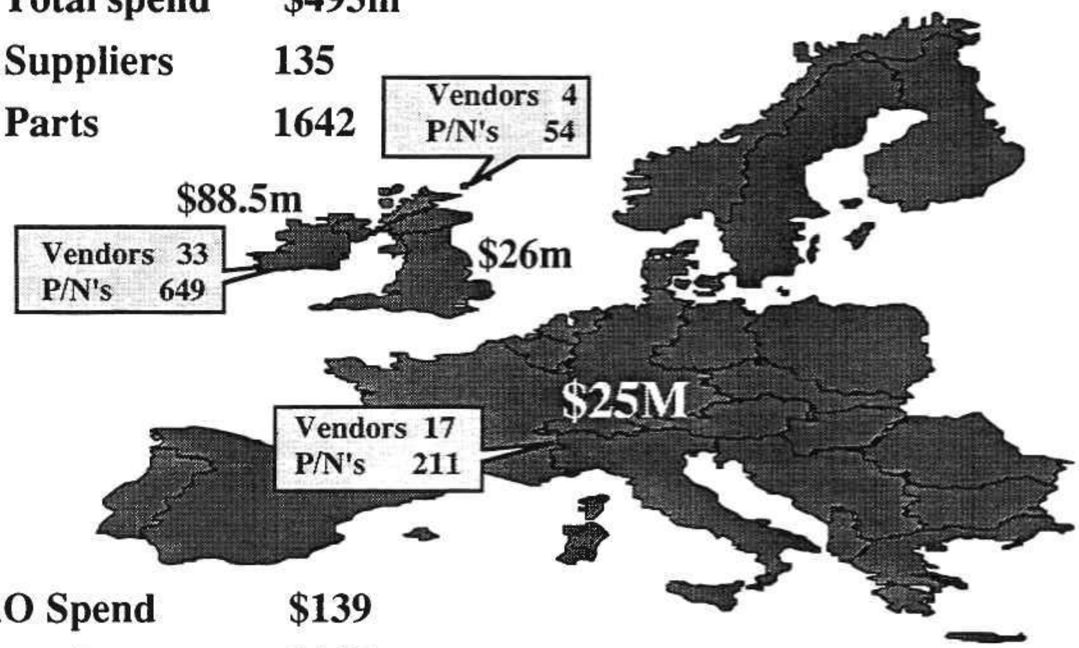
- **Demand Driven Manufacturing**
- **Flexibility / Speed of Execution**
- **Customisation & Configuration**
- **Service**
- **People**

APPLE MANUFACTURING CORK

- **Start-Up October 1980 - IDA Factory 40K Sq. Ft.**
- **Site now 340K Sq Ft with 1000 employees**
- **$90 M invested to date**
- **Process**
  PCB Assy
  Final Assy Test
  Configuration & Pack
  European Service Centre
- **ISO90002**

CORK 1991 EUROPEAN ACTIVITY

Cork Total spend	$493m
Total Suppliers	135
Total Parts	1642



EURO Spend	$139
US Spend	$118
FAR EAST Spend	$236

WHAT IS UNIQUE ABOUT SEMICONDUCTORS?

TECHNOLOGY DRIVER

- Wide Technology Spectrum
- Limited supply base across technologies
- Heavy use of subcontract ie Design House/Fab/Assy
- Long process cycles

MARKET DRIVEN COMMODITY

- Difficult cost models
- "Butterfly" effect e.g. Windows accelerator cards and VRAM

WHAT IS UNIQUE ABOUT SEMICONDUCTORS?

SHORT PART and TECHNOLOGY LIFE CYCLES

- Complex Qualification Cycles : Spec, Application, Mfg Process - No History
- Critical dependency on cross-functional effectiveness
- Supplier and User communications

GEOPOLITICAL FACTORS

- Regional Protectionism i.e. Tarfiffs
- WW Producers remote from Design Centers

TRADITIONAL PURCHASING

- Lowest P.O. Price
- Freight Costs
- Forecasts and Request Date
- Credit Terms
- Procure against AVL
- Operationally Focussed

SUPPLY BASE MANAGEMENT

- Lowest Cost of Ownership
- Local Hub Inventory
- Duty, Tariff, and Currency Mgmt
- Sole sourced strategic relationships
- Exec & Eng. Linkages with Snr Mgmt
- WW Mfg. requires WW Account Mgmt.
- Regional Offsets: Buy where we sell

HOW DOES APPLE ADDRESS THESE ISSUES?

COMMODITY TEAMS

"MULTIFUNCTIONAL TEAM WITH FULL OWNERSHIP AND RESPONSIBILITY FOR THE MANAGEMENT AND IMPLEMENTATION OF ALL ISSUES AND PLANS CONCERNING A PARTICULAR GROUP OF PARTS"

COMMODITY TEAM

SUPPLIER ENGINEERING

DPM and Reliability Improvement
Supplier audits and technical feedback
Apple Process Qualification of new parts
Regional Technical Interface to Suppliers

CONTRACT BUYER

Contract Negotation
Cost Negotation and Business Allocation
Regional Business Interface to Suppliers

OPERATION SPECIALIST

Implement MRP
Ensure allocation plan
Site Metrics

SUPPLIER MANAGEMENT WW
NOT
WW SUPPLIER MANAGEMENT

CENTRALISED HIERARCHICAL MGMT
MARKET INFO HAS CORPORATE BIAS
STRATEGIC AND TACTIAL CONFLICTS

GLOBAL MEMBERS
RECOGNITION OF REGIONAL MARKET
INFORMATION GATHERING NETWORK
UNDISTORTED MARKET INTELLIGENCE TECHNICAL AND COMMERCIAL SKILL SETS

SEMICONDUCTOR GLOBAL TEAM

- **Strategic commmodity along with Display Tech and Mass Storage**
- **Headquartered in proximity to Desgin Community made up of regionally located members**
- **Regional members are global team headcount *NOT* Site Headcount - clear accountability**
- **Regional Experts with strong ties to local manufacturing**

CUPERTINO

RAM SBM
ROM SBM
ASIC SBM
MICROS SBM
COMPONENT ENG X 3

CORK
1 BIZ
1 TECH/BIZ

FREMONT
1 TECH

SINGAPORE
1 TECH/BIZ

FOUNTAIN
1 TECH/BIZ

APPLE COMPUTER LTD DATAQUEST 4th June '92

MAP - ing the Future at Apple

- Overview & Outlook
- Sourcing
- Technology Trends
- Quality
- Recommendations
- Leverage
- Pricing
- Regional Offsets
- Capacity

Material Acquisition Plan

STRATEGIC ALLIANCES

- **IBM AND APPLE FORM ALLIANCE ON RISC**
- **MOTOROLA - MICROPROCESSORS AND MEMORY**
- **APPLE SOLE SOURCES PSRAM FROM HITACHI FOR POWERBOOK!!**
- **SONY SUPPLIES APPLE POWERBOOK 100**
- **SHARP - CODEVELOPMENT PIPS**

APPLE INVESTMENT IN SUPPLIER RELATIONS

SUPPLIER CERTIFCATION PROGRAM

BUSINESS AND QUALITY DEV. PROGRAM WITH KEY SUPPLIERS (54 SUPPLIERS)

EDI

16 ACTIVE TRADING PARTNERS
UTILISING EDIFACT AS STD
30% OF PO VOL is EDI -> 70% by OCT

....means long term relationships

EVOLUTION OF SEMICONDUCTOR PROCUREMENT

Keith Williams
European Managing Director
Avnet EMG

Mr. Williams is the European Managing Director of Avnet EMG: the world's largest distributor of electronic components in 1991. He has spent 22 years in the semiconductor industry. He was the Founder and Managing Director of the Access Group, a start up specialist semiconductor distributor. Mr. Williams also managed the semiconductor business of ITT Electronic Services and has experience of product marketing, production planning and field sales with Texas Instruments. He graduated from Imperial College, London with an honours degree in Physics and Mathematics.

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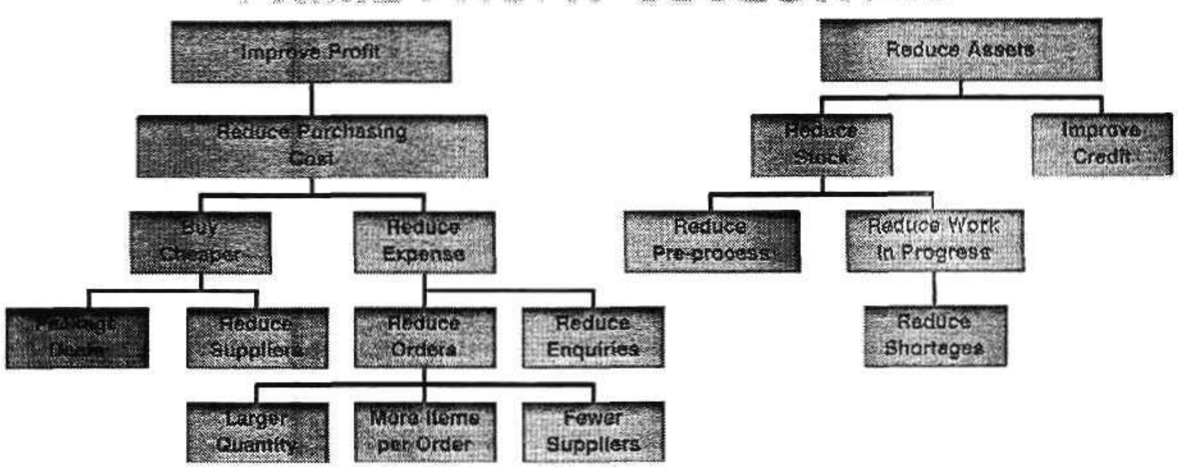
THE CUSTOMER REQUIREMENTS IN THE 1990s

- The prime objectives
- The need for global procurement
- Customers are reading the same books
- Increased strategic flexibility
- Improved quality
- Improved technological support
- Customer coverage
- Long term partnerships

THE CUSTOMERS PRIME PROFIT OBJECTIVES



The use of distribution improves the customers return on capital employed

THE CHANGING ROLE OF DISTRIBUTION IN EUROPE AVNET

THE NEED FOR GLOBAL PROCUREMNT

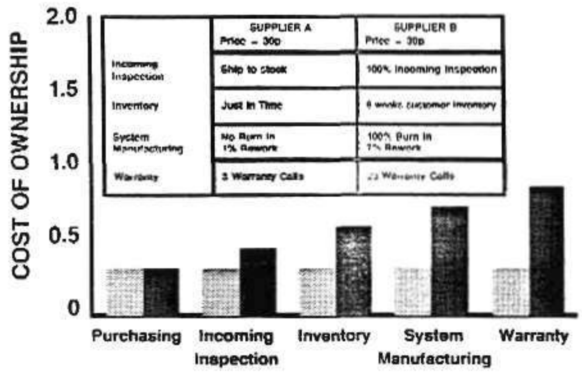
- Competitive need for world class quality
- Continuous need for cost reductions
- Total cost of ownership is becoming the primary vendor measurement
- Companies with local technical and commercial resources backed by worldwide resources are perceived to be capable of reducing the cost of ownership
- Aggressive global sourcing strategies
- Global need to capitalise on technology end economic conditions in developing regions of Europe and ROW
- Access to worldwide inventories - e.g., Avnet EMG has more inventory than the whole of UK distribution

CUSTOMERS ARE READING THE SAME BOOKS

- Focus your factories
- Simplify your process
- Design for manufacturing
- Reduce your supplier base
- Reduce "overhead"
- Partnership with customers and suppliers
- Eliminate non-value activities

REDUCED COST OF OWNERSHIP

- Including the cost of quality, the cost of ownership can be up to 4 times the purchase price
- Managemnt practices traditionally do not differentiate between a $0.010 resistor and a $500 MPU
- A $1.0 film resistor purchase costs 75 cents to manage
- Stock room activities have been estimated at 60% of non-value added costs
- Traditionally there are about 29 steps to purchase a 1 cent resistor
- The distributor needs to be a more cost effective materials handler than the customer



	SUPPLIER A Price - 30p	SUPPLIER B Price - 30p
Incoming Inspection	Ship to stock	100% Incoming Inspection
Inventory	Just In Time	6 weeks customer inventory
System Manufacturing	No Burn In 1% Rework	100% Burn In 7% Rework
Warranty	3 Warranty Calls	[illegible] Warranty Calls

Key Issues

- **Only those distributors with the financial resource, critical mass and vision will be involved in the range of value added services so key to low cost of ownership**

INCREASED STRATEGIC FLEXIBILITY

Strategic Flexibility is a Way of Customers

- **Gaining a competitive edge**
- **Increasing profits**
- **Increasing market share**
- **Increasing quality**

"You gain Strategic Flexibility when you consciously look at each process and increase the number of alternatives you have to perform the operation of your business"

Key Issues

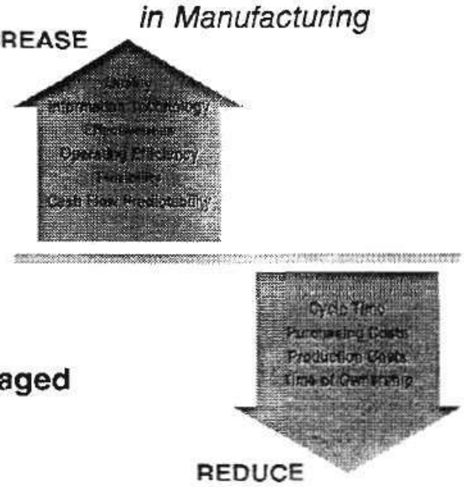
- **The key requirement to gain strategic flexibility is for the customer to focus on his core business using the value added services of the progressive distributor**

INCREASED STRATEGIC FLEXIBILITY

Value Added Service Enables Flexibility by Offering:

- Reduced lead time and cycle time
- Lower cost of procurement
- Improved operational flow
- Improved inventory turns
- High customer return on capital empoyed
- Highest quality components
- $1.2 billion in assets that can be leveraged (e.g., Avnet)

Benefits of Strategic Flexibility in Manufacturing



QUALITY

- The competitive need for world class quality
- Quality is one of the essential requirements of the 1990s
- Product handling is a key element of TQC
  - the need for rail quantities and sealed boxes
- With electrical quality generally under control, non electrical quality is now the major focus
- EDI will be essential to reduce errors
- Traceability will be essential
- Distribution will be judged on zero error goals to a +/- 1 day shipment window

Key Issues

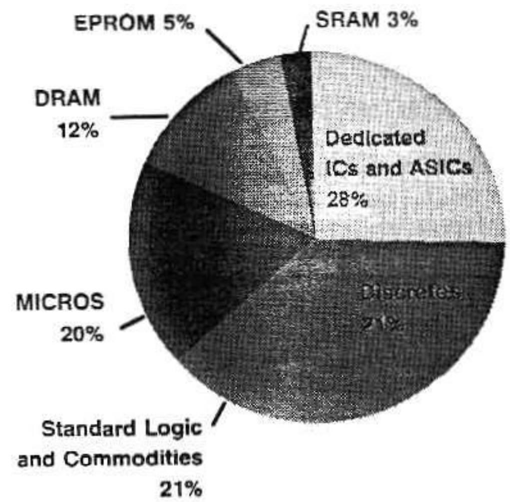
- Customer approved TQM practices in distribution will be essential for the quality conscious customer

TECHNOLOGICAL SUPPORT

- The rate of *change* to VLSI is increasing
- Life cycles are reducing
- The fastest growing sectors will be MPU, ASIC, dedicated ICs and memory
- The component sell is increasingly becoming the system sell
- The customer requires strategic specialist assistance at the front end for processors and specialist assistance at the back end for interconnect and passive
- The distributor will increasingly need to understand the sector needs as well as the product features

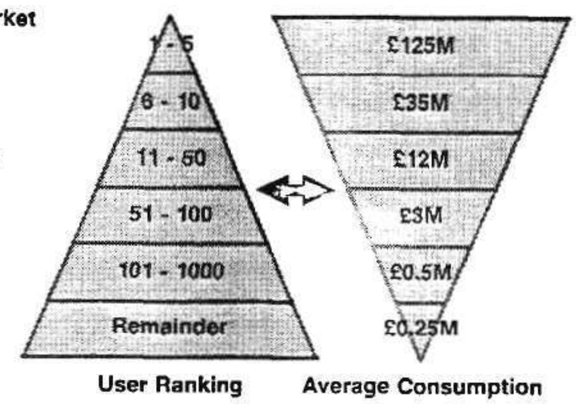
Key Issues

- The purveyor of stocked standard parts has a reducing presence in an ever increasing technological market place



CUSTOMER COVERAGE

- The top 5 customers represent 20% of the market
- The bottom 49,000 customers represent 40% of the market
- Direct manufacturer coverage will increasingly be strategic and not volume dependant
- For 99% of the customers, *distributor coverage is the only option*
- Distribution must develop as well as service demand throughout the pyramid



Key Issues

- Distribution will increase its market share as technical support, value added services and emphasis on cost of ownership increases

LONG TERM PARTNERSHIPS

- Local distribution will increasingly lose franchises to the Global and European Groups
- Distribution will be characterised by an increasing number of mergers and acquisitions
- The customer must develop long term partnerships with distributors and manufacturers alike
- Partnerships must be sought within the spirit of mutual trust
- Will distribution be characterised by a small number of Global Groups plus local niche specialists?
- Only distributors with an acceptable ROTC through the cycle will survive

The Key Issues

- The customer must select tomorrow's distributors and manufacturers

THE ADVANTAGES OF THE GLOBAL DISTRIBUTOR

- The high probability of franchise retention vs the local distributor
- The size and depth of available global inventories
- The inevitable reduction in cost of ownership as a result of economies of scale
- The benefits of global partnering to global customers
- The effort and resources capable of being directed towards "Total Quality"
- The ability to plan long term

EVOLUTION OF SEMICONDUCTOR PROCUREMENT

Earl Kitchen
Purchasing Manager
GEC Plessey Telecoms

Mr. Kitchen is Purchasing Manager of GPT's largest division, Telephone Switching Group, at its headquarters in Liverpool, England. He is responsible for all procurement matters in relation to System X, intelligent networks, mobility and voice applications. Mr. Kitchen has been involved in the procurement function for almost 30 years, during which time he worked for Plessey, ITT (STC) and GPT. He received an M.Sc. degree in the Faculty of Management Sciences from Manchester University.

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Dataquest Europe Limited, a company of The Dun & Bradstreet Corporation
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"THE PROCUREMENT EVOLUTION IN TELECOMMUNICATIONS"

- The changing market place
- The changing buyer - supplier relationship
- Competitive advantage through the value-chain
- The change process in buyer-supplier relationships
- Creating the right conditions for buyers-suppliers
- Implications for suppliers
- Win-win relationships

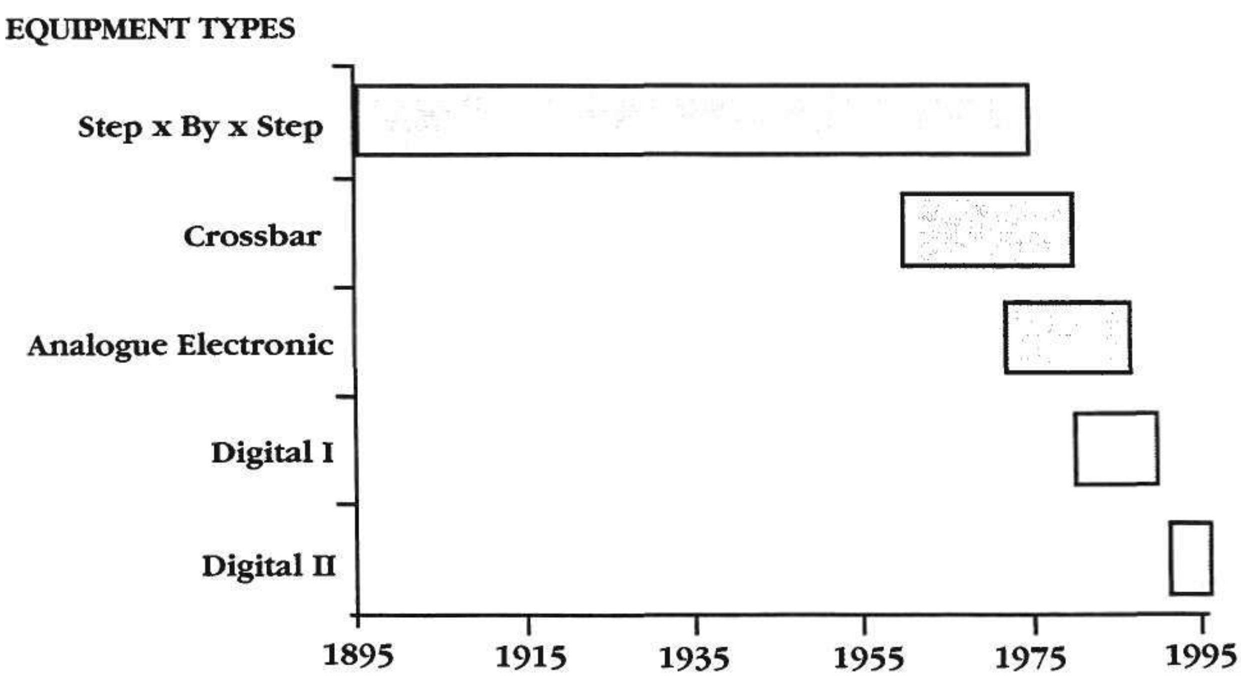
THE CHANGING MARKET PLACE

- Internationalisation of Telecom
- Industry restructuring
- Price erosion
- Technological advances
- Government legislation
- International trade policies
- Customer support
- Software content increasing

THE CHANGING BUYER/SUPPLIER RELATIONSHIP

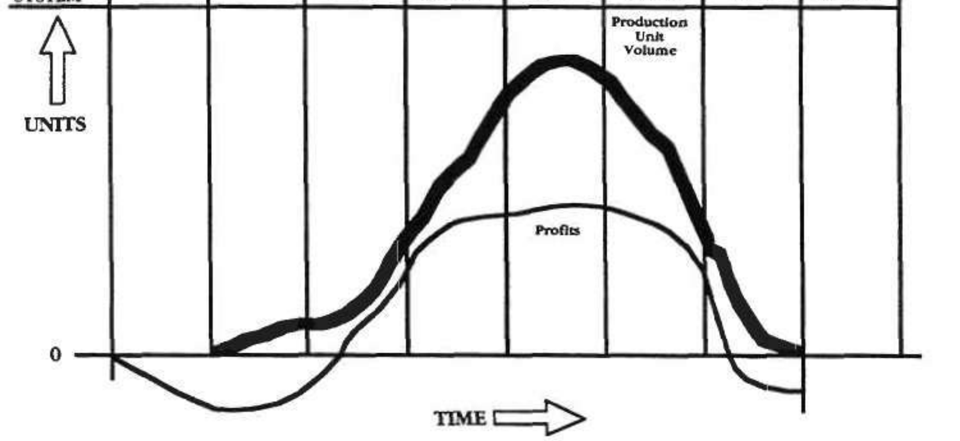
1960s/70s Adversarial	1980s Partnership	1990s Searching/Balanced
BUYING AT THE LOWEST PRICES	Lowest Overall Cost → Supply Chain Management; Balance, Workload, Effort, Measurement → Supply Positioning	INTERDEPENDENCE
Them vs Us Many Sources Large Stocks	Partnerships Source Rationalisation Low Stocks	Win-Win Relationships Change Market Complexities

PUBLIC SWITCHING PRODUCT LIFE CYCLES



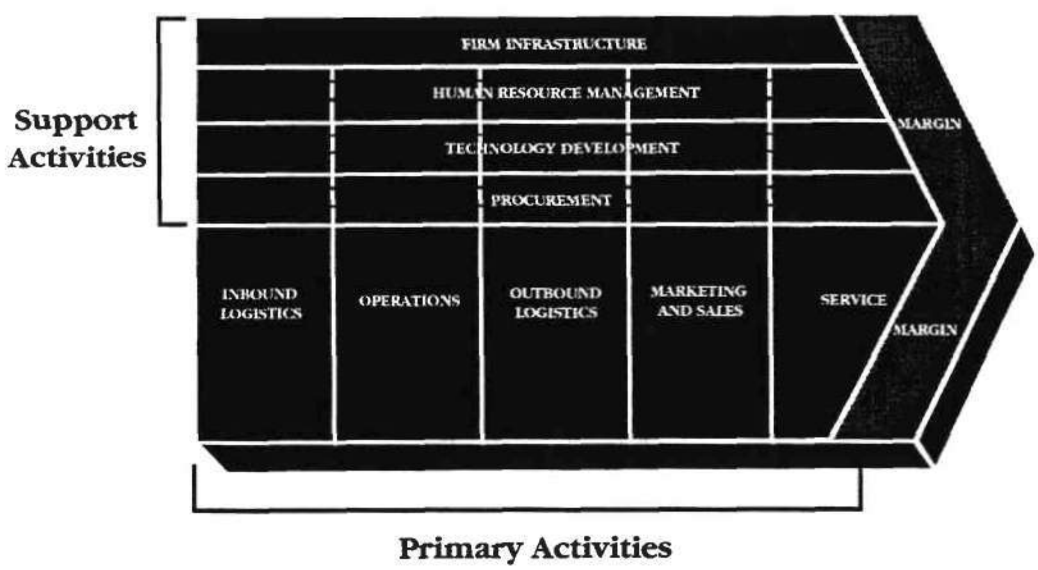
TYPICAL INTEGRATED CIRCUIT LIFE CYCLE VERSUS TELECOMMUNICATION SUB SYSTEM

PHASE	R&D	Introduction	Growth	Maturity	Saturation	Decline	Phaseout	TOTAL YEARS	
TYPICAL TIME COMPONENT	1-3 Years	3-12 Months	6 Months - 2 Years	3 Months - 2 Years	6 Months - 1 Year	3 Months - 2 Years	1-2 Years	MIN. 3.75 MAX. 13	AVE. 8 YEARS
SUB SYSTEM	1-3 Years	1 Year	3 Years	3 Years	1 Year	2 Years	1 Year	MAX. 14 YEARS	



Source : Dataquest

COMPETITIVE ADVANTAGES THROUGH THE VALUE CHAIN

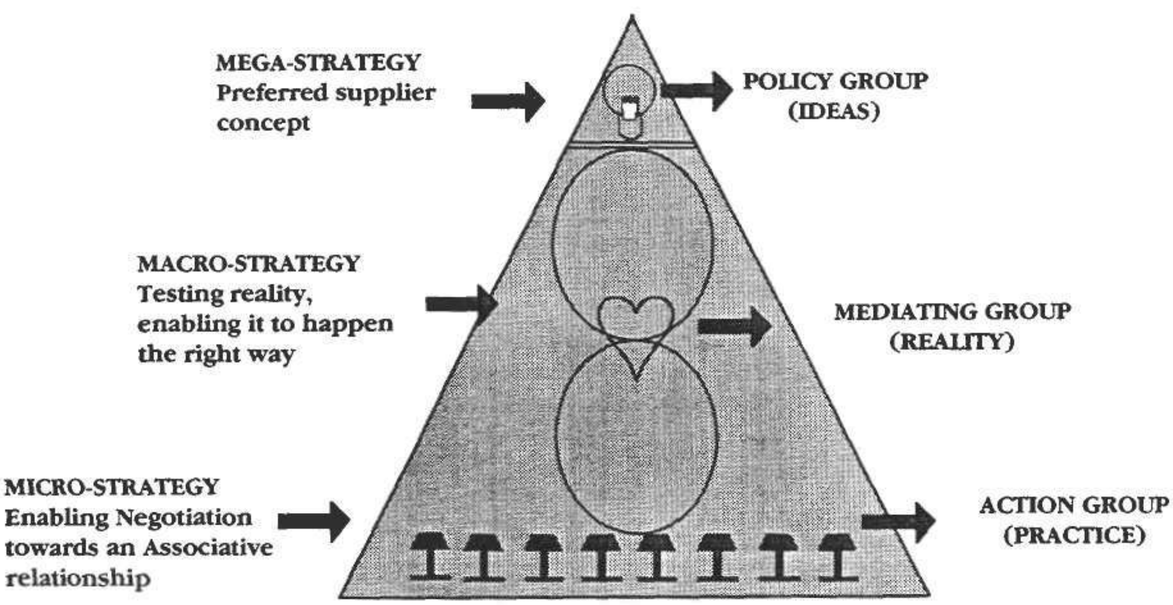


Source : Michael E. Porter (Competitive Advantage)

CREATING THE RIGHT CONDITIONS FOR BUYERS

- Vision
- Ethics
- Resources
- Appraisal

THE CHANGE PROCESS IN BUYER-SUPPLIER RELATIONSHIPS



Source : Beyond Negotiation, J.A. Carlisle / R.C. Parker

CREATING THE RIGHT CONDITIONS FOR SUPPLIERS

- Early involvement
- Trust
- Solving problems together
- Fairness
- Keeping key players informed
- Develop opportunities together

IMPLICATIONS FOR SUPPLIERS

- Fewer
- Larger
- Market driven
- Committed to continuous improvement
- Improved time to market
- Reduced lead times
- Sharing of risks
- Electronic trading

WIN - WIN RELATIONSHIPS

- Regular senior executive meetings
- Consistent communication
- Integration of interfacing disciplines
- Ongoing audit process

EVOLUTION OF SEMICONDUCTOR PROCUREMENT

Klaus Wangerin
Director
European Procurement
Sony Europa GmbH

Mr. Wangerin is Director of European Procurement for Sony Europa GmbH. He has spent many years in various responsible positions in Germany's consumer products electronics industry. Mr. Wangerin was General Manager Materials Division for Sony Wega Produktions GmbH. Prior to this he worked for Sony Europe and was responsible for all European procurement activities. Mr. Wangerin graduated as an Industrial Manager.

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Ladies and Gentlemen,

First of all I'd like to express my sincere appreciation for having the chance to speak to such a distinguished audience about some of the key issues facing a European consumer products manufacturer with a Japanese background, and I understand this role as an honour for our corporation recognizing our enormous efforts towards localization.

Thanks again to the organizer "Dataquest".

Sony has a history of more than 30 years in Europe and meanwhile 18 years have passed since Sony began to produce TV-sets in the United Kingdom. Sony has now got 15 production sites in Europe employing more than 8.000 people.

Time has passed and perhaps just a few people will remember that our European manufacturing operation started with almost all parts shipped from Japan but consistent with the decision of our chairman Mr. Akio Morita to work towards the global localization concept

"Where we sell, we have to produce
where we produce, we have to buy
where we buy, we have to research."

we are proud of our overall achievement in increasing the degree of local content in the various product lines and the high percentage of parts locally procured.

But material categories can differ and since today's subject is the "semiconductor", I think I should first present some slides to explain our demand in general and in Europe especially . They will explain with a brief overview the development of our usage by volume and semiconductor categories compared to the situation in Sony Japan. Regarding these slides I would briefly like to mention that the consumer hardware we are manufacturing in Europe consists of TV-sets, home- and personal-video units and audio products like compact disc player, car-radios and some hifi-units, not to forget loudspeaker boxes.

Slides
- Sony demand total
- Sony demand by categories
- Sony demand Europe
- Sony demand Europe by categories

You may understand that I cannot show the split among the different vendors which are attracting us with their devices but if you buy and open our products you can easily see that we are sourcing parts for our production in Europe not only from Japan of course, but also a lot from the USA and Europe.

However, with my responsibility for European Procurement and strengthening localization I am still not satisfied with European semiconductors for use in producing products in Sony EC plants and there is certainly a large opportunity for doing more. The reason why that has not happened yet and why again it will take some time is difficult to explain but it has something to do with the keynotes we were asked to give to this conference.

In my opinion there are several fundamental reasons:

1) History

Nobody can deny that the sales forces of the European semiconductor industry have explored the potential Japanese procurement market rather late and have underestimated the obstacles to enter a market as a newcomer considering the needs of excellent products and with the concept to fulfill the cultural different requirements of that market.

I have now worked for about 25 years in the European/German electronics consumer market and I have not forgotten what tough work it was for Japanese sales engineers to develop an interest for their products in the European market in the mid-sixties but they have not given up and they have learnt the lesson that a newcomer has to be better in all aspects than an existing local source - European manufacturers must now learn this same lesson!

2) Communication

Apart from a few commodities the decision to integrate a new semiconductor in a new chassis- or set-design starts at a very early design-in-stage. Our members in research and engineering - whether located in Japan or in Europe - have to feel completely certain which products and which vendor will enable them to fulfill their requirements for an innovative, cost conscious and very reliable concept.

This feeling certainly is supported by good or bad experiences (trust and confidence), knowledge of the market, internal statistics about vendor rating and constant communication with the partners of the semiconductor market. Communication is a matter of common understanding and that includes the key factor of language.

For some product lines we have already localized our engineering departments and here it can be proved the share of European semiconductors are the highest. But unfortunately for me in case of other product lines there is no urgent need to move these engineering activities to Europe. The reason is either that there is no advanced technology available in Europe - just think of personal video - or that Europe's industry has stopped the development and manufacture of certain products in Europe - if you think of several audio products. Which means in our case vendors have to look for a way how to awake our users interest. Believe me this will only happen if communication takes place at the source and unfortunately for you that means for various products - Japan -.

Another criteria in regard of communication should be that parts suppliers shall make effort to establish longterm relationship with their customers. The relationship will bring about open mind friendship between supplier and customer beyond company manners and the supplier will be able to get future information about products development and other useful information.

If a supplier wants to establish the relationship with a customer, he should consider multi-relations. The meaning is that the business talk used to include complicated factors for achieving the result. Sometimes the matter of engineering or top decision as for instance investment should be discussed in business talk.

Additionally it is to say that if the supplier has as a communication channel only the salesperson, he better should take a time for organizing communication channels between executive and executive or engineer and engineer to be able to understand all aspects of a longterm relationship.

Both parties should spent a lot of time for communicating what they think or what they want, even though the salesperson could arrange opportunity for discussion. And if the supplier has managed to arrange communication channel on each other's management level the supplier can easily respond quickly through the suitable channel.

3) Technology

I have already mentioned technology as a reason for not rushing set-engineering into Europe. Moreover in semiconductor technology we will find maybe another reason why European semiconductors participate below our target level in our demand calculation. We in Sony believe that the final customers, the consumers, are extremely interested in buying small and light-weight consumer products which they can carry, that are robust and reliable, but by no means cost more than they are used to paying for less compact products. I do not want to list all of Sony's inventions in this regard which have created new markets, but this was only possible with the strong support of our vendors towards miniaturization. Sony has set benchmarks but we are sure that we still have not reached the end of the road. And as usual these innovative tiny component devices soon will become standard, a reason why we want to know from our vendor candidates what product strategies they have in mind. Most of our concern is IC package. According to the result of our survey, 93 % of Japanese semiconductor users have headaches of finding suitable tiny and thin IC package as like VSOP and VQFP in foreign semiconductor's line up, even if user can find suitable function of chip.

European semiconductor manufacturers do not seem to intend to develop devices in miniaturized packages because of not so strong market demand in Europe. We hope that Eruopean semiconductor manufacturers become aware that miniaturization technology is a fruitful apple tree.

Another concern of us are the low power consumption chips. As customer of WALKMAN knows, consumer products operate on a battery of 1,5 volt but we do not know foreign semiconductor manufacturers who are able to design 1,5 V operation CMOS chips. Japanese semiconductor user of consumer products are looking for good capable partner of foreign semiconductor manufacturers, which means only vendors who are able to support us in our requirement for innovation can actually become key-vendors, being involved at the earliest stage in the development of new products. The next slides may underline the direction we are marching towards package design.

Slides: Package design

4) Customer satisfaction

For our semiconductor demand there exists a significant number of companies who want to supply us with their devices. Sometimes it is very hard to make the correct decision but one factor can be counted as the key for the vendor selection:

Customer satisfaction

We in Sony see it as our external as well as internal duty to manage our tasks towards 100 % customer satisfaction. Everybody is a customer but in turn has a customer too. To be satisfied is one issue, but to satisfy a customer is even more difficult and if you think of all the necessary factors for 100 % customer satisfaction you will come to a long check-list.

I have already outlined some of these requirements. One is communication and this includes more European design-in centres in the semiconductor branch with Japanese speaking members in Japan. Another is technology in products and packaging but we should not forget quality as well.

Quality is one of our major sales arguments. As you may understand the miniaturization and complexity of the sets does not allow repairs anymore. So far the quality of the devices is a key factor in our vendor-selection. I don't want to go into details but frankly speaking there exists a big gap between the different global semiconductor markets.

And as you know, the Japanese user looking for good partner as a supplier who can quick respond for urgent trouble. Most foreign semiconductor manufacturers have a business contract with Japanese traders but if trouble occurs on production line at user's site, the trader must take care of the user's trouble.

But due to lack of communication between trader and semiconductor manufacturers or technical capability of the trader, sometimes we have frustration that is caused by slow response. Foreign semiconductor manufacturers should feel much more responsible for traders training.

There are many more points that are necessary for complete customer satisfaction. Let me just mention on-time delivery, cost performance, response time, participation in improvement programmes or involvement in environmental issues such as recycling.

A final issue I'd like to add. Business can be a matter of a big contract which involves all legal, technical and commercial affairs and sometimes vendors want to start business on the base of such a contract including a promise for long-term relationship.

But is not customer satisfaction a better base for doing business? A customer who is satisfied will use this experience as a foundation to build business relationships.

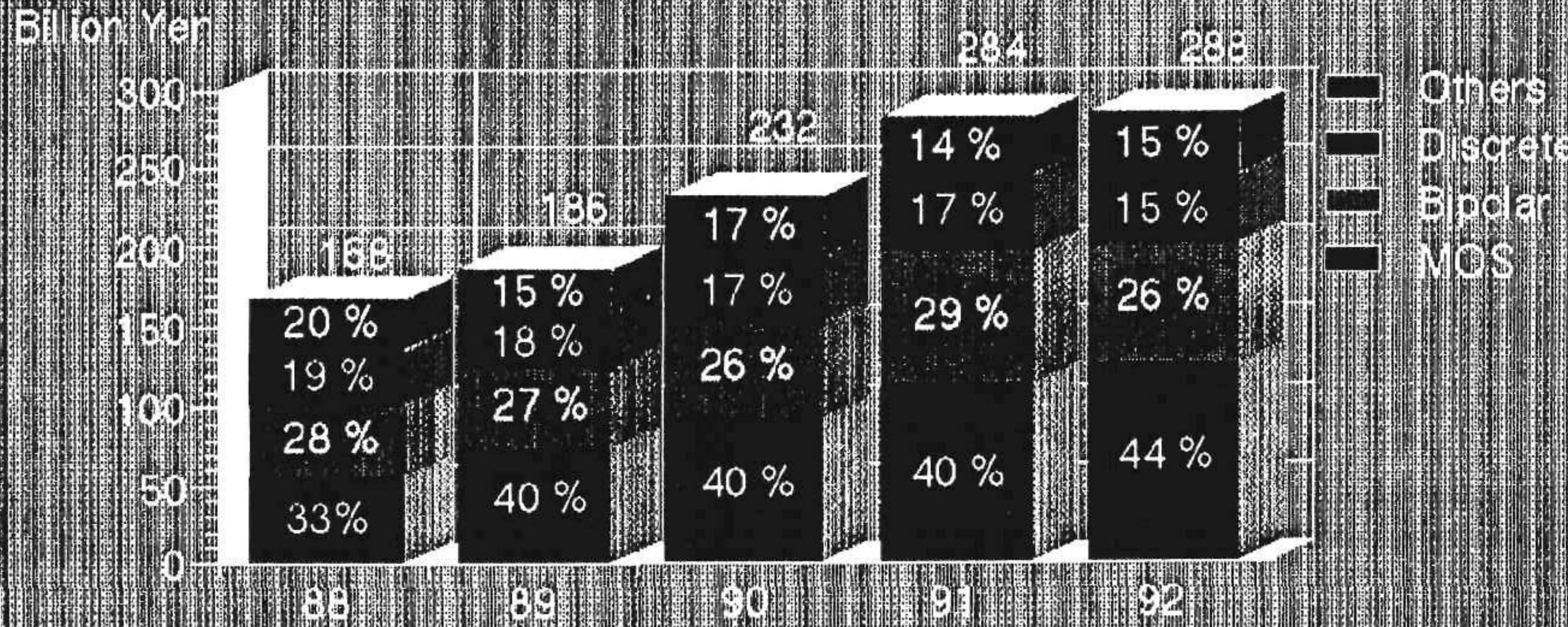
The Japanese electronics industry has furnished a requirement list for foreign semiconductor manufacturers which should be considered as a minimum requirement to satisfy Japanese set-makers. Let me present this chart as a summary of the arguments needed for achieving customer satisfaction.

Slide Requirement list

This chart is fully in line with our European opinions and let me close my speech with the hope that the European semiconductor industry with all of its products and operations will become so attractive that Sony will be forced to integrate more European semiconductors into its products. Not only in consumer products for the European market but in its products for the other global markets as well.

Thank you for your attention.

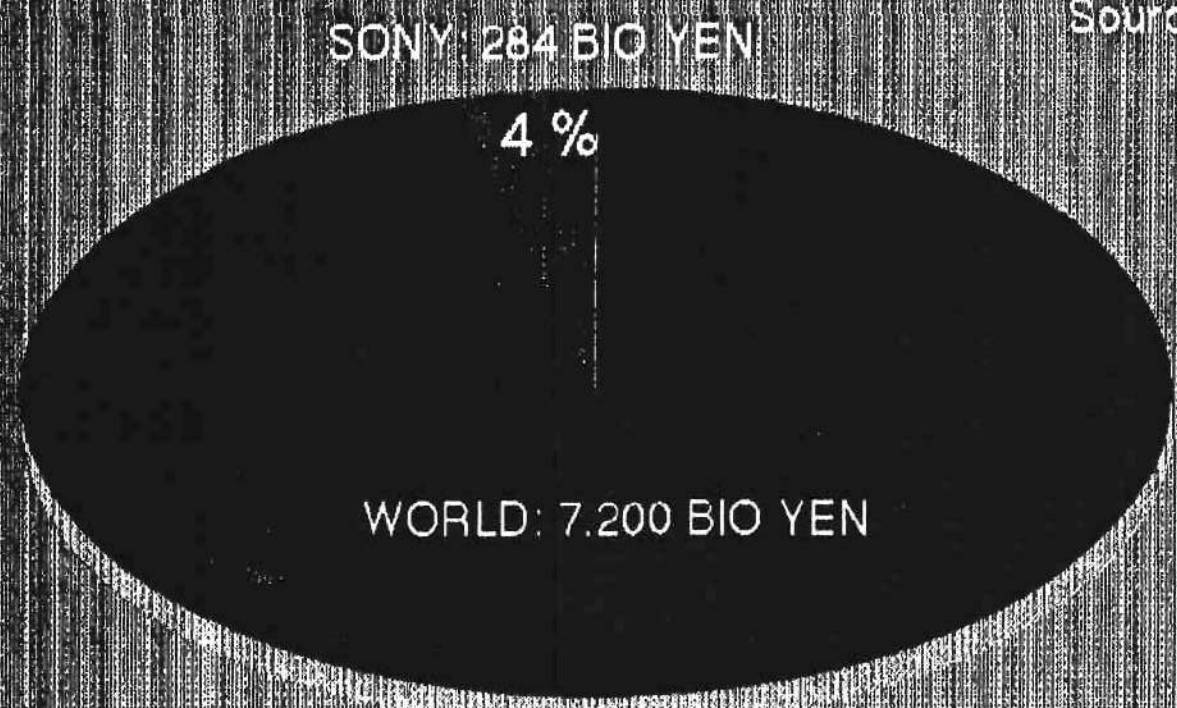
ESTIMATE SEMICONDUCTOR TOTAL CONSUMPTION IN SONY WORLDWIDE



SONY

COMPARISON TOTAL CONSUMPTION
WORLD vs. SONY

Source: 1991 WSTS



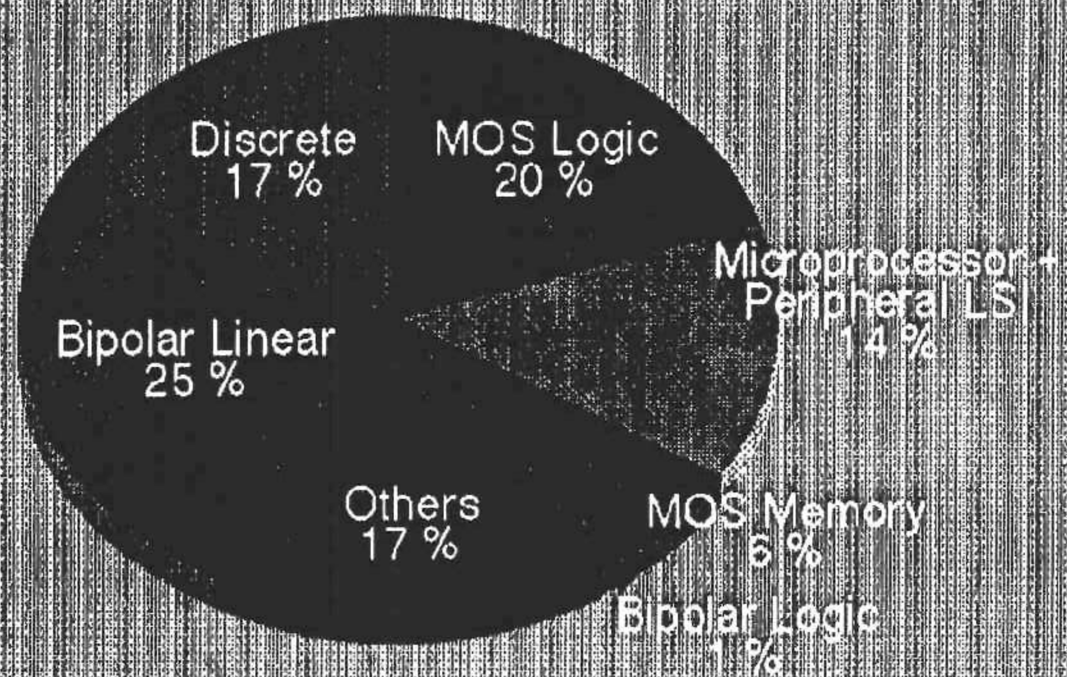
SONY

CUSTOM/COMMODITY RATIO OF TOTAL SEMICONDUCTOR CONSUMPTION IN SONY

SONY

SEMICONDUCTOR TOTAL CONSUMPTION IN SONY JAPAN BY CATEGORY

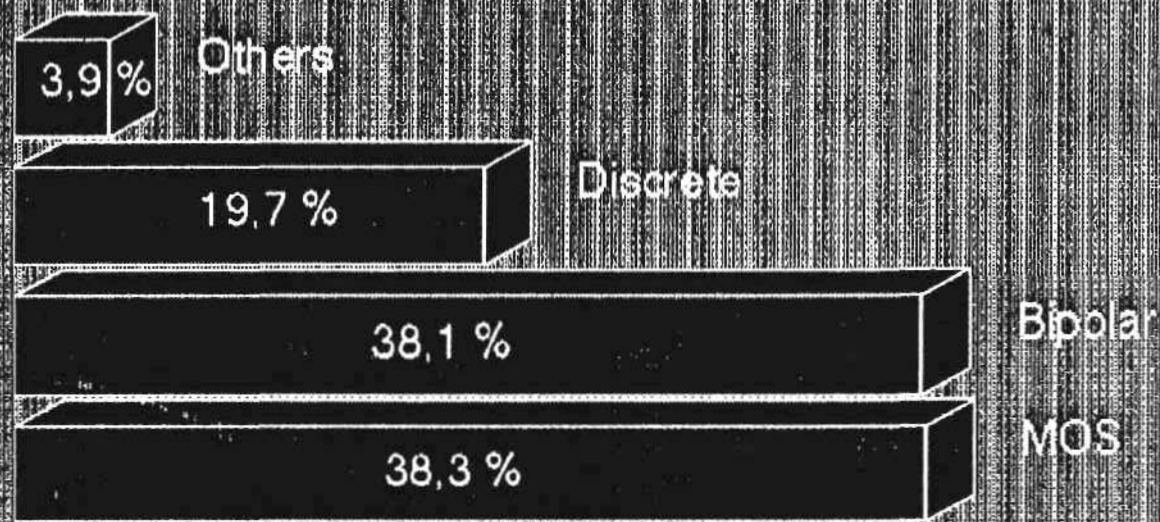
FY 90



SONY

SONY EUROPE SEMICONDUCTOR CONSUMPTION

FY 91

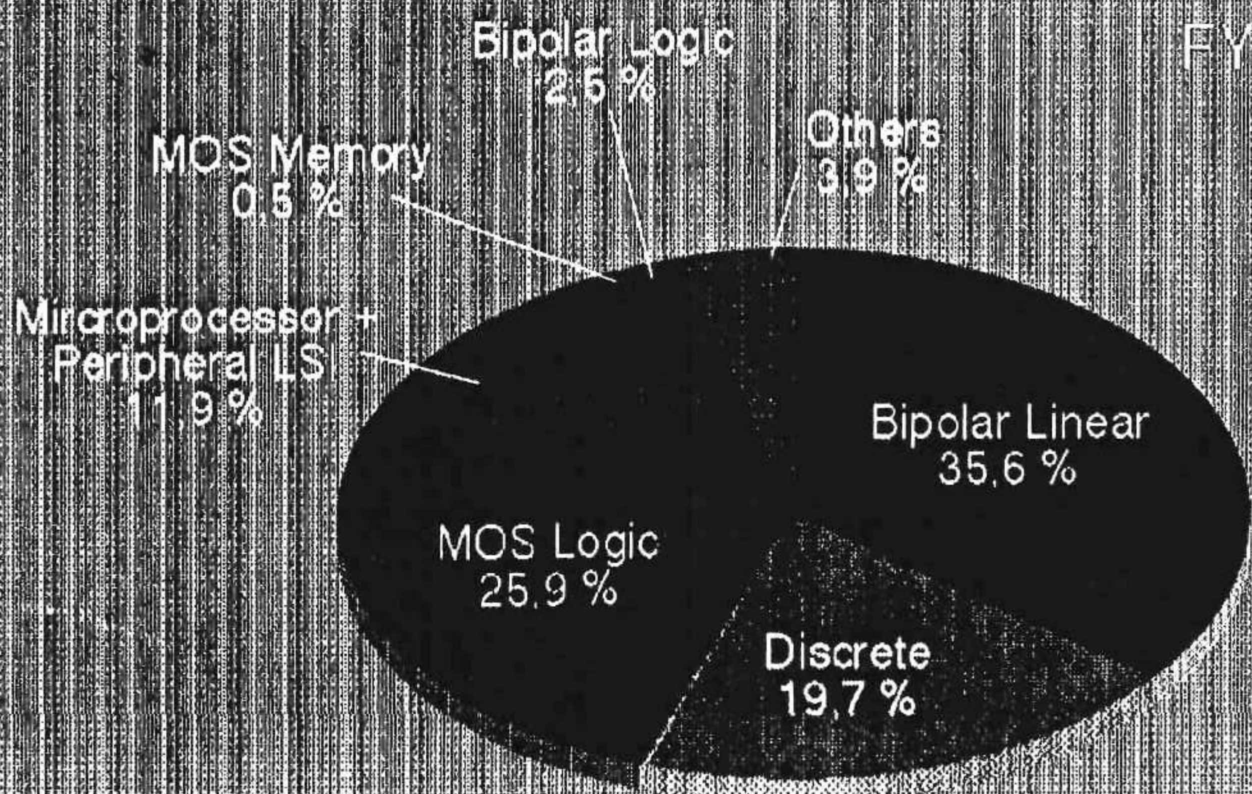


Total Amount: 25 Billion Yen

SONY

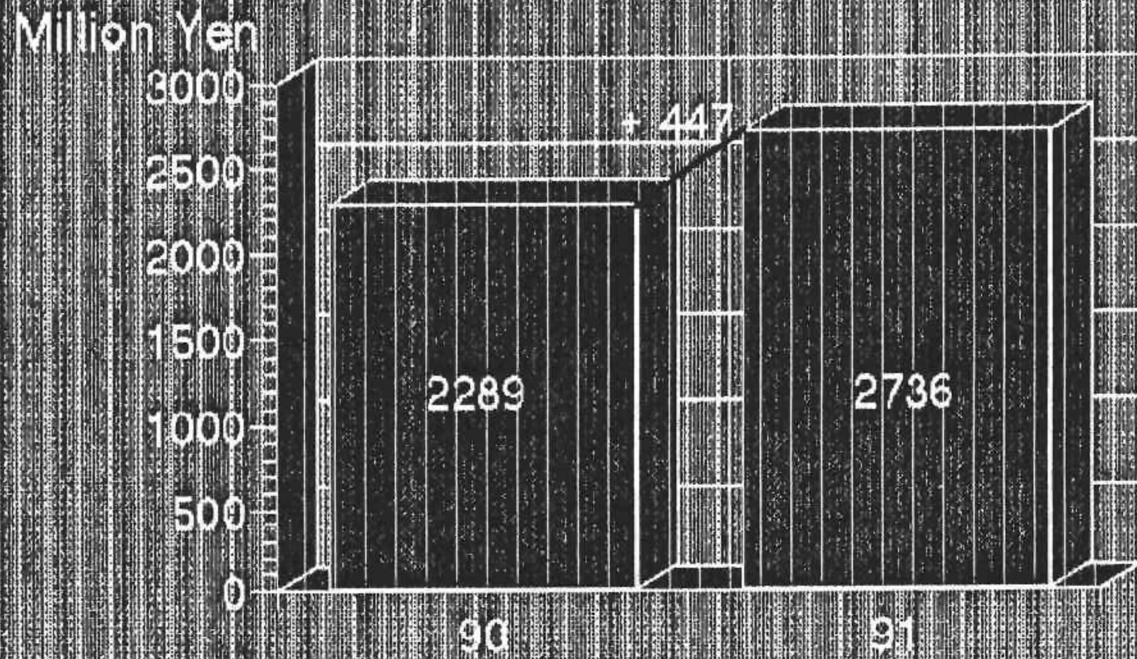
SEMICONDUCTOR TOTAL CONSUMPTION BY CATEGORY IN SONY EUROPE

FY 91



SONY

EUROPEAN SEMICONDUCTOR SUPPLIES TO SONY JAPAN



SONY

TREND

- Quad Flat Plastic Package for Surface Mount (QFP-type)

	QFP	→	VQFP
lead pitch	*1.27 mm - 0.65 mm*	→	*0.5 mm*

SONY

TREND

- Small Outline Plastic Package for Surface Mount (SOP-type)

	SOP	→	SSOP
lead pitch	*1.27 mm*	→	*0.65 mm*

SONY

TO ACHIEVE THE HIGH-DENSITY MOUNTING

- Change to small and low-profile devices
  - shrink SOP from 1.27 mm lead pitch to SSOP with 0.65 mm
  - fine pitch QFP (1.27 - 0.65 mm) lead pitch to 0.5 mm; next target may be 0.3 mm in lead pitch
  - 1608 package for small signal transistors
    1712 package (2012 eq.) diode
    1005 type package is under development

SONY

TO ACHIEVE THE HIGH-DENSITY MOUNTING

- Improved heat-resistant package of IC's
  - free from heat-destruction in reflow soldering
  - reflow soldering is applied two times (or more) for double sided assembly

SONY

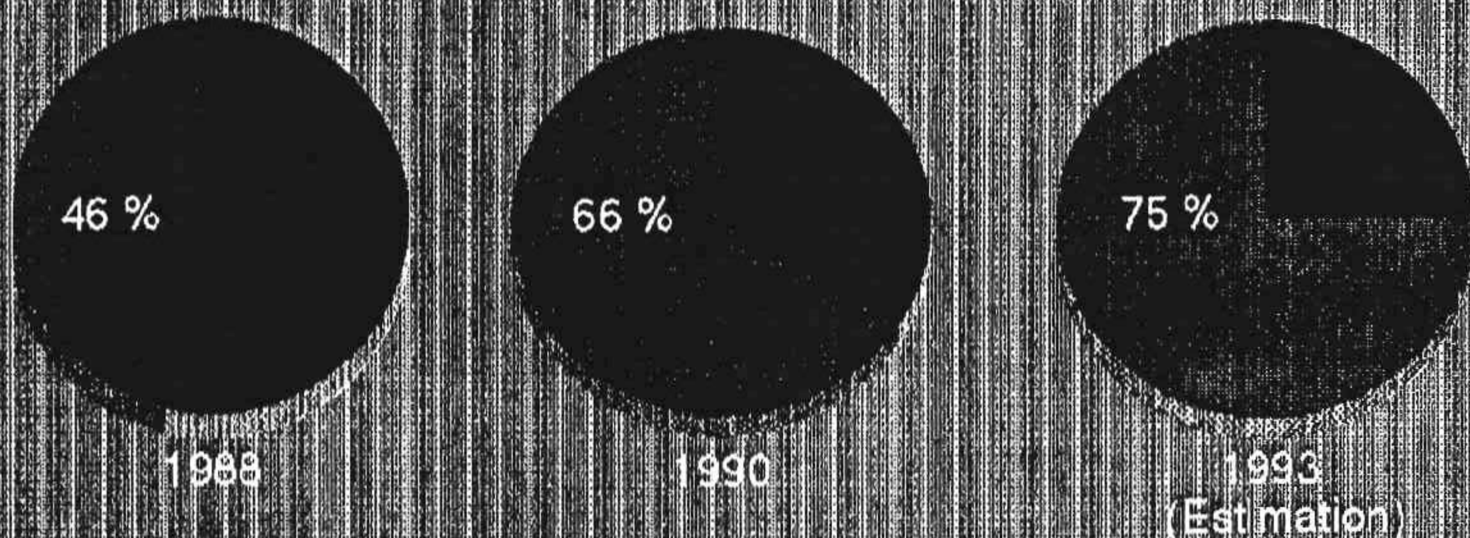
TO ACHIEVE THE HIGH-DENSITY MOUNTING

- Surface of P.C.B. shall be filled by components
  - precision form of components give space-saving between device to device
  - multy-layer P.C.B. is applied to minimize surface wiring
  - SMD small size connector is used

SONY

TREND

- Surface Mount Type Parts Quantity Ratio in Sony Products



Japanese trend for reference: 58 %

SONY

TECHNICAL SPECIFICATION FOR PRECISE PACKAGE

- Heat proofing plastic mold materials
- High reliability chips
- Precise arrangement of package lead
- Solderable lead plating

SONY

WHAT FACTORS WERE OBSTACLE TO ADOPT FOREIGN SEMICONDUCTORS?

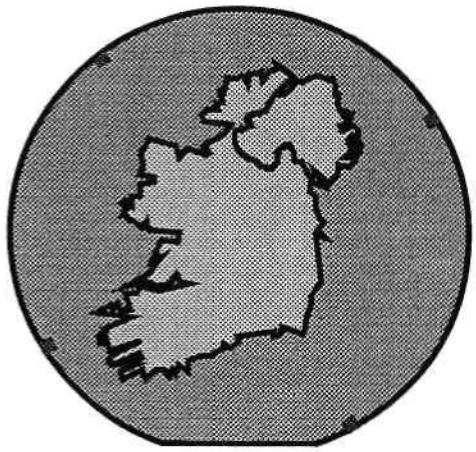
- Electric specifications of the semiconductor chip were satisfactory but suitable package was not existing 93 %
- Electric specifications were not satisfactory 33 %
- Electric specifications and package were satisfactory but leads arrangement and other quality control factors were not satisfactory 27 %
- Satisfied package was existing but electric specifications were not satisfactory 20 %

SONY

REQUIREMENTS - PROPOSALS FROM USER'S POINT OF VIEW

- Establish Local Design Centres
- Build trust between users and suppliers
- Speed up processing of quality control problems
- Provide proper training for distributors
- Develop surface-mount devices
- Improve responsiveness to user's flexible production plans

SONY



PANEL SESSION 2: SEMICONDUCTOR MANUFACTURING IN EUROPE

Chaired by Bipin Parmar
Dataquest Europe Limited

Thomas E. Hartman
Intel Corporation

George Bennett
Motorola Semiconductors Ltd.

Larry Murtagh
NEC Semiconductors Ireland Ltd.

Laurent Bosson
SGS-Thomson

Dataquest Europe Limited, a company of The Dun & Bradstreet Corporation
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SEMICONDUCTOR MANUFACTURING IN EUROPE

Thomas E. Hartman
General Manager
Ireland Components Manufacturing
Intel Corporation

Mr. Hartman is currently General Manager, Ireland Components Manufacturing for Intel Corporation. He has been in the semiconductor field since 1959 in various capacities ranging from R&D to wafer fab plant management. With Texas Instruments he started up the company's first Japanese wafer fab. Mr. Hartman then joined Intel where he has been involved with nine fab start-ups over the last 17 years.

Dataquest Europe Limited
EUROPEAN SEMICONDUCTOR INDUSTRY CONFERENCE
June 3–5, 1992
Dublin, Ireland

This presentation was not available

at the time of publication

SEMICONDUCTOR MANUFACTURING IN EUROPE

George Bennett
Vice President and General Manager
MOS Memory and Microprocessor
Division (Europe)
Motorola Ltd.

Mr. Bennett joined Motorola in 1979. He held various management positions in the wafer fabrication area before being appointed General Manager, East Kilbride, Scotland in 1988. In the same year he was appointed Vice President and General Manager, MOS Memory and Microprocessor division of the European Semiconductor Group. Prior to this he held various positions within Ferranti, Glasgow University and Logitech, and ran his own manufacturing business. Mr. Bennett gained a B.Sc. in Applied Physics from Heriot-Watt University and then graduated from Glasgow University in 1969 with a Ph.D in Electronics and Electrical Engineering.

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at the time of publication

SEMICONDUCTOR MANUFACTURING IN EUROPE

Larry Murtagh
Managing Director
NEC Semiconductors Ireland Ltd.

Mr. Murtagh is Managing Director of NEC's Semiconductor manufacturing facility located in Co. Meath, Ireland. His company is responsible for assembly and test of memory, microprocessor and application-specific integrated circuits for the European market. Before joining NEC, Mr. Murtagh was Managing Director of Ecco Ltd., the European subsidiary of General Electric (USA) Semiconductors. Mr. Murtagh received a B.Sc. degree in Chemistry at University College, Galway, Ireland.

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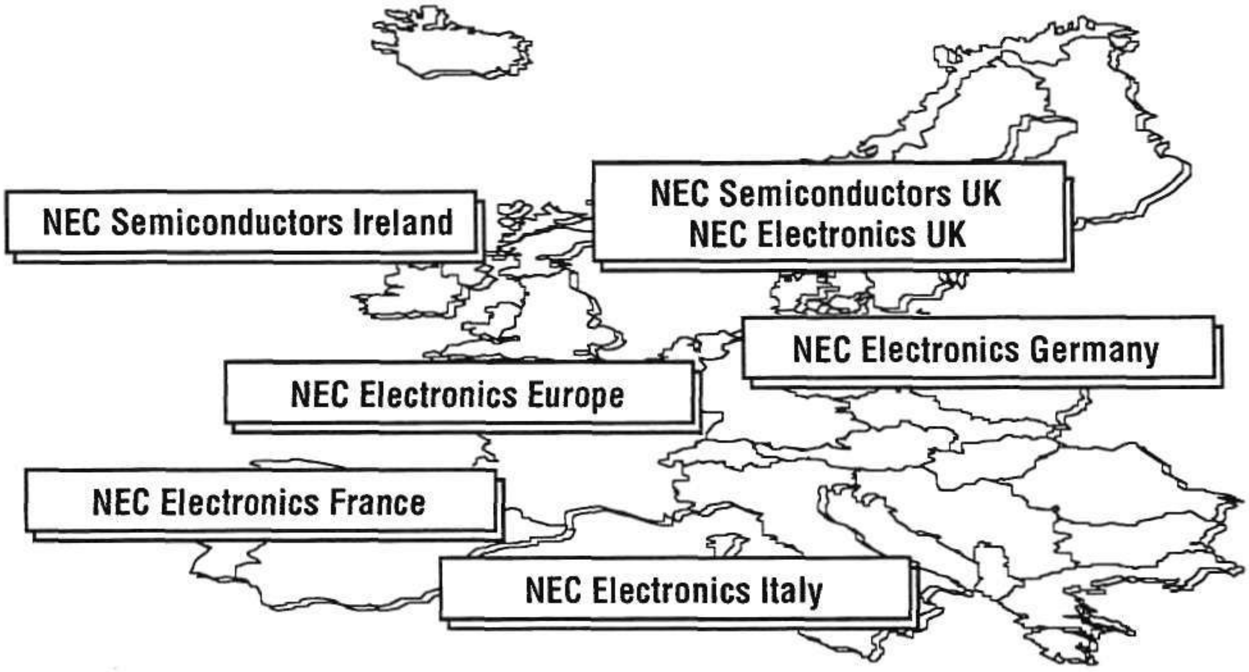
June 3–5, 1992
Dublin, Ireland

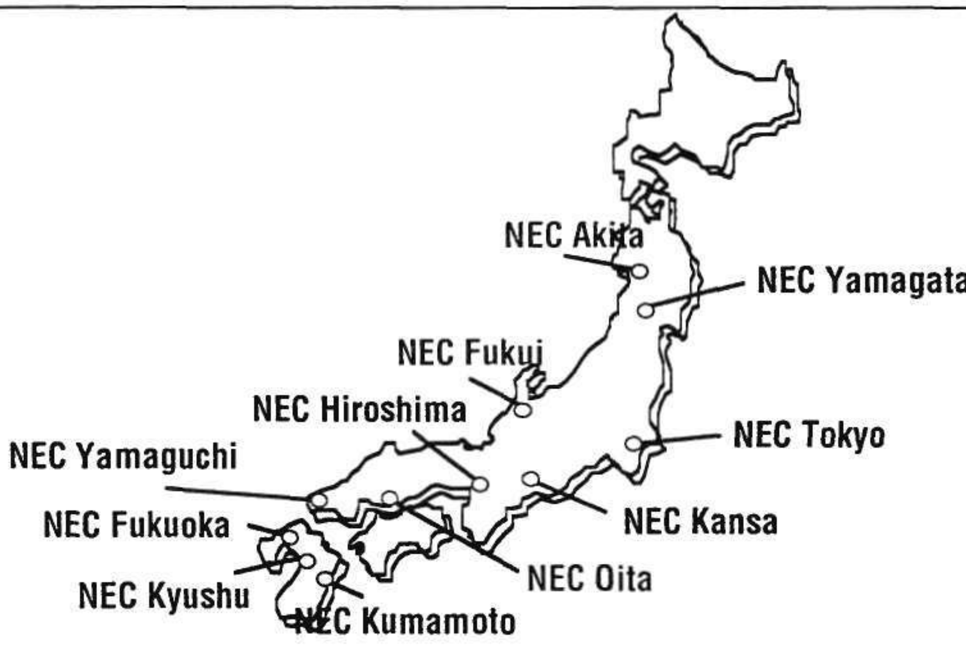
C&C Computers and Communications

NEC Europe



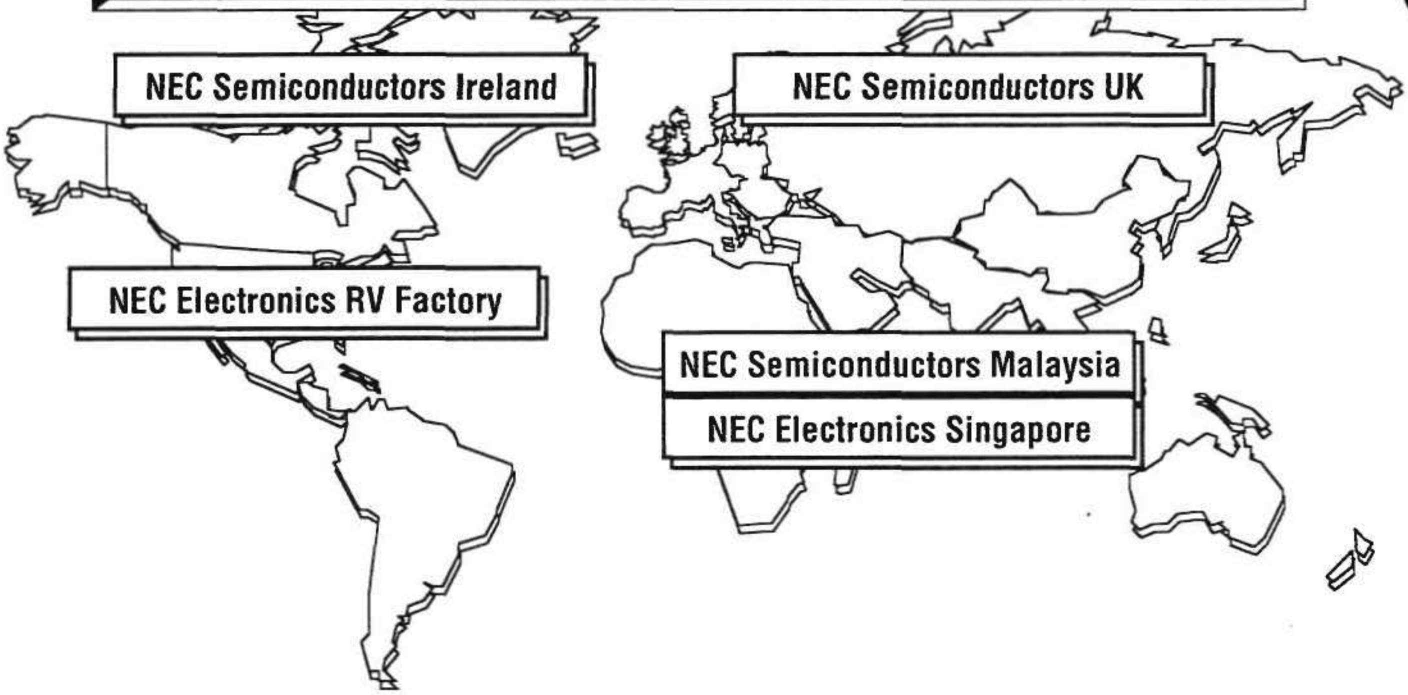
C&C Computers and Communications

NEC Semiconductor Manufacturing Japan



C&C Computers and Communications

NEC Semiconductor Manufacturing World Wide



C&C Computers and Communications

Issues

1. Why Do You Think Manufacturing Semiconductors in Europe is More Expensive than Other Parts of the World?
2. Why is it Important to Manufacture in Europe if it is More Costly Here?
3. Is it Viable to Expect a European Plant to be Constructed to Supply Just Local Market Needs or Must it supply Products for Worldwide Consumption?
4. Do You Think there are Factors that Lead to a European Plant Being More Inefficient than Elsewhere, eg Training Skills, Supplies, Local Government?
5. How Do You Think Government Policies Effect Manufacturing in Europe? Which Policies Help and Which Hinder?

C&C Computers and Communications

Semiconductor Manufacturing in Europe More Expensive?

Cost	Japan	Europe
Land	Higher	Lower
Building / Servces	Higher	Lower
Equipment	Lower	Higher

Total Startup Cost Compared to Japan = Marginally Higher

C&C Computers and Communications

European Semiconductor Manufacturing

- Start up *Cost* of a European Wafer Fab is Slightly Higher than in Japan
- Offset by *Benefits* from European Wafer Fabrication

C&C Computers and Communications

European Semiconductor Manufacturing

NEC Policy:

Production Inside Market to Support European Customer Needs

C&C Computers and Communications

European Semiconductor Manufacturing

Benefits:

- Service / Flexiblity for Customer Satisfaction
- Improved Logistics and Communication
- Positive Trade and Technology Balance
- Key Element of European Business Structure

C&C Computers and Communications

NEC's European Business Development

1st Stage	'72	Direct Export			
2nd Stage	'73 - '74		Sales Through Subsidiaries		
3rd Stage	'74 - '86			Assembly Overseas	
4th Stage	'87				Integrated European Production

C&C Computers and Communications

Basic Policy of NEC's Globalisation

1. Production within the Market to Support Regional Needs

2. Affiliates to be Placed in the Most Suitable Locations

3. Inter Regional Cooperation on Specific Products

Computers and Communications

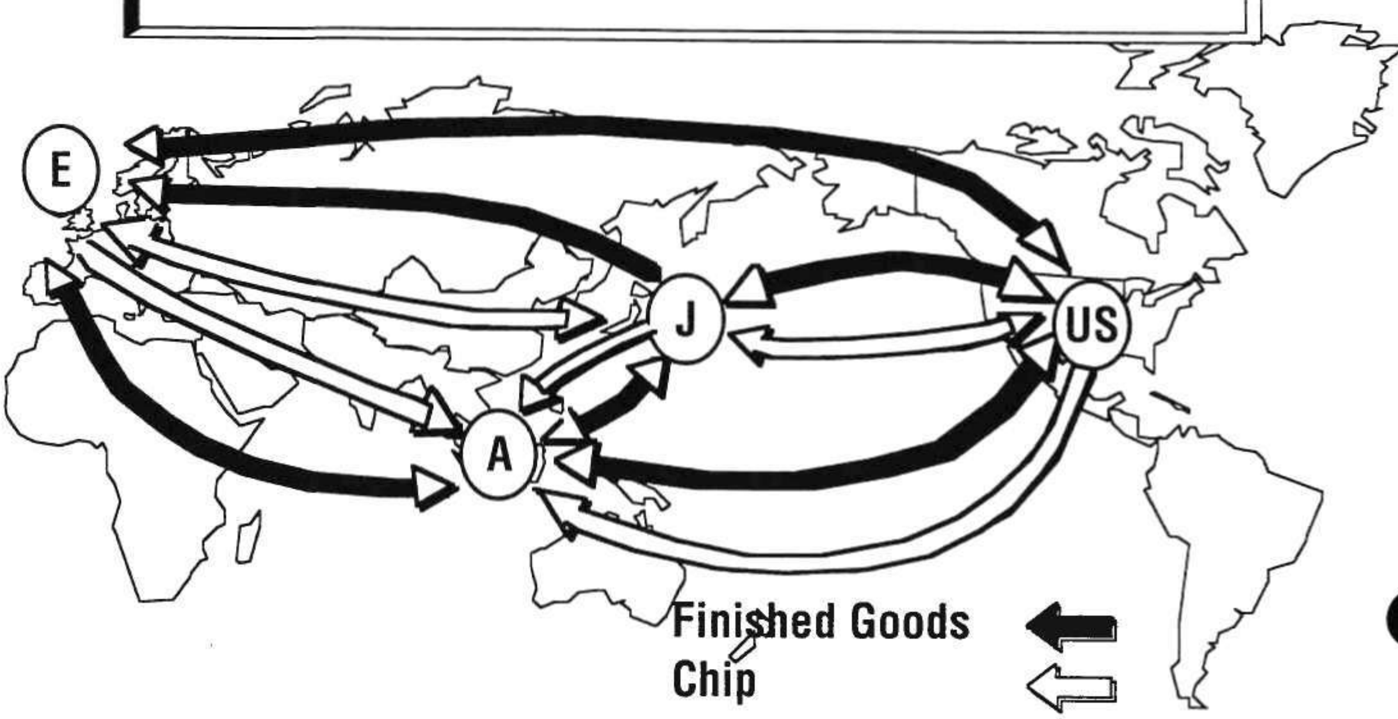
Philosophy for Manufacturing

- Use of the Most Advanced Equipment World Wide
- Production of Various Products to Support the Market
- Worldwide Production / Information Network

Establishment of World Wide Integrated Manufacturing

Computers and Communications

Global Logistics Semiconductors



C&C Computers and Communications

European Manufacturing Environment

- Education / Training Positive
- Local Governments Supportive
- Main Problem is Absence of Major European Semiconductor Equipment Vendors
- Import of Equipment from Japan / USA is Expensive
- Import Duty on Equipment by European Governments Further Increases Cost

C&C Computers and Communications

Government Policies

Positive:

- Local Investment Incentives
- Capital Allowances
- Local Content

Negative:

- Import Duty on Semiconductor Equipment

European Semiconductor Manufacturing

Summary:

- Wafer Fabrication Manufacturing Cost is Similar to Japan
- Local Manufacturing Improves Customer Satisfaction and Service
- NEC's Semiconductor Business is Committed to Worldwide "Globalisation" Concept

This presentation was not available

at the time of publication

SEMICONDUCTOR MANUFACTURING IN EUROPE

Laurent Bosson
Corporate Vice President
Manufacturing
SGS-Thomson

Mr. Bosson is Corporate Vice President, Director of Central Manufacturing and Director of VLSI fabs for SGS-Thomson. He was also appointed President of SGS-Thomson Microelectronics US earlier this year. Prior to this he was General Manager of the Rennes facility for SGS Microelettronica, later SGS-Thomson Microelectronics Group. Before this Mr. Bosson held various positions in the components branch of Thomson CSF responsible for maintenance, engineering manufacturing and business administration. He graduated from the University of Dijon, France with a degree in Chemistry and Physics.

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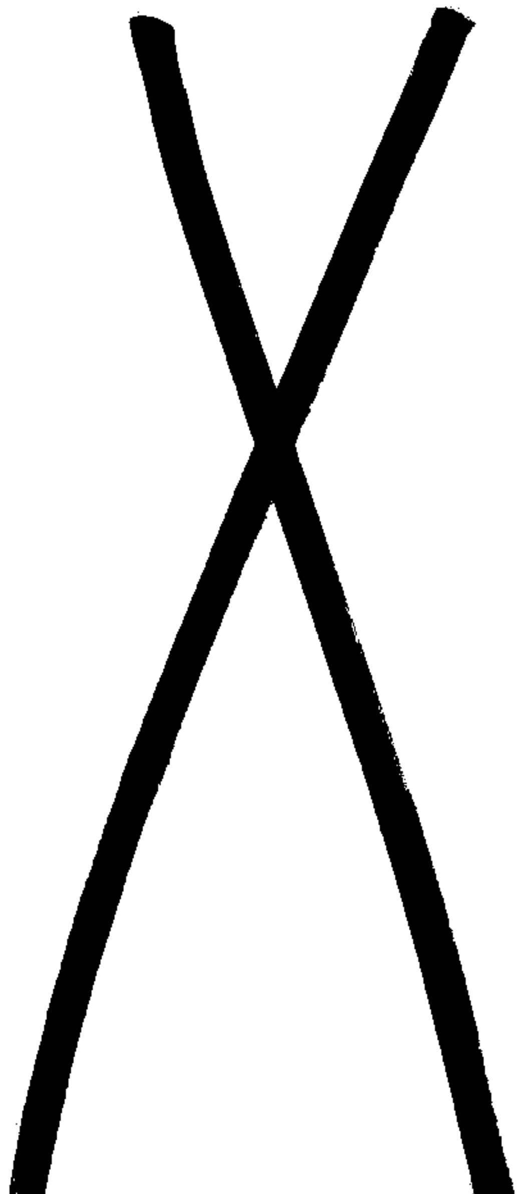

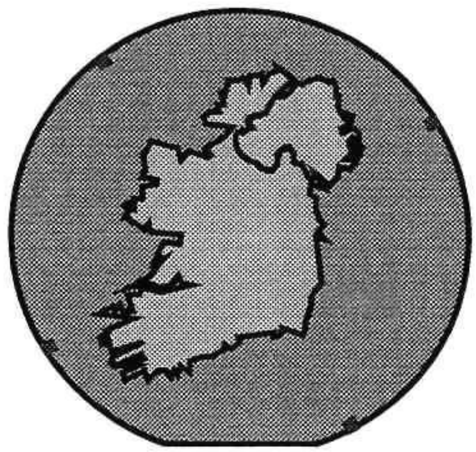

EXECUTIVE ISSUES: THE SEMICONDUCTOR INDUSTRY
INTRODUCTION

Jim Eastlake
Senior Industry Analyst and Manager
European Semiconductor Group
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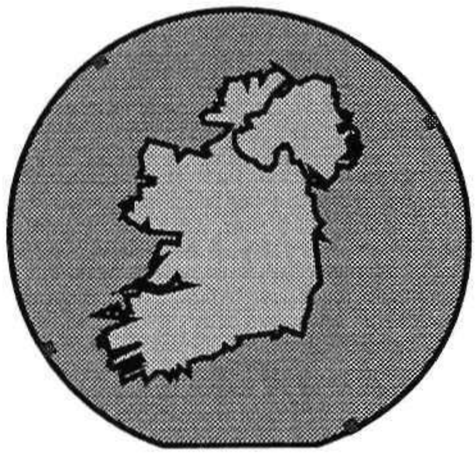

FUTURE TRENDS IN LCD MARKETS AND TECHNOLOGIES

Isamu Washizuka
Corporate Director
Sharp Electronics Europe GmbH

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FUTURE TRENDS IN LCD MARKETS AND TECHNOLOGIES

Isamu Washizuka
Corporate Director
Sharp Electronics GmbH

Mr. Washizuka is Corporate Director of Sharp Electronics GmbH. He is also General Manager of the LCD Group. Mr. Washizuka has held many managerial roles within different divisions. He is a senior member of the IEEE and a member of the Institute of Electronics, Information and Communication Engineers. Mr. Washizuka graduated from Osaka Prefecture University, Japan.

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PROMISING FUTURE OF LCD (1)

LCD WHOSE INITIAL APPLICATIONS WERE SMALL NUMERIC DISPLAYS FOR CALCULATORS AND WATCHES HAS BEEN QUICKLY EXPANDING ITS APPLICATIONS.

THANKS TO ITS DISPLAY QUALITY AND LOW POWER CONSUMPTION, WHICH DIFFERENTIATES LCD FROM OTHER FLAT DISPLAYS, LCD HAS MADE CONSIDERABLE CONTRIBUTION TO CREAT ENTIRELY NEW MARKETS FOR PORTABLE EQUIPMENT SUCH AS PORTABLE WORD PROCESSORS, PERSONAL COMPUTERS(PC),INCLUDING NOTE BOOK PC.

LCD IS REGARDED, THEREFORE,"THE" FLAT DISPLAY HAVING THE HIGHEST COST-PERFORMANCE AND IS EXPLODING ITS APPLICATIONS IN THE FOLLOWING FOUR AREAS

SHARP

1. VISUAL APPLICATION /OA DISPLAY (DIRECT VIEW DISPLAY, LCD PROJECTORS, VIRTUAL REALITY, ETC.)
2. NEW INFORMATION DISPLAY DEVICES SERVING AS INTELLIGENT ELECTRONIC WRITING PAPER (PROVIDING INTERACTIVE RELATION BETWEEN HUMAN AND MACHINE, BETWEEN MACHINES, AND BETWEEN MACHINE AND NATURE)
3. INTERIOR AND EXTERIOR APPLICATIONS (APPLICATIONS UTILIZING THE MOLECULAR ORIENTATION CONTROL FUNCTION IN ADDITION TO DISPLAY)
4. SUBSTITUTE FOR CRT TO SOLVE THE PROBLEM (MAINLY 14" OR SMALLER CRTS FOR DIRECT VIEW LCD)

SHARP

PROMISING FUTURE OF LCD (2)

THE EVER GROWING NEEDS FOR COLOR DISPLAYS CREATE NEW APPLICATIONS OF COLOR LCDS, EXPANDING TFT-LCD APPLICATIONS BECAUSE OF ITS MULTI-MEDIA DISPLAY CAPABILITY.

SHARP

PROMISING FUTURE OF LCD (3)

O CONTRIBUTION TO HIGHLY INFORMATION-ORIENTED SOCIETY

AS SHOWN BELOW, LCD IS NOT ONLY USED IN SPECIAL AREA BUT ALSO IN PRODUCTS AND EQUIPMENT FAMILIAR TO ORDINARY PEOPLE. WITH THE TECHNOLOGICAL ADVANCEMENT,LCD WILL COME CLOSER AND CLOSER TO HUMAN, SERVING AS BETTER INTERFACE BETWEEN HUMAN AND INFORMATION MEDIA

[OA/FA EQUIPMENT]
SPACE & ENERGY SAVING WITH AMENITY
[HOME/PERSONAL EQUIPMENT]
BETTER ACCESS TO INFORMATION "ANYWHERE,ANYTIME"
EXAMPLE: PORTABLE PLAYBACK TERMINAL SUCH AS
CAMCODER, CD-ROM, CD-I,PALMTOP (PC)
HYPER ELECTRONIC ORGANIZER
[AUTOMOBILE] NAVIGATION-SYSTEM (GPS DISPLAY)
[PUBLIC TRANSPORTATION] IN-TRAIN ENTERTAINMENT
INFORMATION PANEL

SHARP

New Creative Products

LCD HAS GREAT POTENTIALITY TO CREATE NEW MARKETS FOR FINISHED PRODUCTS SINCE LAST YEAR, WHICH CRT COULD NOT REALIZE WITH CONVENTIONAL TECHNOLOGIES, AS SHOWN IN THE FOLLOWING PAGES.

SHARP

1. THE 32-BIT COLOR NOTEBOOK PERSONAL COMPUTER EMPLOYING THE 8.4" TFT COLOR LCD CAN DISPLAY THE DELICATE COLOR TONES WHICH ARE NECESSARY FOR COLOR GRAPHICS. THE COLOR NOTEBOOK PERSONAL COMPUTERS ARE INCREASING RAPIDLY.

SHARP

2. UNTIL LAST YEAR MOST OF THE COLOR LAP-TOP PERSONAL COMPUTERS COMMERCIALLY AVAILABLE HAD VGA DISPLAY (640 X RGB X 480 PIXEL MODE) WITH 512COLORS. IN THIS YEAR THE MULTI-MEDIA LCD CAPABLE OF DISPLAYING 260,000 COLORS OR 16,700,000 COLORS HAS BEEN BEGINNING TO BE USED.

3. PEN-INPUT OR PEN-BASED PALMTOP PC / NOTEBOOK PC HAVE BEEN INTRODUCED, OFFERING EASY INTERACTIVE FUNCTIONS.

SHARP

4. "WALL- HUNG TV " INCORPORATING 8.6" TFT COLOR LCD IS GETTING POPULAR IN THE MARKET.

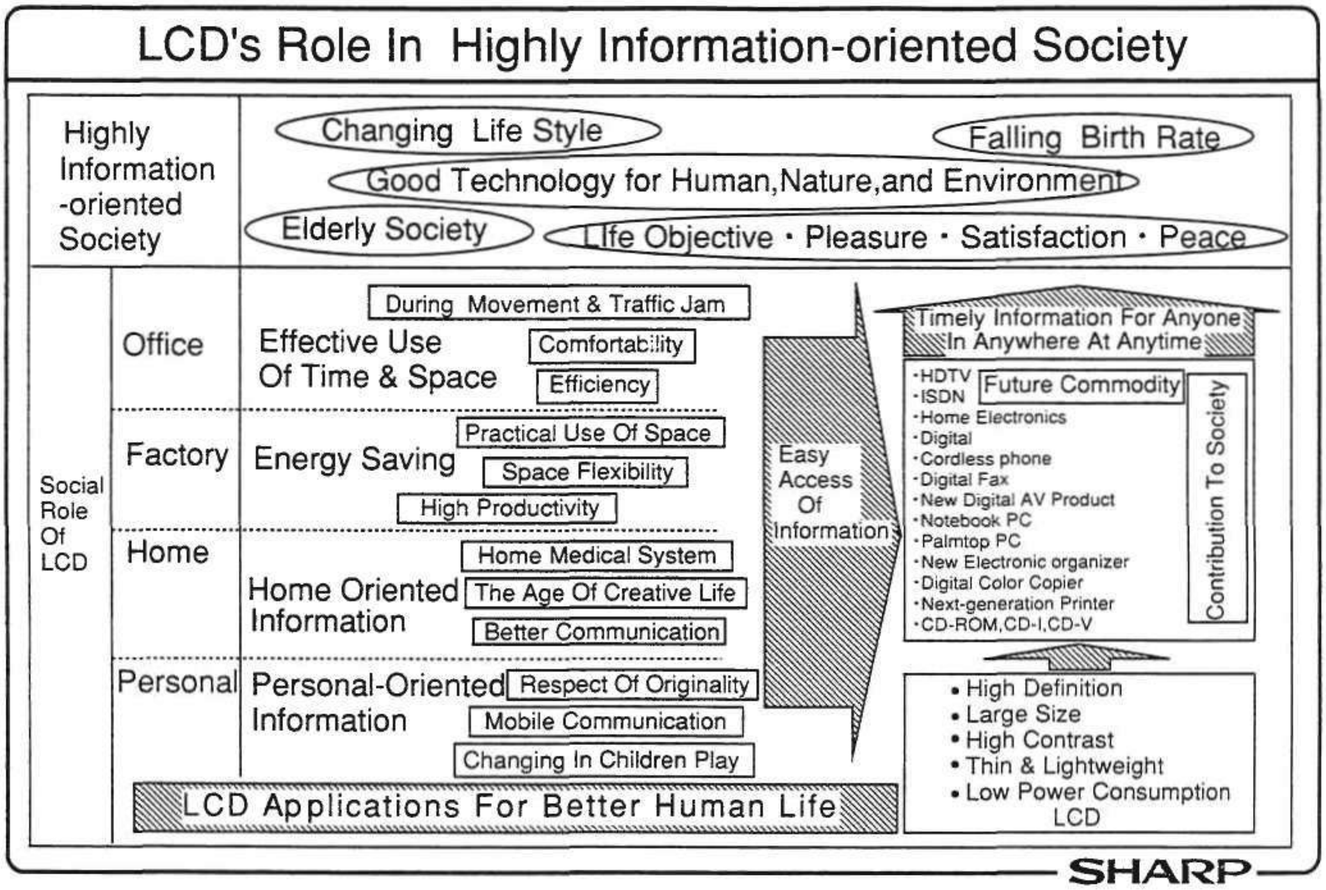
5. WIDE SCREEN LCD PROJECTION HDTV WITH 16:9 ASPECT RATIO HAS BEEN MARKETED.

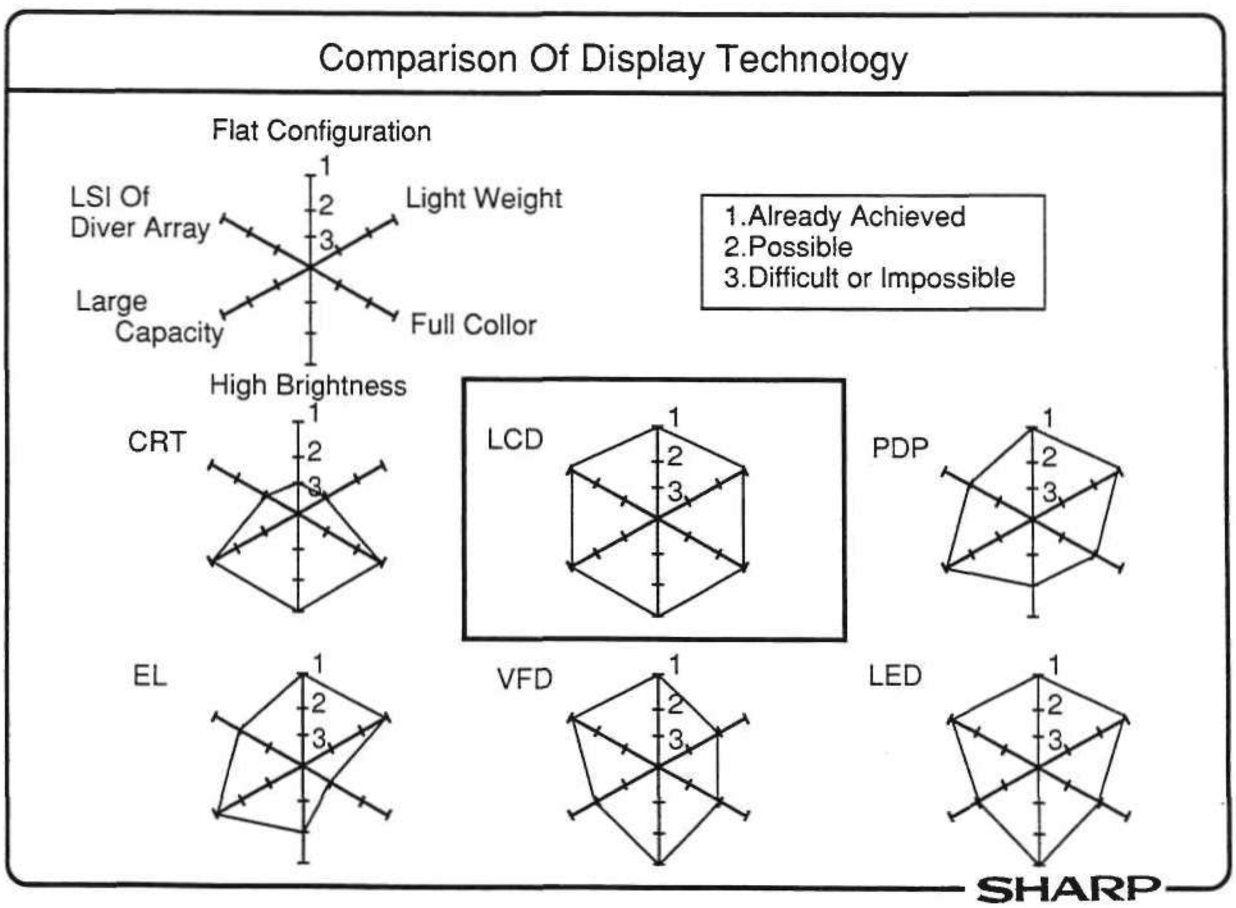
SHARP

Application Of LCD(STN,MIM,TFT)

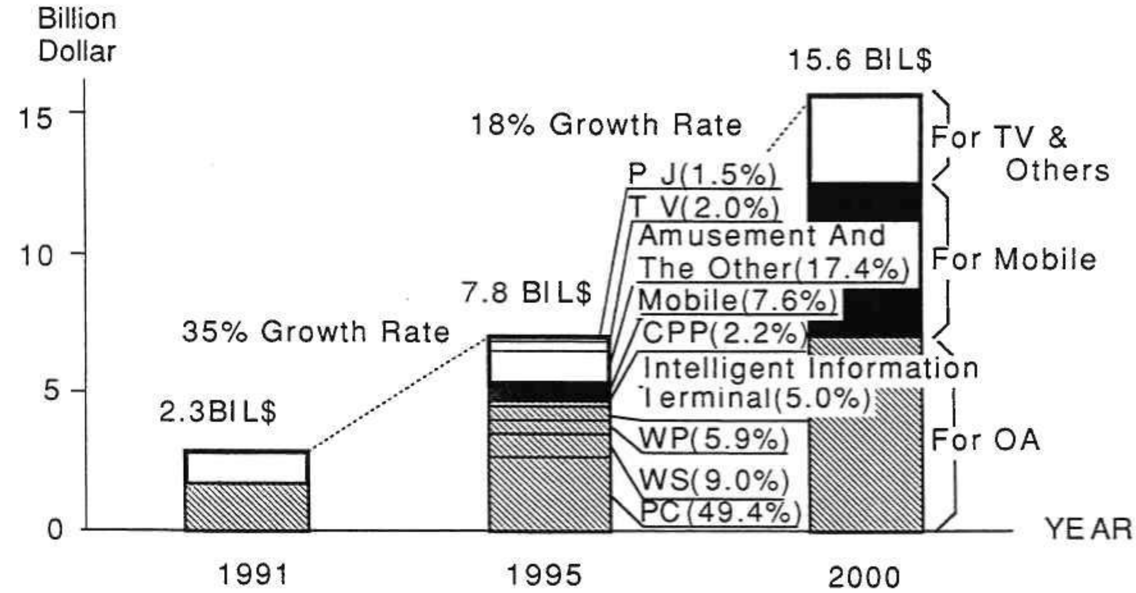
Application			Simple Matrix	Active Matrix	
			STN	TFT	MIM
Small And Middle Size	B / W	Pocket Calculator And Auxiliary Display Of Information Machine	◎	△	△
		Palm-top PC	◎	△	○
		New Electronics System Passport	◎	△	○
		Digital Cordless telephone	◎	△	△
	Color	TV game	◎	△	○
		TV Telephon	○	◎	◎
		Portable TV	△	◎	○
		Home Electronics	△	◎	○
		Digital Copy machine	△	◎	△
		View Finder	○	◎	○
		Camera with VTR Monitor	△	◎	○
		CD-ROM,CD-I,CDV	△	◎	○
		Seat Vision	△	◎	○
		LC D Projection	△	◎	△
		Navigation System	△	◎	○
Large Size	B / W	Lap-top PC	◎	△	○
		Note Book PC	◎	△	○
		Word Processor	◎	△	△
		Work Station	◎	△	○
		Digital Fax	◎	△	△
		Next generation Printer	○	△	○
	Color	Lap-top PC	○	◎	○
		Note Book PC	○	◎	○
		Work Station	○	◎	○
		Machine for ISDN	△	◎	○
		New Digital AV	△	◎	○
		Wall Hung TV	△	◎	○
		HDTV	△	◎	△

◎: Excellent ○: Good △: Fair


LCD's Role In Highly Information-oriented Society
Highly Information -oriented Society
Changing Life Style
Falling Birth Rate
Good Technology for Human,Nature,and Environment
Elderly Society
Life Objective · Pleasure · Satisfaction · Peace
Social Role Of LCD
Office
Effective Use Of Time & Space
During Movement & Traffic Jam
Comfortability
Efficiency
Factory
Energy Saving
Practical Use Of Space
Space Flexibility
High Productivity
Home
Home Oriented Information
Home Medical System
The Age Of Creative Life
Better Communication
Personal
Personal-Oriented Information
Respect Of Originality
Mobile Communication
Changing In Children Play
LCD Applications For Better Human Life
Easy Access Of Information
Timely Information For Anyone In Anywhere At Anytime
Future Commodity
·HDTV
·ISDN
·Home Electronics
·Digital
·Cordless phone
·Digital Fax
·New Digital AV Product
·Notebook PC
·Palmtop PC
·New Electronic organizer
·Digital Color Copier
·Next-generation Printer
·CD-ROM,CD-I,CD-V
Contribution To Society
• High Definition
• Large Size
• High Contrast
• Thin & Lightweight
• Low Power Consumption
LCD
SHARP


Comparison Of Display Technology
Flat Configuration
Light Weight
Full Collor
High Brightness
Large Capacity
LSI Of Diver Array
1
2
3
1.Already Achieved
2.Possible
3.Difficult or Impossible
CRT
LCD
PDP
EL
VFD
LED
SHARP

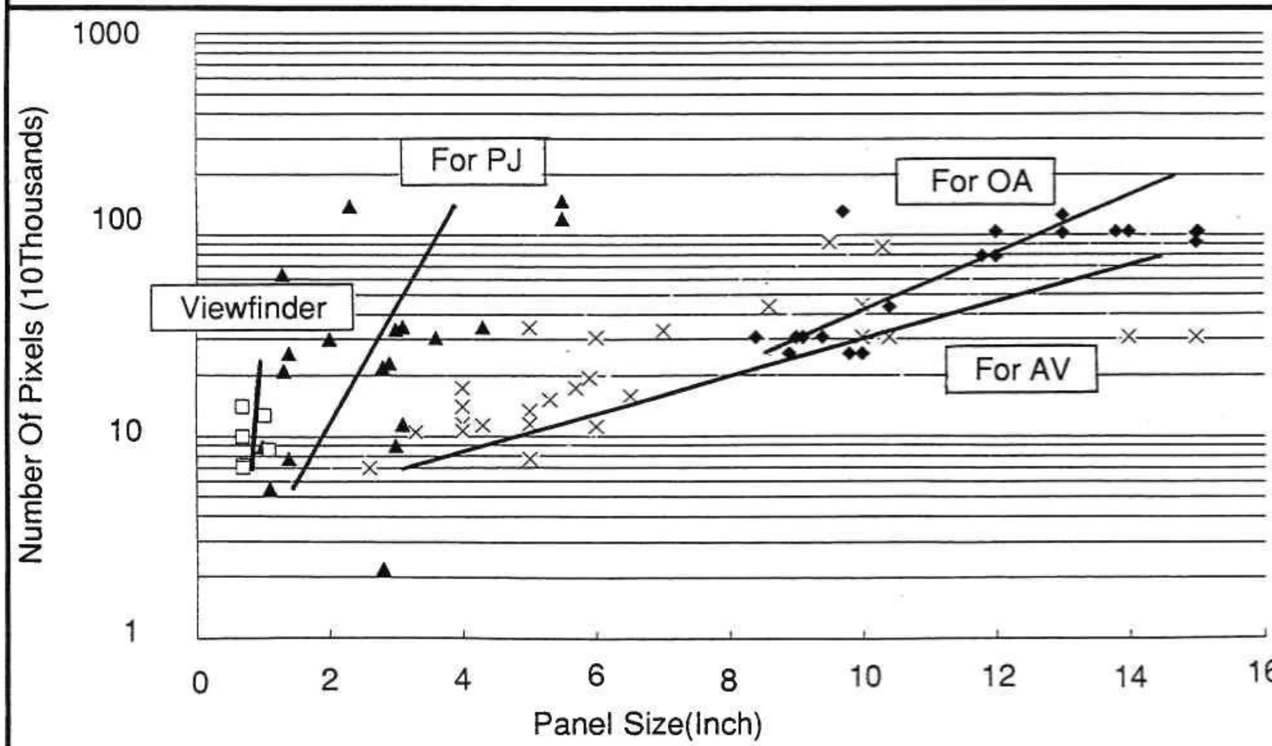
Market Forecast Of LCD



Ref:Nomura Reserch Ins. / Sharp

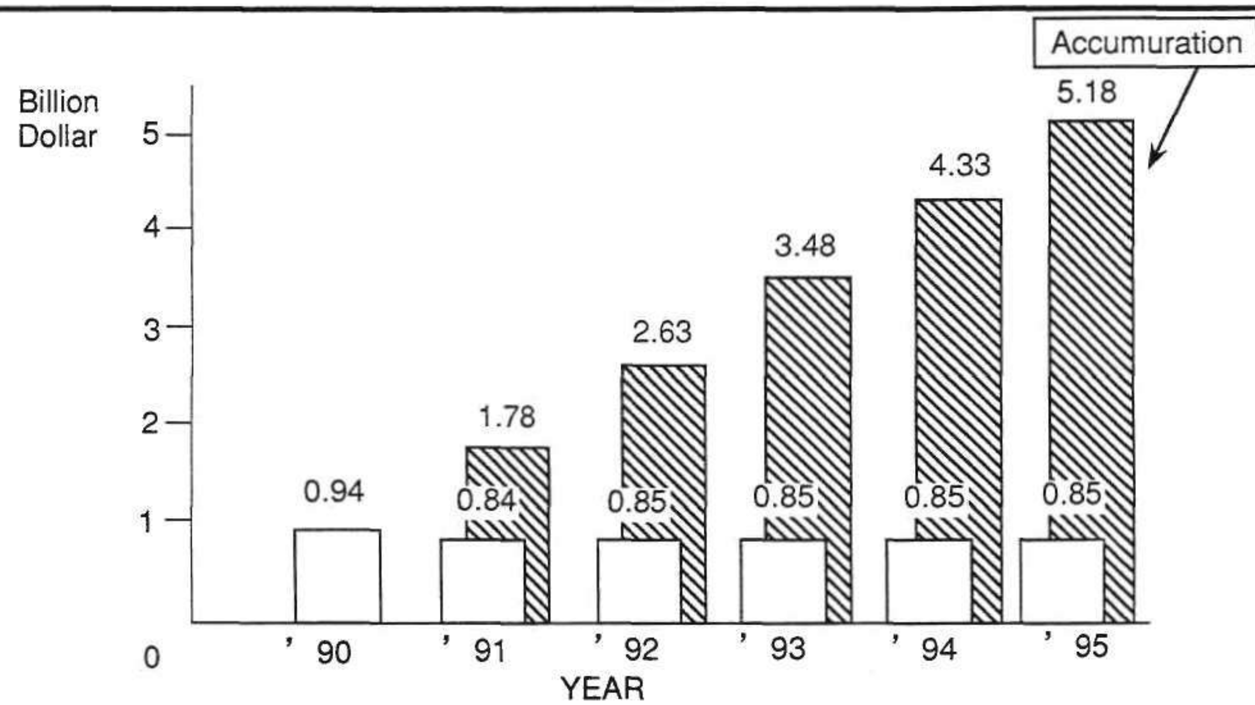
SHARP

Size vs Pixel Of Active Matrix LCD



SHARP

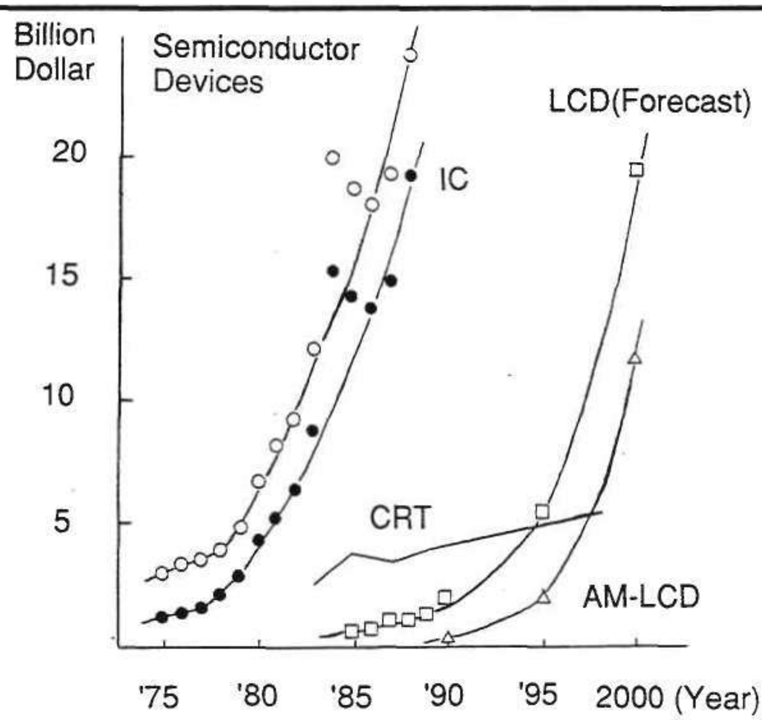
Forecast For Capital Investment By LCD Panel Manufacturers



Ref. : Nikkei BP Flat panel Display '92 , /Sharp

SHARP

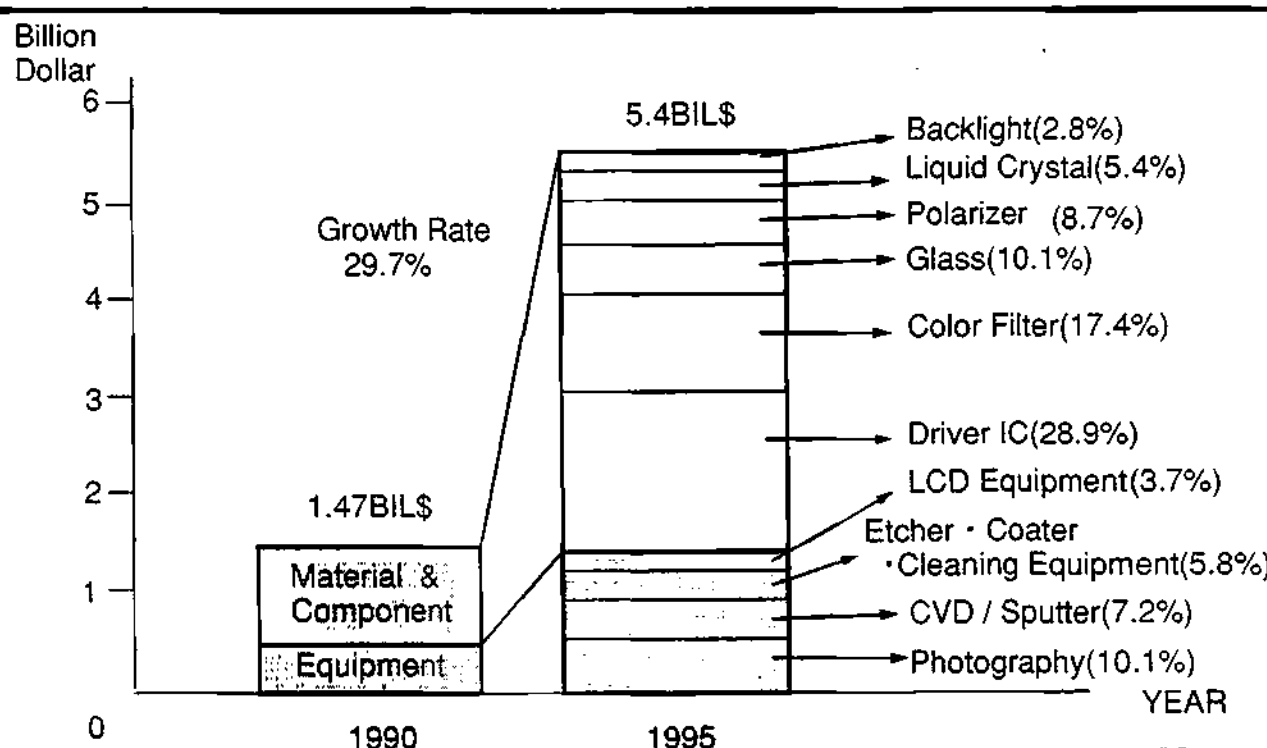
Market Forecast For Semiconductor And LCD



(Ref.:Nomura Research Institute)

SHARP

Worldwide Market Forecast Of LCD Peripheral Industries



Ref. : Nomura Research Ins , /SHARP

SHARP

RECENT TREND OF TFT PRODUCTION FACILITIES, EQUIPMENT AND PERIPHERAL MATERIALS

IN ADDITION TO THE IMPROVEMENT OF THROUGHPUT, THE EQUIPMENT PROCESS MARGIN, STABLE OPERATION AND RESOURCE SAVING ARE IMPORTANT FACTORS.

AT PRESENT, THE BATCH PROCESSING EQUIPMENT IS MAINLY USED. THE NEW TREND IN THE INDUSTRY IS SHIFTING TO THE APPLICATION OF SINGLE PLATE PROCESS. THE THIN FILM FORMING EQUIPMENT FOR "UNIFORM FILM QUALITY "AND "REMARKABLY REDUCED PARTICLES" HAS BEEN ANNOUNCED.

FURTHER IMPROVEMENT FOR SAVING SPACE AND INTEGRATION OF MULTIPLE PRODUCTION PROCESSES TO IN-LINE SINGLE PLATE PRODUCTION SYSTEM ARE THE PROBLEMS TO BE SOLVED.

SHARP

Technological Trend Of TFT Process Equipment

TFT process	Present ⇨	Future & Equipment Manufacturers
Film Deposition (P-CVD, Sputter)	**1.P-CVD/Sputter**	• AMAT • Kokusai Electric • Anelva • ULVAC etc.
	① In-Line Vertical Two Side Batch Deposition System(with tray)	⇨ Multi Chanber Single Plate (Trayless)Deposition System
	② Film Uniformity(±15%)	⇨ ±<5%
	③ Eliminate Particle	⇨ Inprocess Plasma Cleaning
	④ Foot Print / Throughput	⇨ 1.5~2.0 Ratio
Patterning (Resist Coat, Exposure, Develop)	**2.Patterning**	• D.N.S • Nikon • Canon etc.
	① Reduction Of Photo Resist Consumption	⇨ Roll Coater
	② Stepping Exposure System (Boundary Problem Grey Scale Shift)	⇨ Improvement Of Alignment Accuracy / In Large Shot Size
Etching, Cleaning	**3. Etching • Cleaning**	• Plasma System • Tokyo Electron • Anelva • Shibaura • AMAT etc.
	① Wet Etching	⇨ Single Plate Dry Etching (RIE/Plasma Mode)
	② Batch Clean System (With Cassette)	⇨ Single Plate Cleaning Process (Megasonic • Brush • Water Jet Dry Cleaning)

SHARP

THE FOLLOWING TWO TYPES OF INSPECTION EQUIPMENT HAVE BEEN REMARKABLY IMPROVED.

1. **EQUIPMENT TO INSPECT ALL TFT ARRAYS QUICKLY AND AUTOMATICALLY WITH HIGH SENSITIVITY WITHOUT CONTACT.**

2. **INSPECTING EQUIPMENT TO DETECT DEFECTS AS PHYSICAL PATTERN FAULTS AND INDICATES THEM BY PICTURE PROCESSING TECHNOLOGY .**

SHARP

Technological Trend Of TFT Inspection Equipment

Process	Item	Technology & Manufacturers	
TFT Array	· Pinhole · Particle · Pattern	Optical Method	
		· Lasertec	High Speed Periodic Pattern Comparison
		· KLA ACROTEC	High Speed Periodic Pattern Comparison
		· Orbot	Check & Reference Comparison Design Rule
		· Insystems	Holographic Inspection
Panel	· Panel Image Quality · Point Defect · Line Defect · S-G Short	Electro-Optical Method	
		· Photon Dynamics	Measurement Of Pixel Potential Using Pockels Effect
Display Module	· Display Quality	Electrical Method	
		· GenRad	Transfer Admittance Method
		· IBM	Charge Sensing

SHARP

THE PERIPHERAL MATERIALS HAVE BEEN REMARKABLY IMPROVED AS A RESULT OF ;

1. **IMPROVEMENT OF IN SPECTRAL CHARACTERISTICS, CHEMICAL AND THERMAL STABILITY OF COLOR FILTER**
2. **REDUCTION OF POWER CONSUMPTION, THICKNESS AND WEIGHT OF BACKLIGHT**
3. **REDUCTION OF SIZE OF DRIVER LSI**
4. **REDUCTION OF DRIVE VOLTAGE**
5. **APPLICATION OF MULTI-GRADATION DIGITAL DISPLAY SUITED FOR LARGE AND HIGH DEFINITION TFT-LCD.**

SHARP

Technological Trend Of Color Filter

Materials	Coloring Method & Subject	Manufacturers
Dye [Excellent In Spectrum Characteristic] Application : TFT-LCD For AV	Dyeing Type[Photolithography] ・Uniformity Of Coating / Dyeing ・Chemical & Thermal Stability	Toppan Printing Dainippon Printing Micro Engineering Shintron Kyodo Printing
Pigment [Excellent In Optical & Thermal Stability] Application : TFT-LCD For OA / PJ	Dispersion [Photolithography] ・Color Matching Dispersion [Print] ・Resolution ・ Pitch ・ Leveling Electro Deposition [Photolithography]	Hitachi Casio Sanyo Seiko Epson Kyocera etc.

SHARP

Technological Trend Of Peripheral Materials

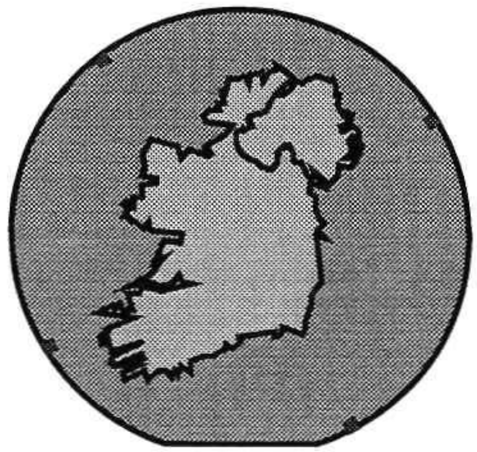
Peripheral Components	Materials	Problems	Manufacturers
Backlight (Fluorescent Lamp) Direct light Edge light	CCFT HCFT(High Brightness) CCFT(Bend) CCFT(Flat)	Low Power Consumption (12W⇨4W) High Brigtness Long Life Thin / Lightweight	Harison , Stanley Panasonic GE Silvania Toshiba etc.
Optical Guide Unit	Acrylic Board Reflected Board Magnified Board	With Polarizer Low Cost Lightweight Small Size & Thin (<5.0mm)	Meitaku Tama etc.
Polarizer	Non-glare Hard-coat	High Durability	Nitto Denko Sanritz, Cayapora Fuji Photo Film etc.
Reterdation	Reterdation Film		
Non-Reflected Coat	Non-Reflected Cr Anti Reflection Treatment Anti Glare Treatment	Appearance Of Surface Control Of Anti Glare Improvement Of Visibility High Durability	Sumitomo Chemical Three-M etc.

SHARP

Technological Trend Of Driver LSI For Large Size & High Definition TFT-LCD

Development	Subject	Present ⇨ Future
Small Size	Shrinking Of Chip Size Slim Chip Fine Output Pin	$37mm^2$ (7.4×5mm) ⇨ $26mm^2$ (15.0×1.7mm) Width 10mm ⇨ Width 5mm 120 ⇨ 240
Low Power Consumption	Low Voltage Drive System (Source Driver)	Analog 13V ⇨ 6V Digital 5V ⇨ 3V
For Large Size & High Resolution	Grey Scale Drive System High Speed Frequency (Source Driver)	16 Grey Scale ⇨ 256 Grey Scale Analog(Non-Interlace) ⇨ Digital(Multi-Media) Analog 7.5MHz ⇨ 10MHz (3-Phase Clock) Digital 15MHz ⇨ 30MHz
Others	Low Output Impedance Minimum Output Deviation EMI Reduction	

SHARP



ACHIEVING CRITICAL MASS THROUGH INDUSTRIAL COOPERATION

Giulio Cesare Grata
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European Commission

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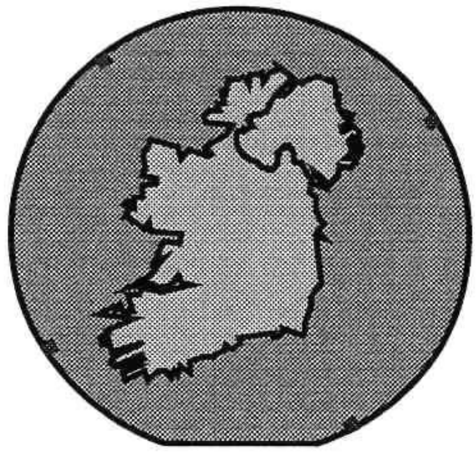

INTRODUCTION

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Group Director European Semiconductors
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HORIZONTAL INTEGRATION IN EUROPE

Guy Dumas
Matra-MHS Honorary President
Representative of the Telefunken
Electronic Group for European Affairs

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HORIZONTAL INTEGRATION IN EUROPE

Guy Dumas
Matra-MHS Honorary President
Representative of the Telefunken
Electronic Group for European Affairs

Mr. Dumas is Honorary President of Matra-MHS and a representative of the Telefunken Electronic Group for European Affairs. In 1983 he was appointed Chairman and Chief Executive Officer of Matra-MHS. Prior to this he was Managing Director of the semiconductor division of Thomson-CSF, and before this Technical Director, then Managing Director, and later Chairman of the Board with Silec Semiconductor. Mr. Dumas studied Electrical Engineering at the Ecole Supérieure d'Electricité and graduated from Ecole Normale Supérieure with a doctorate in Physics.

Dataquest Europe Limited
EUROPEAN SEMICONDUCTOR INDUSTRY CONFERENCE
June 3–5, 1992
Dublin, Ireland

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MHS electronic

Eleventh annual European Semiconductor

Industry Conference 3rd - 5th June 1992

Guy DUMAS

Slide 1. **Horizontal integration in Europe.**

Horizontal integration is a concept that has been broadly debated in Europe and elsewhere in the world. It has been also debated in the USA on the purpose of the SEMATECH venture that certainly has some horizontal integration features.

Slide 2. **Definition.**

The debate is mostly centered around the supposed lesser efficiency of precompetitive cooperative development compared to virtue of vertical integration. After all, it is often said that the Japanese semiconductor vendors leadership is partly due to sound vertical integration. To clarify my purpose, let me say my company is very much involved with both concepts. I believe foolish to oppose one concept to the other, when, in fact, they gain from each other. However the dispute existes, and arise brcause for the last two decades, Europe has been losing ground in the electronic business and corrective actions are taken to steer away from this trend.

Slide 3. **Semiconductor Worlwide Market.**

You may see on the screen over 30 years of semiconductor business history. Since 1959 until now the market has grown about 100 fold. In 59, with around 750 millions dollars, the worldwide market was not even the size of the 1991 Belgium market. Such a growth indicates the pervasive power of silicon! Pervasiveness that has definitively modified our way of working, entertaining, communicating, thinking and what so ever... Faxes, copying machines, mobile telephone, video recorder/players, Digital records etc etc, le list is endless of product that would not exist without IC's.

...

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Slide 4. **Main Events.**

All this, because of successive improvements, inventions, that were geared to produce more while spending less per unit. Devices were, generation after generation more and more complex although their costs went on a negative slope. It is amazing to realize there is a very small 30 years span between the transistor radios of the late 50's (Germanium transistors, they were) and the recently published pictures of a 15 billions years old event. I will not resist to say that between those two outcomes that I just mentionned, there has been the BIG BANG OF SILICON. Mind you, this is not finished, for the industrial society is still surfing on the ripples of that big bang.

Slide 5. **Semiconductor Company Market Share.**

Proceeding to scrutinize the past, we may see that, when it comes to surfing the silicon wave, some people seem more talented than others. The integrated circuit was invented in the US, and still the worldwide market share of American companies went from over 50 % in the late 70's, down toward the 30 % region in our days. European companies had close to 20 % of the world market in the past, but are down now to under 10 %. I certainly do not want to add to vague Japan bashing, however market shares lost by the US and Europe were mostly taken up by Japanese companies.

Slide 6. **European Market Split**

Let's set apart the performances of American companies and take a closer look at the European market. In 1979 European companies were holding around 45 % of their home market, while the japanese companies were owning 3 % of this European market. In 1990, the market share of European companies was down to around 35 %, and the japanese companies share climbed to 20 %. In this part of the world where Free Trade was invented (remember Adam SMITH), those figures should not raise any objection... Except that the future economic growth of Europe is more and more dependant on silicon.

Slide 7. **Share of Value added in European Industries.**

You may see on that transparency, that the experts estimate that by 1995, in Europe, the electronic industry, compared to other imanufacturing segments, should be the one that will have the largest added value share . I would like, here, to quote my estimated colleague Mr Pascale PISTORIO, from ST, who recently said in an address to the press, Quote "No advanced industrial society c&an exist without contolled access to an advanced electronic industry, which in turn cannot exist without controllec access to an advanced microelectronic industry." End of quote.

Slide 8. **Reasons of Decline.**

Of course, there are plenty of reasons for the lost of worldwide market share from US and European companies. I think those that spelled out here have some value. The hermiticity of the Japanese market does not help, indeed. But European and American companies may also be directly responsible for the lost ground. There is the "Quarter Syndrom" coming from the belief that shareholders expect ever increasing profit. So when bad times come, to keep the profit at an acceptable level, you cut in R&D spendings. Although the quarter syndrom is said to typically American, the Europeansare far from immune to it. On top of it, in Europe, we have nationalism, which brougth market fragmentation. Markets that were too small to support the large investments required in semiconductors. And finally the Cost of Capital was damaging. Interest rates that were, in the 80's, much higher in Europe and in the US than they were in Japan.

Slide 9. **Escalating Cost.**

Talking about capital, you may see on the screen the historical cost of a fully equipped clean room for volume production. In the late 70's the cost came to 70 Millions Dollars, while in 1990 it is about 5 times higher. Product development has followed the same slope, exept that it's still more dramatic. One estimates that to develop (product and process) a 256 K SRAM the expenses were in the 100 Millions Dollars range. Only two generation later (1 Mbit, then 4 Mbit), the R&D cost of the 4 Mbit SRAM is estimated at 400 Millions Dollars. And I am hearing of 850 millions Dollars for the 16 Mbits... Total investment, fab room plus product/process development, would then come close to 1.5 Billion Dollars. Now, let's remember that the largest European semiconductor company has a yearly revenue in 3 billions Dollars range... So European companies do have a very simple choice: Either they cooperate or they disappear...

Slide 10. **J E S S I Joint European Submicron Silicon.**

The Joint European Submicron SIlicon, JESSI, is a cooperative R & D program that spans over 7 years. Its stated objective is to advance Europe position in the information technology in the crucial submicron silicon sector by improving cooperation between various european industries and research institutes. JESSI aims are the improvements of Horizontal AND vertical cooperations. Initial phase ended on December 31st, 1991 and proved that cooperation could be extremely productive even though initiation this cooperative process took time and efforts.

Slide 11. **Start-up Phase.**

The expenses incurred over the two years of the start up phase came up to 460 Millions ECU (one ECU is worth about 1.23 Dollar) and represented over 3000 men years of engineers and scientists. On top of those listed on the screen and that are specific to silicon process technology. Achievements were made on production lithography equipement, CAD tools for automatic design and on hardware description language synthesis. That may not sound like major achievements, although they are, but anyway everybody understand that they are part of the electronic food chain, which Europe needs to restore to a competitive stage.

Slide 12. **Main Phase.**

The main phase started on January 1st of this year and will extend to 1997. The budget allocated for 1992 amounts to 430 Millions ECU that are distributed over a number of projects that encompass applications in the fields of High definition T.V, digital audio broadcasting, broadband telecommunication, cellular mobil telephone, and electronic system for automobile saFety. The totalprogram aims to develop application specific chips sets in the relevant state-of-the-art silicon technology.

Slide 13. **Project Organization.**

Using the experience drawn from the start up phase, a new organization has been devised for the main phase program. Projects that relate to the same field of application are gathered in a cluster. Each cluster has a flagship project that is helped and supported by all other linked projects. The goal of this organization is to achieve a better focus on the core theme and thus improve overall efficiency. This type of organization is, obviously, a form of horizontal integration. I have taken here the example of competitive CMOS manufacturing cluster.

Slide 14. **Project Matrix.**

Horizontal integration implies that every project has partners working together . I have put on the screen the matrix of the participating nations in all the projects. For instance, you can see from the transparency that Belgium companies are cooperating with British companies on a total of 10 projects, or that France and Italy have 15 projects in common. Since there are more than two partners on any given project, the view here does not tell how many they are. However the projection says that 13 countries are joining their efforts towards the same goal.
A giant company such as IBM is joigning in an advanced lithography project and 200 mm wafer engineering project in both Germany and France.

Slide 15. **The European Players.**

As previously stated, all this projects for different application aim at promote the development of submicron silicon technology. It is, therefore, only natural that all the European semiconductors manufacturers cooperate in the field of process technology. Today there are seven European companies. Two small ones, are somehow linked to more powerfull manufacturers, ES2 with PHILIPS and MIETEC/ALCATEL with SGS/THOMSON. The other five companies are : PHILIPS, SIEMENS, SGS/THOMSON (ST), GEC/PLESSEY (GPS) and MEG. (TELEFUNKEN Electronic - MHS).

Slide 16. **M E G - The Company.**

MEG is certainly not a name with wich you are familiar, yet. In fact is not quite real. It will be legally incorporated sometimes mid year, and will be immediately active since its members are already very effective in the market. MEG will start its existence with revenue exeeding the Billion Dollars mark, which is rather a good background for a start-up company !

Slide 17. **M E G & J E S S I**

Through one or the other of the smaller companies that make MEG, the corporation participate in many JESSI project. In the CMOS logic cluster, and particularly in the joint logic project where 0.5 micron digital CMOS will be soon produced. MEG also participate in the tools and methods for high reliability products, in support tools for design automation, and last but not least in the Manufacturing Science & Technology (MST) linked with the Flexible automated wafer fab project (FAW). Recently Professor Dr Ingr Hartmut WEULE, from the board of DAIMLER BENZ, emphasized the support this later project will receive from the whole corporation for addressing the significant number of application specific products dedicated to the Group needs.

Slide 18. **Strategic Applications.**

That cannot be a surprise considering that the Automotive, as well as the Aerospace part of the Corporation need the previously mentionned controlled access to advanced semiconductor technology. Only speaking about the automobile and forgetting the aircraft for the lack of time, just bear with me in reading some of the application were top notch silicon will be mandatory. Ignition - pollution free emission, clutch management, tire pressure sensor, active damper and level control Eetc, etc.

Slide 19. **JESSI Program.**

I feel that the true conclusion of this presentation is to put on the screen the summary of the JESSI program. Obviously there are obstacles and difficulties. Technical difficulties and political difficulties. However the program moves on. The 0.7 micron digital CMOS is a reality that came trough thanks to this very program. First structure of the 0.3 micron technology have been completed at the research level. Everyday see some sort of progress in one field or another. Europe is on the move, European electronic is back.

Thank you very much.

HORIZONTAL INTEGRATION

IN EUROPE

92 06 / DC 1

DEFINITION

HORIZONTAL INTEGRATION

- Cooperative development works on a particular technical field

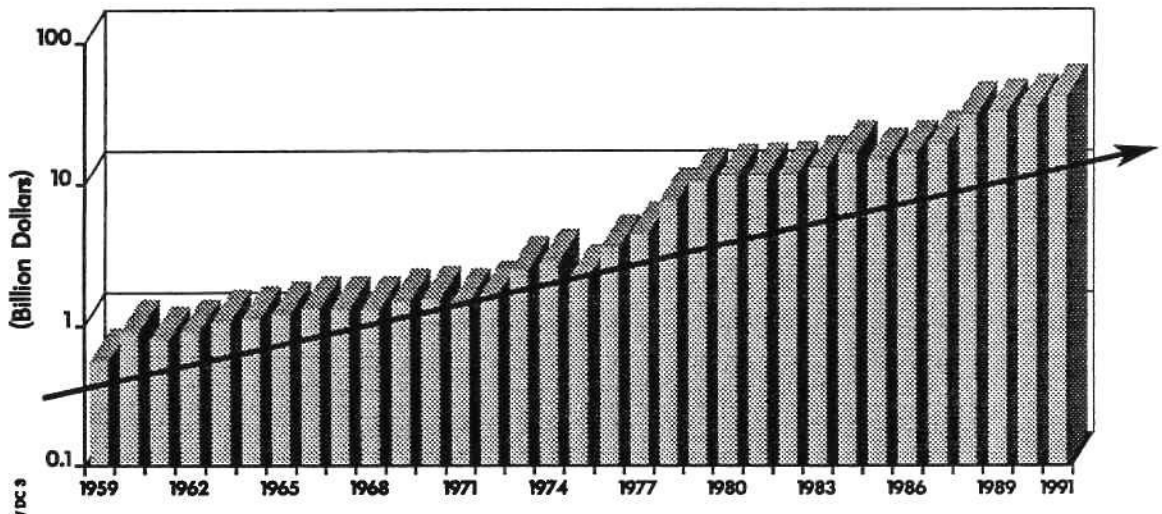
VERTICAL INTEGRATION

- Brings together all manufacturing aspects of a range of products

92 06 / DC 2

Horizontal integration
in Europe

SEMICONDUCTOR WORLDWIDE MARKET



92 06 / DC 3

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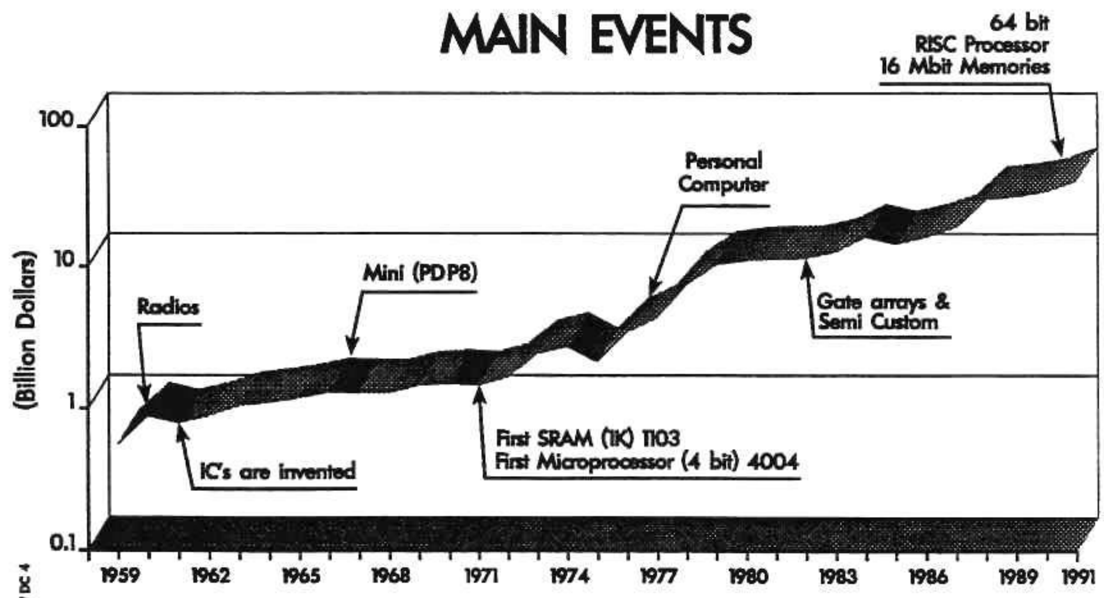
TELEFUNKEN electronic . EUROSIL electronic . SILICONIX electronic . MHB electronic

Horizontal integration
in Europe

MAIN EVENTS



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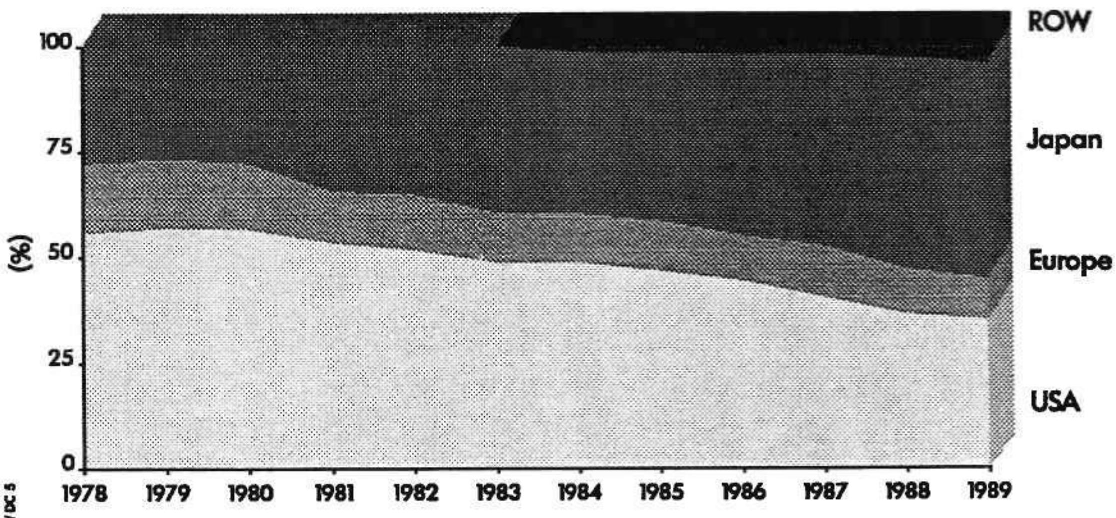
Horizontal integration in Europe

SEMICONDUCTOR COMPANY MARKET SHARE



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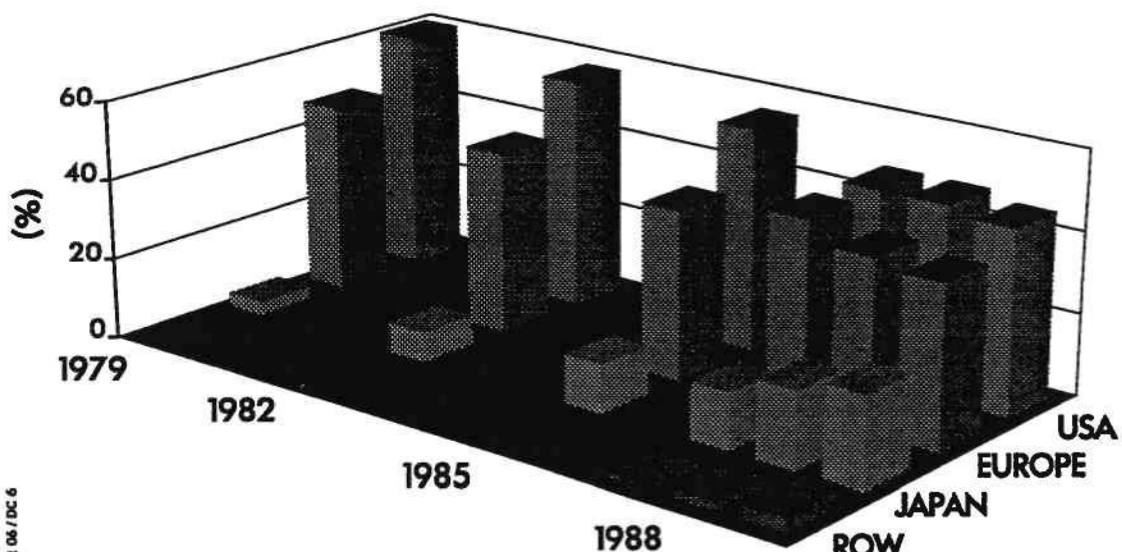
Horizontal integration in Europe

EUROPEAN MARKET SPLIT



92 06 / DC 6

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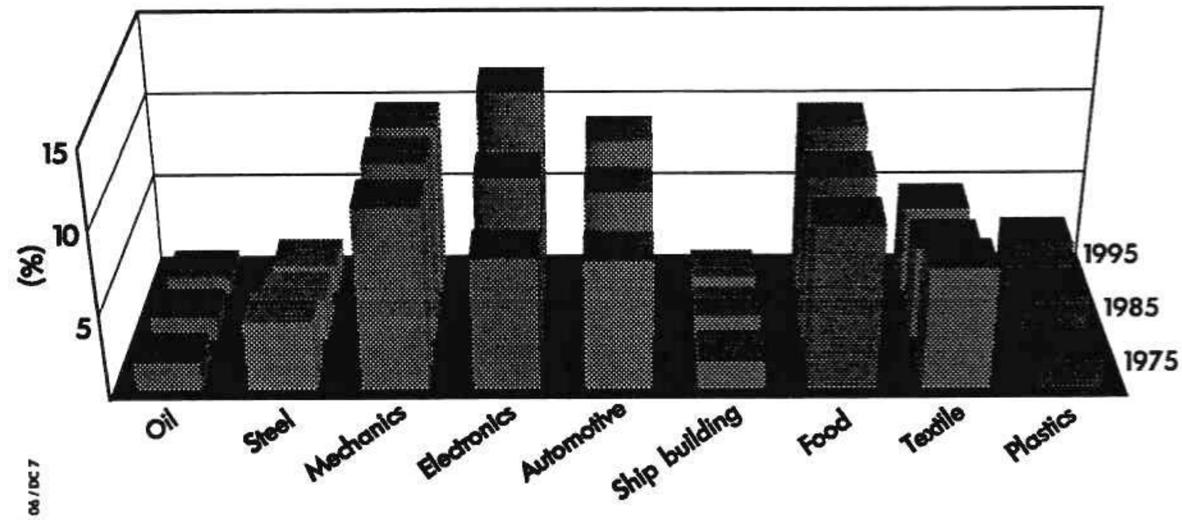
SHARE OF VALUE ADDED IN EUROPEAN INDUSTRIES



92 06 / DC 7

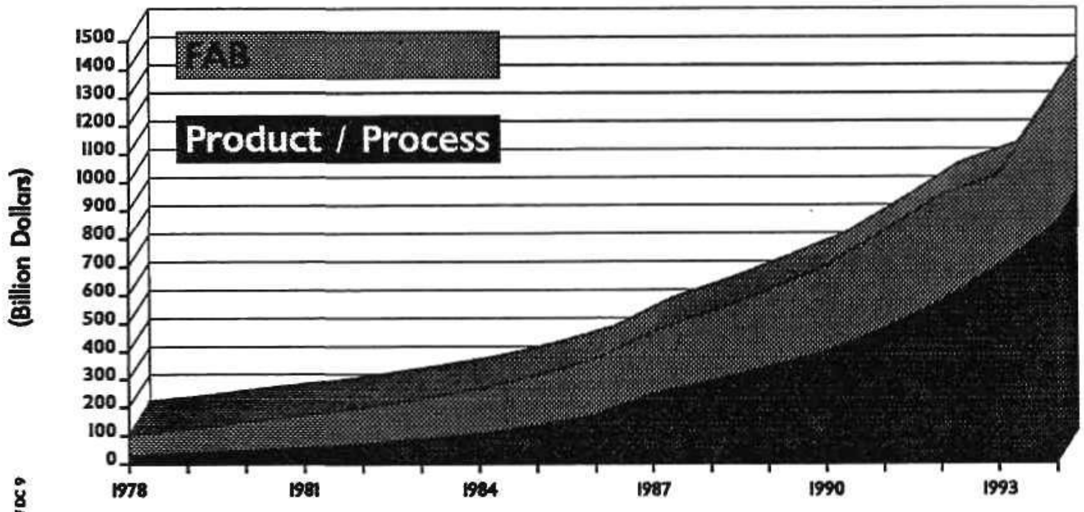
REASONS OF DECLINE

- Japanese market tightly closed
- Quarter syndrom in USA
- Market fragmentation in Europe
- Cost of Capital

92 06 / DC 8

Horizontal integration in Europe

ESCALATING COST



92 06 / DC 9

Horizontal integration in Europe

JOINT EUROPEAN SUBMICRON SILICON

- Organize cooperative development projects
  - 1990 / 1991 : Start-up phase
  - 1992 / 1996 : Main phase
- Objectives
  - Reduce market fragmentation
  - Increase transnational cooperation
  - Integrate relevant sectors of the industry

92 06 / DC 10

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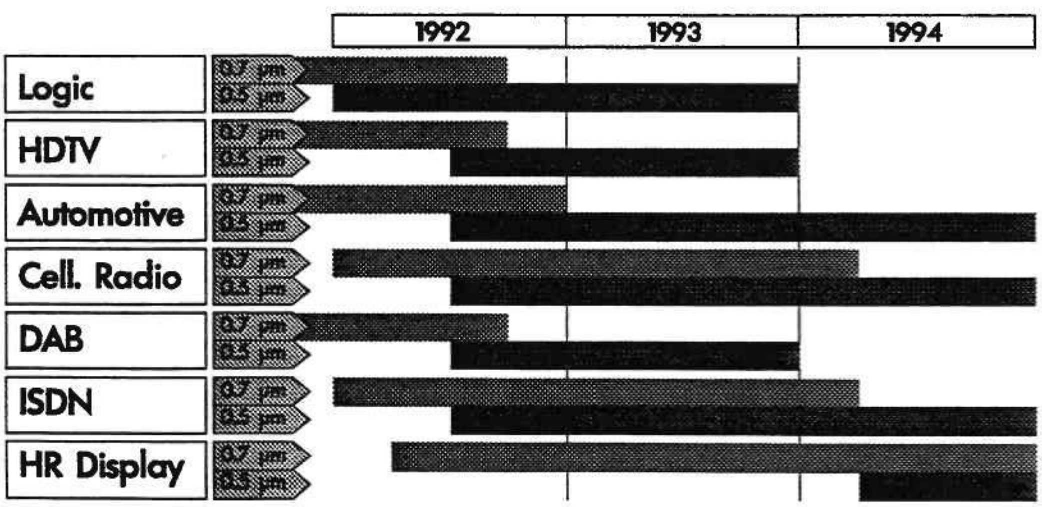
START-UP PHASE

- Complete on December 31st, 1991
- Expenses of 460 Millions ECU & 3000 men years
- Achievements (Silicon)
  - 16 Mbit SRAM / 16 Mbit EPROM
  - 0.7 micron CMOS digital circuits
  - Structures of the 0.3 micron CMOS technology

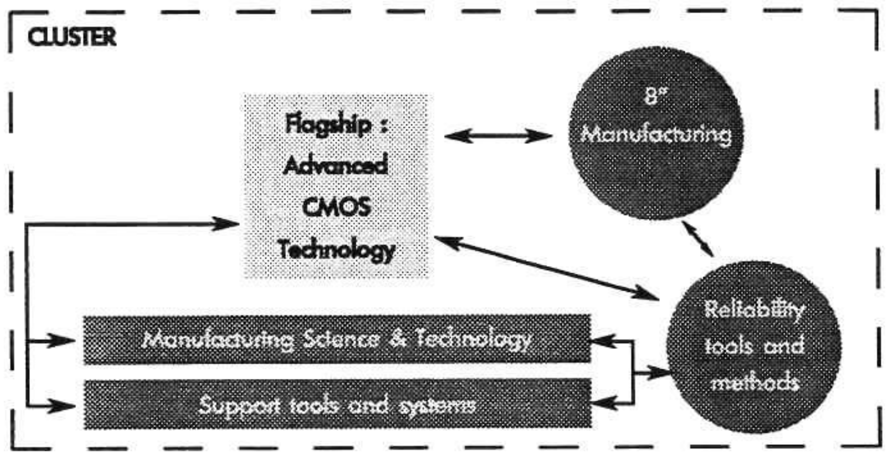
MAIN PHASE



Horizontal integration in Europe

PROJECT ORGANIZATION

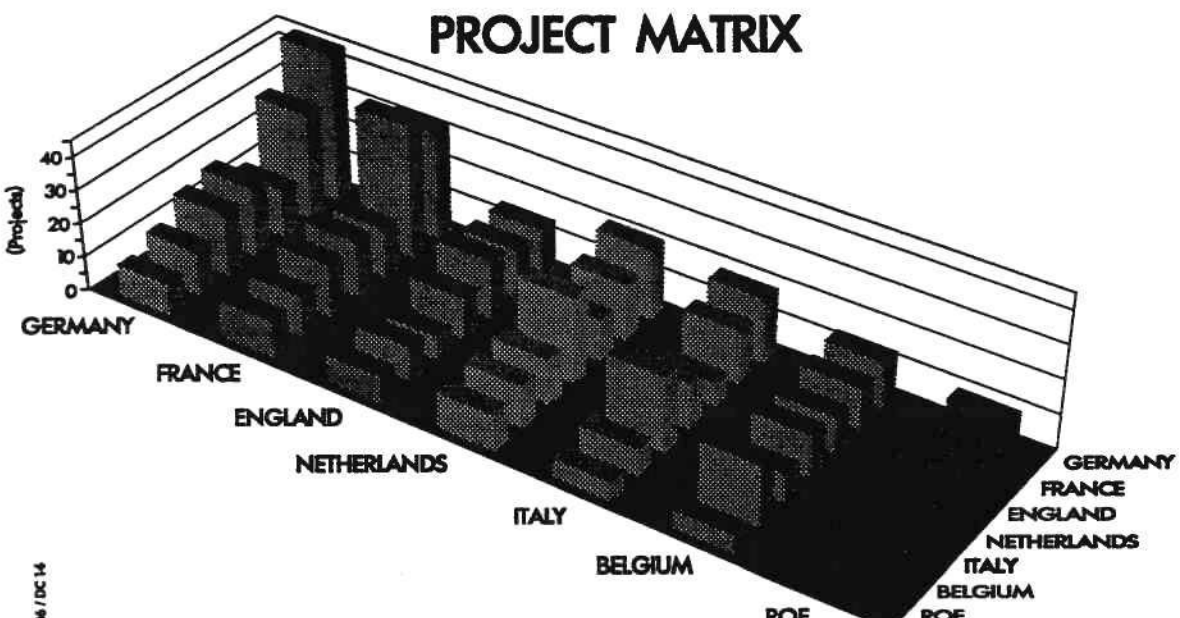
Example of cluster : Competitive CMOS manufacturing



92 06 / DC 13

Horizontal integration in Europe

PROJECT MATRIX



92 06 / DC 14

THE EUROPEAN PLAYERS

TWO SMALL

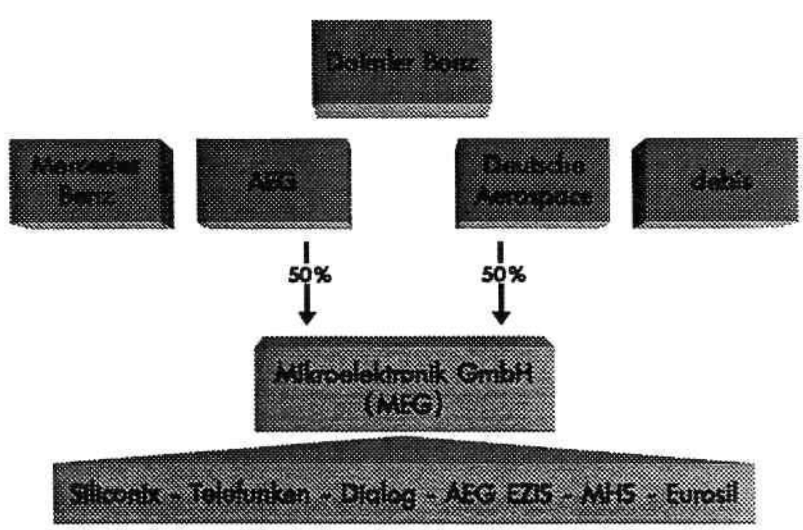
- ES2 → tied to PHILIPS
- MIETEC / ALCATEL → tied to SGS / THOMSON

FIVE MAJOR

- PHILIPS
- SGS / THOMSON
- SIEMENS
- GEC / PLESSEY
- MEG

92 06 / DC 15

MEG - THE COMPANY



92 06 / DC 16

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MEG & JESSI

MEG PROJECT PARTICIPATION

- CMOS logic cluster
- Tools and methods for high reliability
- Manufacturing science & technology (FAW)
- Support tools & systems

STRATEGIC APPLICATIONS

UNDER THE HOOD

- Ignition - Pollution free emission
- Clutch management
- Tire pressure - Damper & Level control
- Multiplexed data bus

CABIN

- Seat and mirror memories
- Rain sensor
- Air bag
- Infrared cabin surveillance
- Radars (anti-collision, rear warning, blind spot ...)

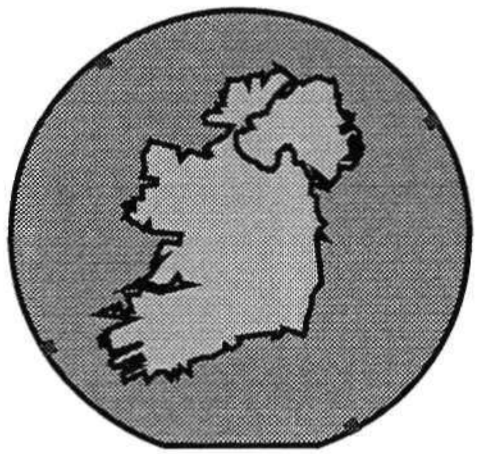
JESSI PROGRAM

1990	1991	1992	1993	1994	1995	1996

CMOS: 0.7 micron | 0.5 micron | 0.3 micron

OPTIONS: 1 micron | 0.7 micron | 0.5 micron

92 06 / DC 19



RIDING THE SECOND WAVE IN EUROPE

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RIDING THE SECOND WAVE IN EUROPE

Hans Geyer
Director and General Manager
Intel Europe

Mr. Geyer is Director and General Manager for Intel Europe. He joined Intel in April 1980 and has since held various managerial positions and has a wealth of experience in computer architecture, technical marketing, microprocessors and peripheral controllers and components. Prior to joining Intel, he was involved in hardware and software development for intelligent and point-of-sales terminals at Siemens AG, Germany. Mr. Geyer studied Computer Science and Mathematics at the Technical University of Munich, holds a Masters Degree (Diplom-Informatiker) in Computer Science and is an INSEAD alumni.

Dataquest Europe Limited
EUROPEAN SEMICONDUCTOR INDUSTRY CONFERENCE
June 3–5, 1992
Dublin, Ireland

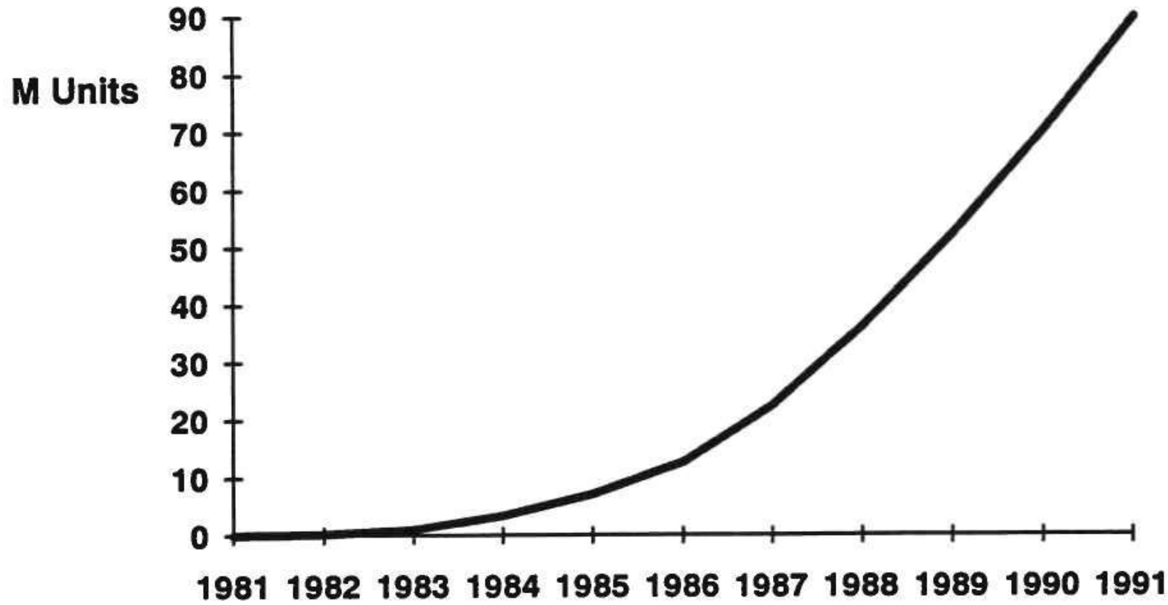
Riding The Second Wave - In Europe

Hans Geyer
Director and General Manager, Intel Europe
Dataquest European Semiconductor Conference
June 5, 1992

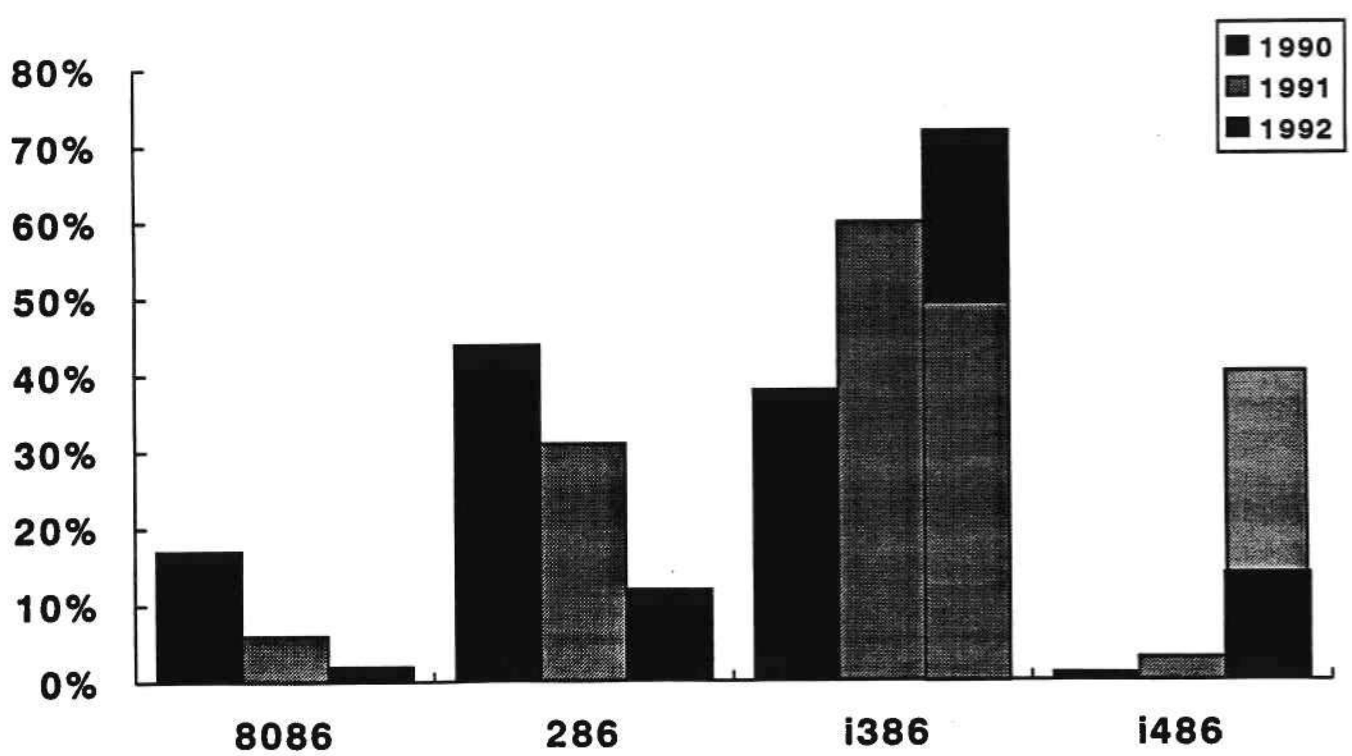
Agenda

- PC Market
- Move To The Second Wave
- European Procurement Trends
- Future Of Business Computing
- Manufacturing In Europe

Worldwide Installed Base of X86-Based PCs



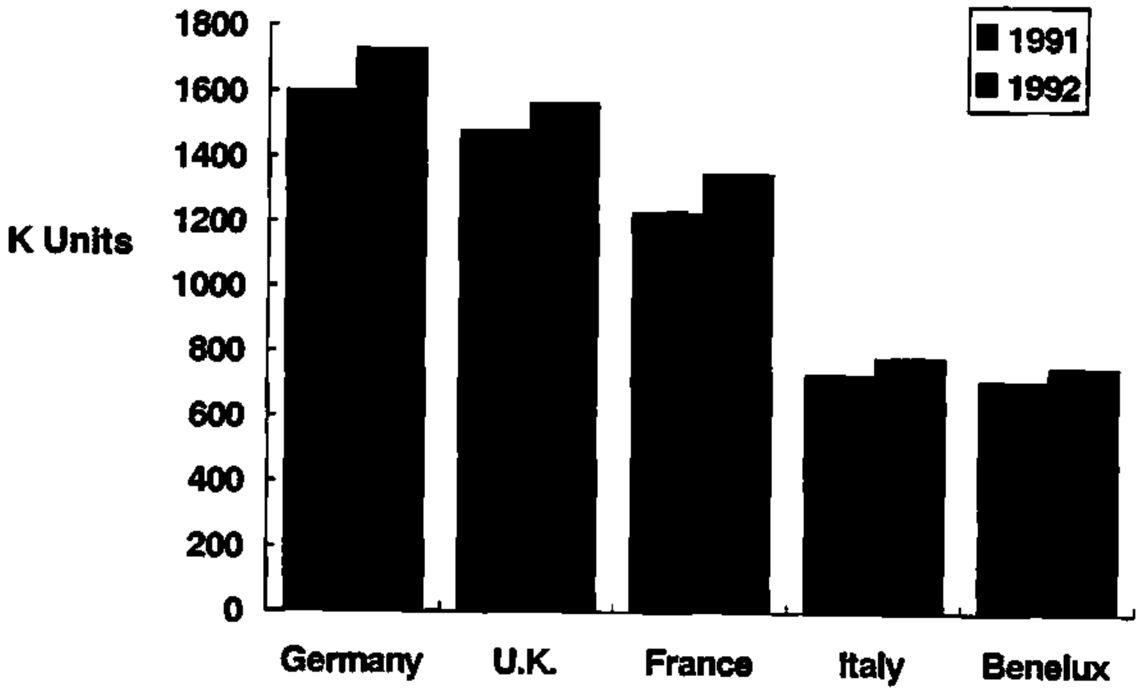
Total European PC Shipments



Source: Intel and Dataquest

European PC Market By Country

X86 Architecture



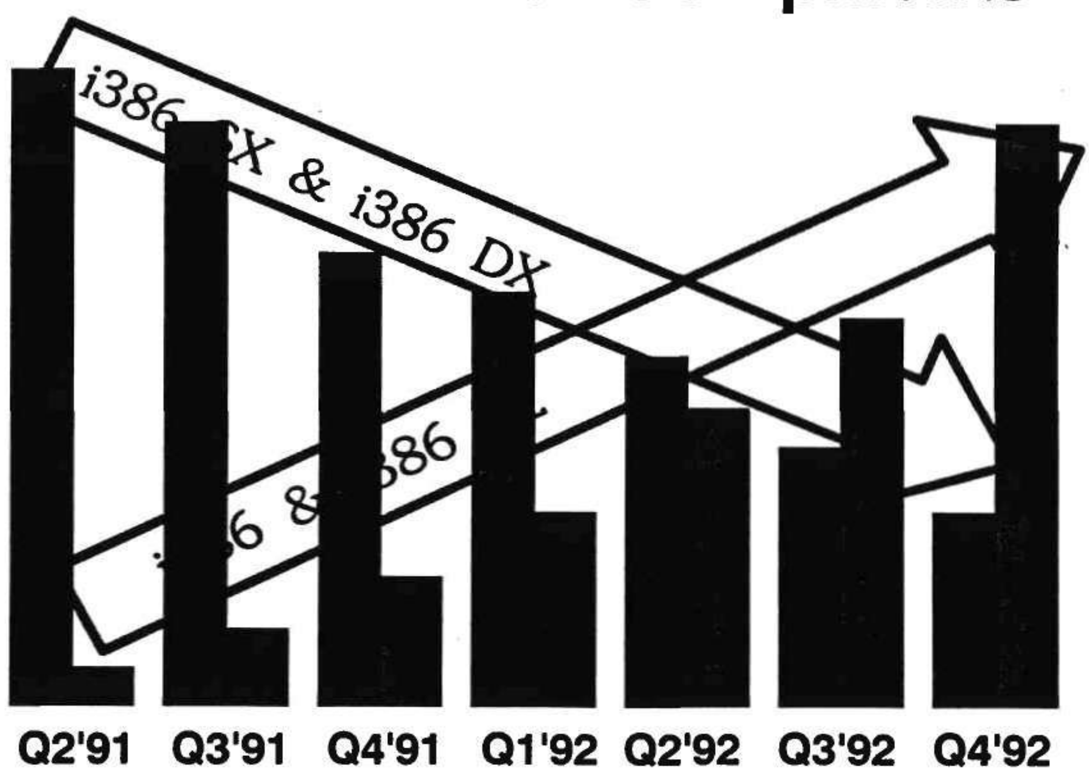
Agenda

- PC Market
- Move To The Second Wave
- European Procurement Trends
- Future Of Business Computing
- Manufacturing In Europe

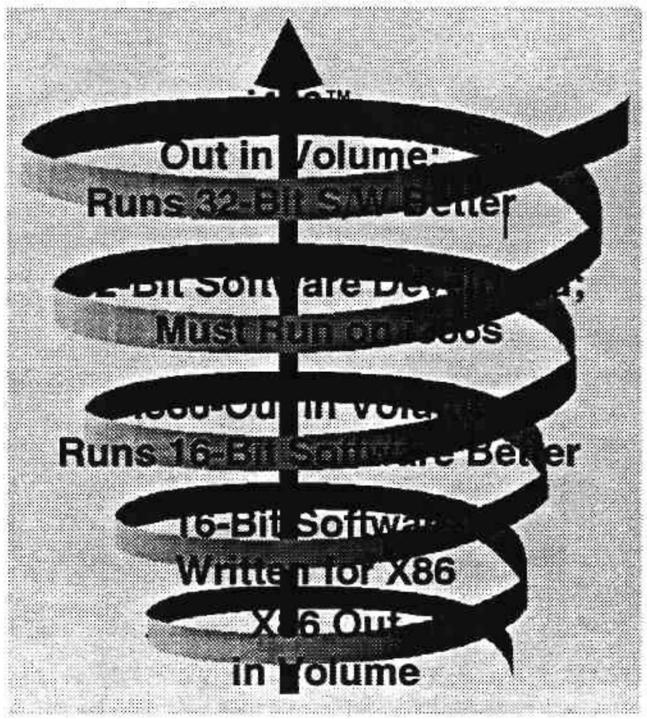
Software Power Spiral

> **“The Next Generation of Software is Always Developed to Run On The *Current* High-Volume CPU. But it Runs Slow.**
>
> **It Takes the *Next* Generation of CPUs to Run it Properly.”**
>
> Andy Grove

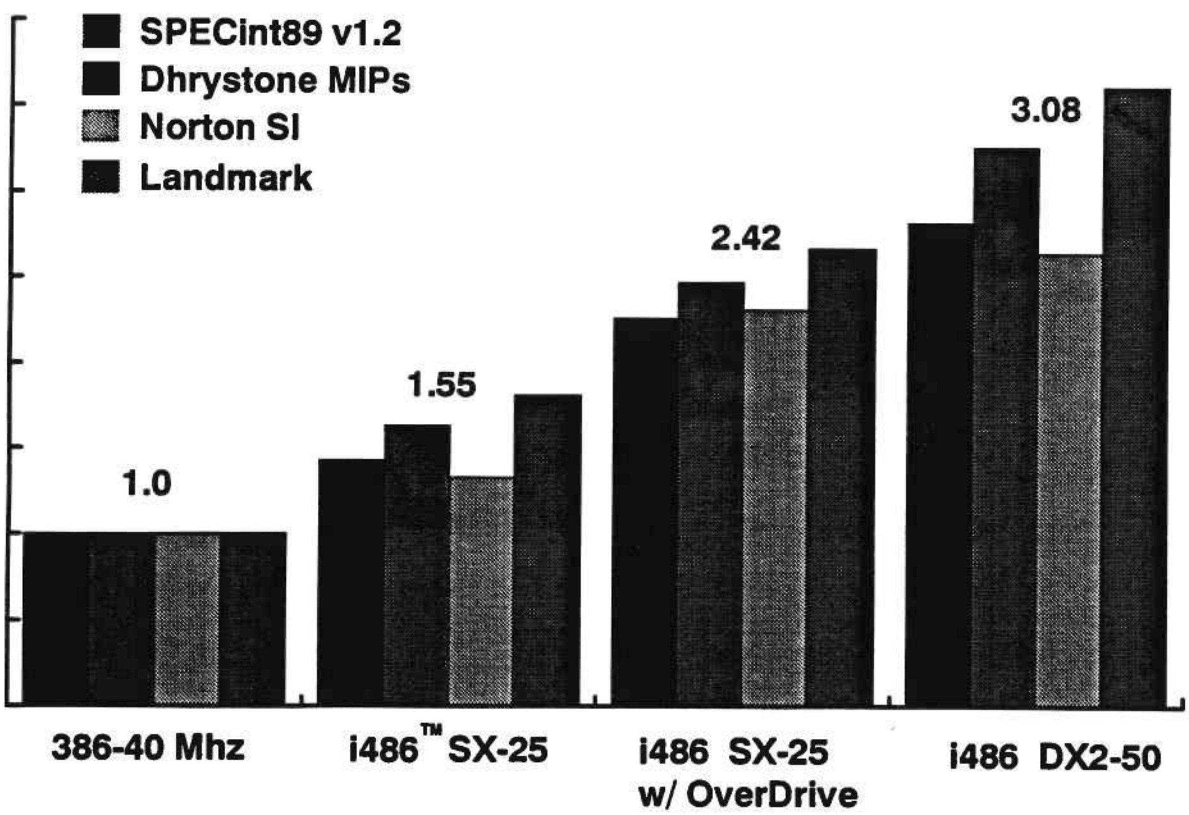
Second Wave Unit Shipments



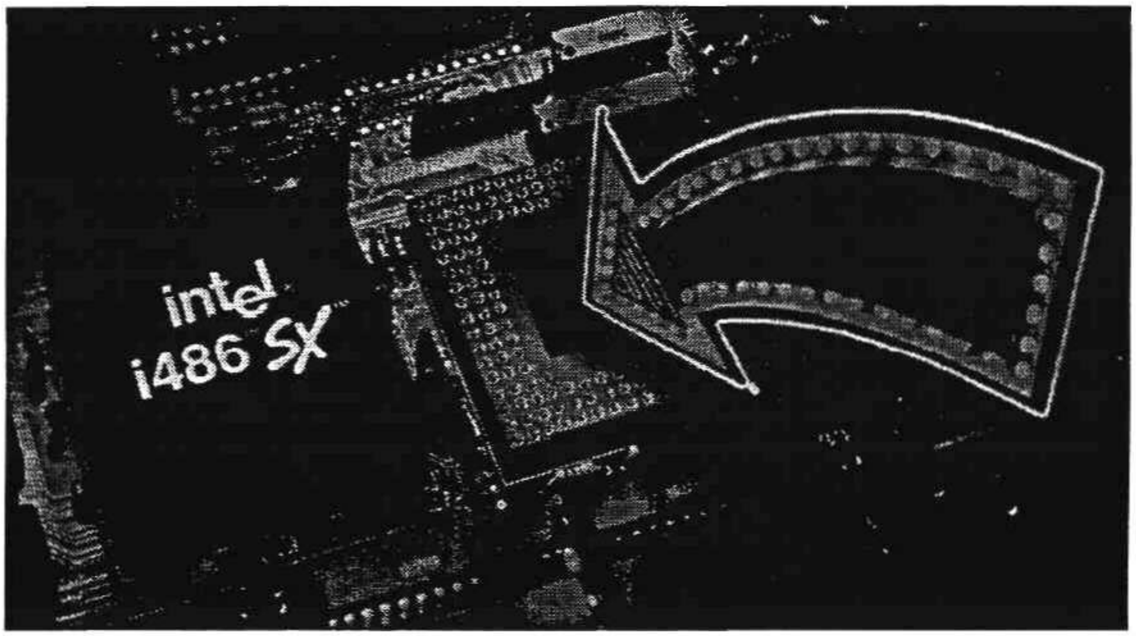
New Software Drives Intel486™ Family Volumes



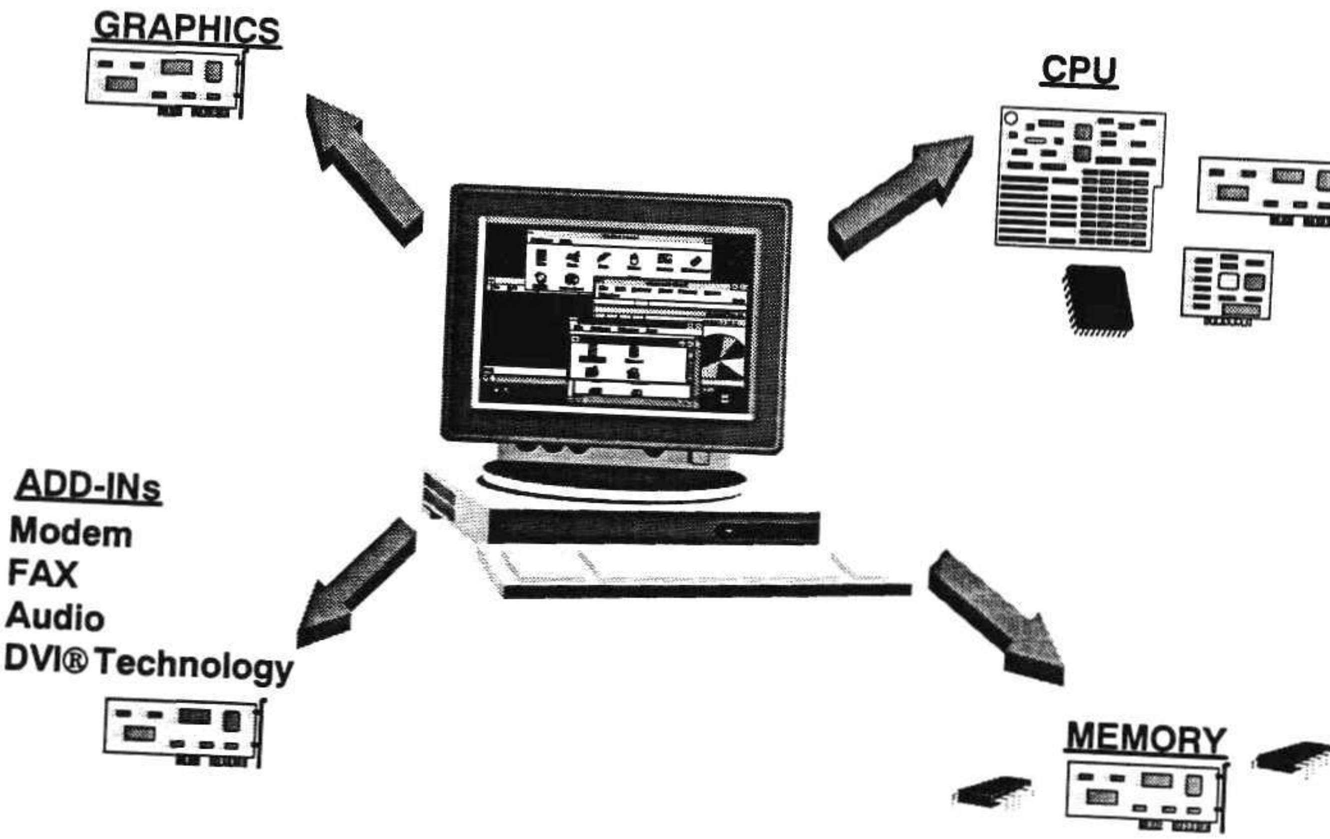
Synthetic Benchmarks



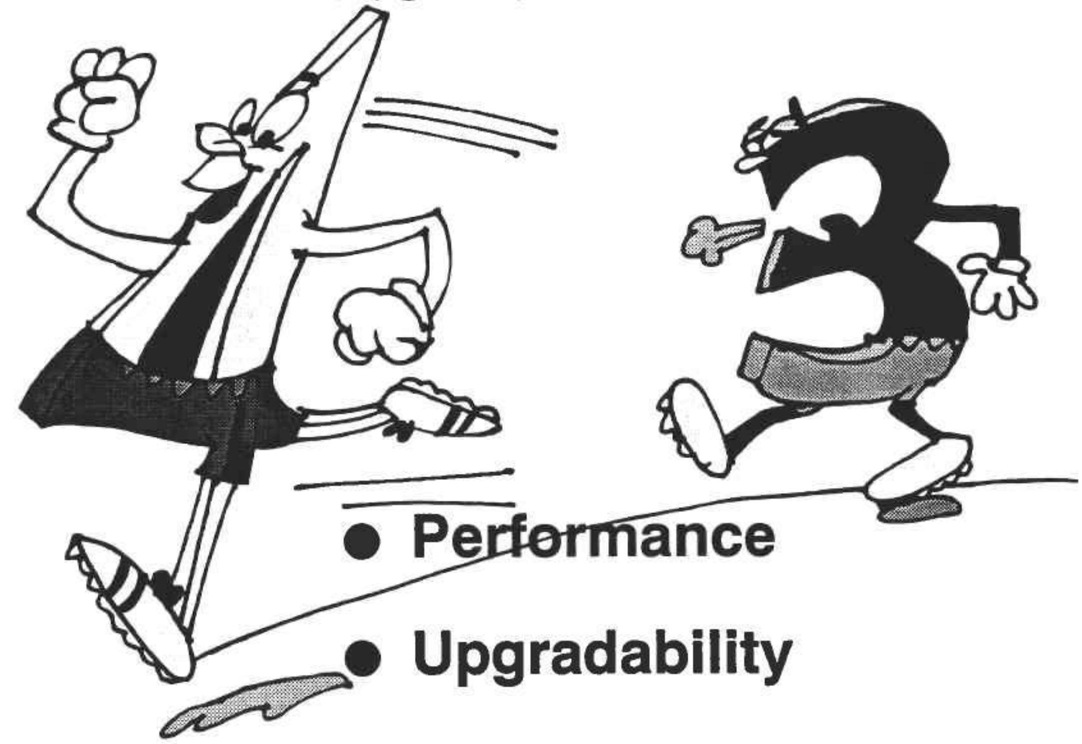
Intel486™ Processors are Upgradable



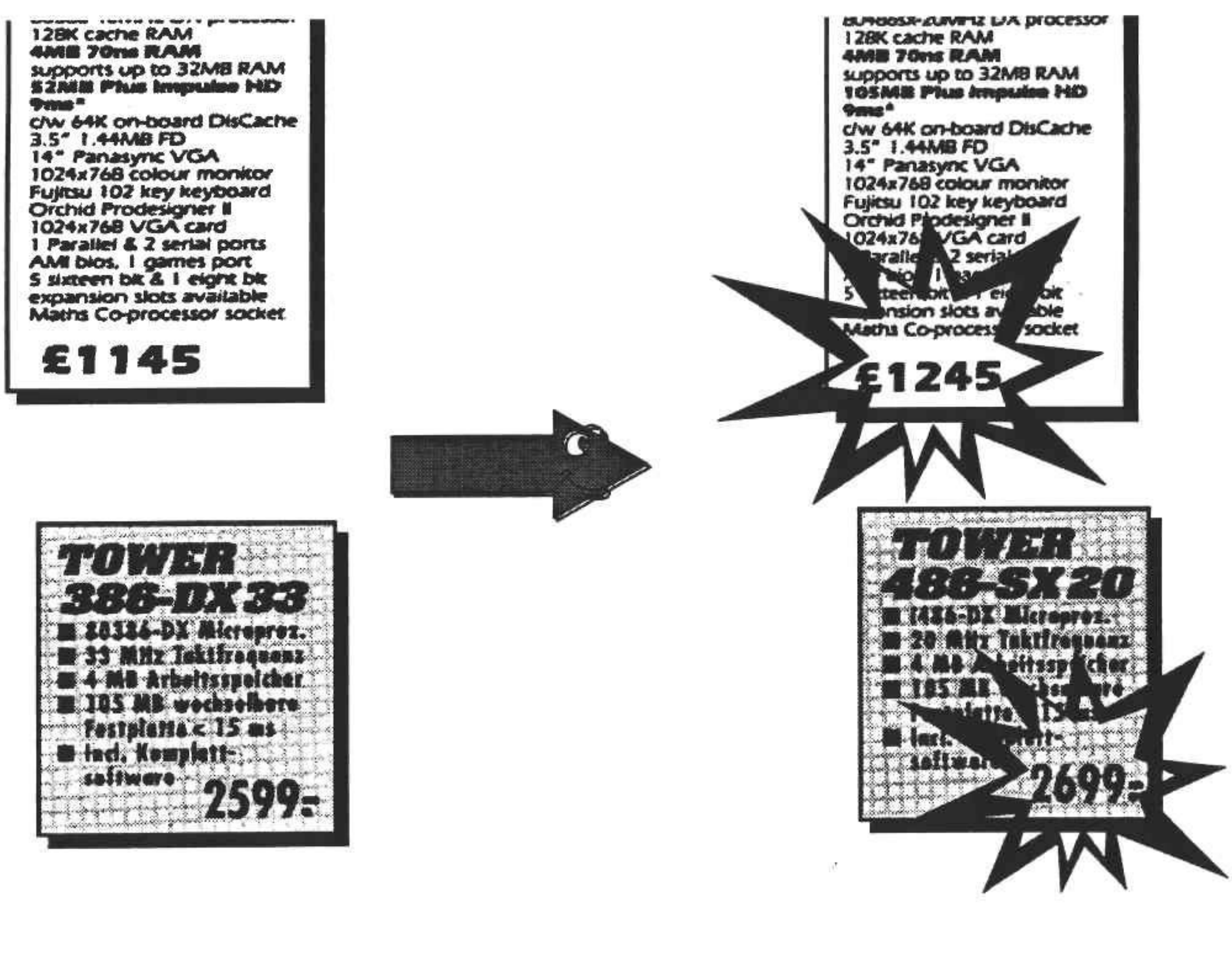
End Users Want Upgrade Options



4 is Better Than 3



- Performance
- Upgradability



P5: Next Generation Microprocessor

- Performance in the 100 MIPs Range
- Superscalar ("RISC") Technology
- Mainframe-Class Capabilities

Agenda

- PC Market
- Move To The Second Wave
- European Procurement Trends
- Future Of Business Computing
- Manufacturing In Europe

Agenda

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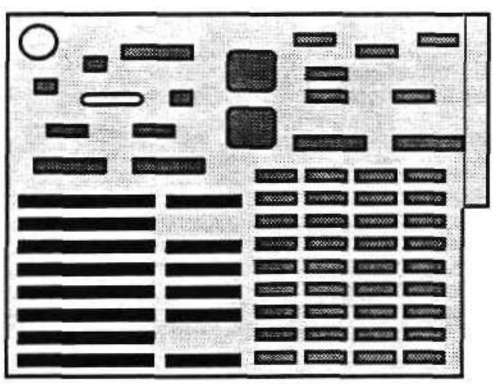
Reducing Duty Charges

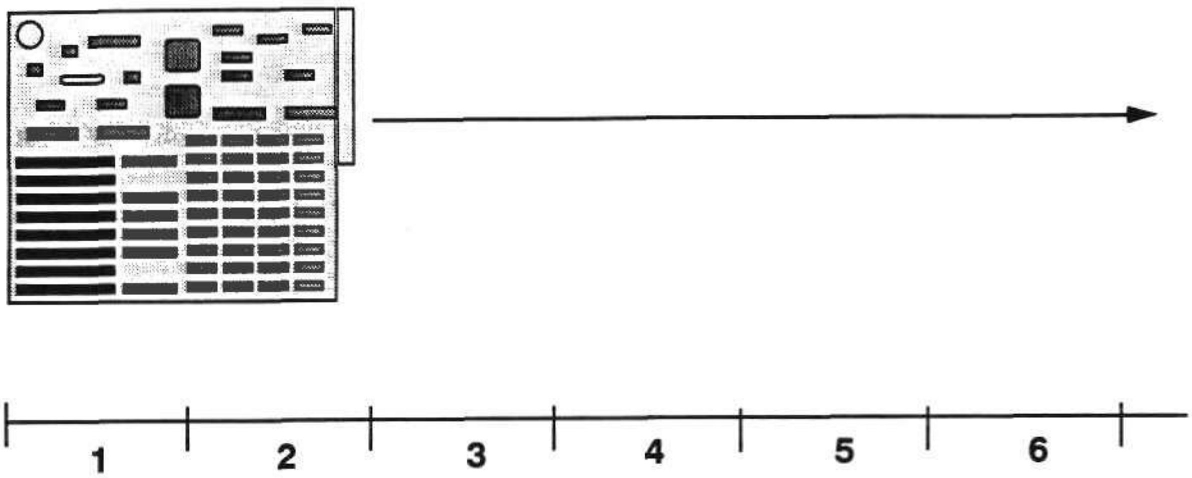


4.8 %

0%

Reducing Inventory Costs

CPU On The Motherboard

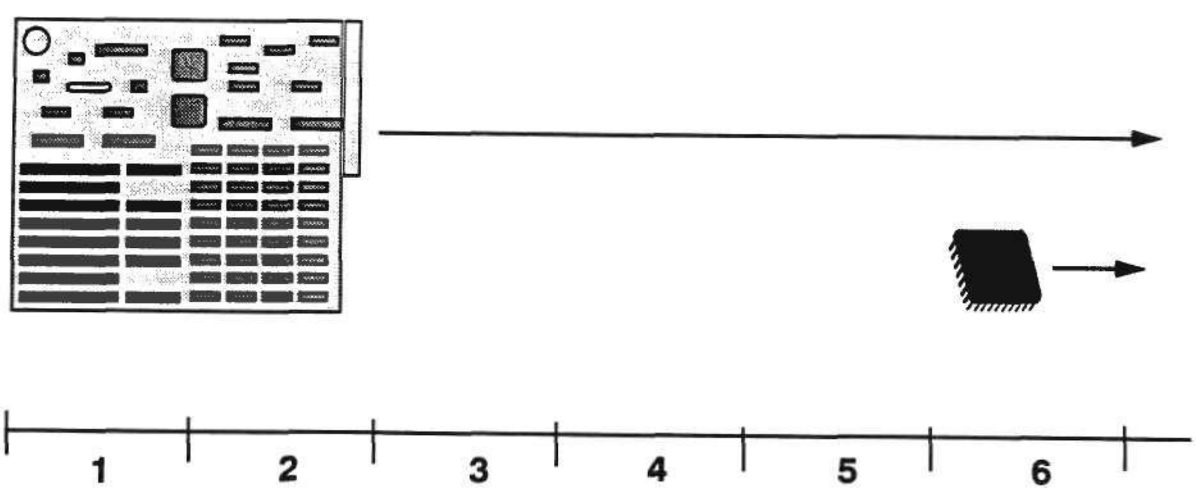


Weeks of Inventory Cost

6 x ($MB inv + $ CPU inv)

Reducing Inventory Costs

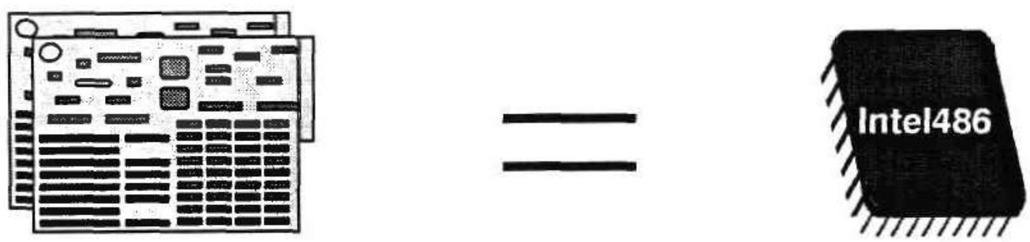
CPU and Motherboard Separate



Weeks of Inventory Cost

(6 x $MB) + (1 x $ CPU)

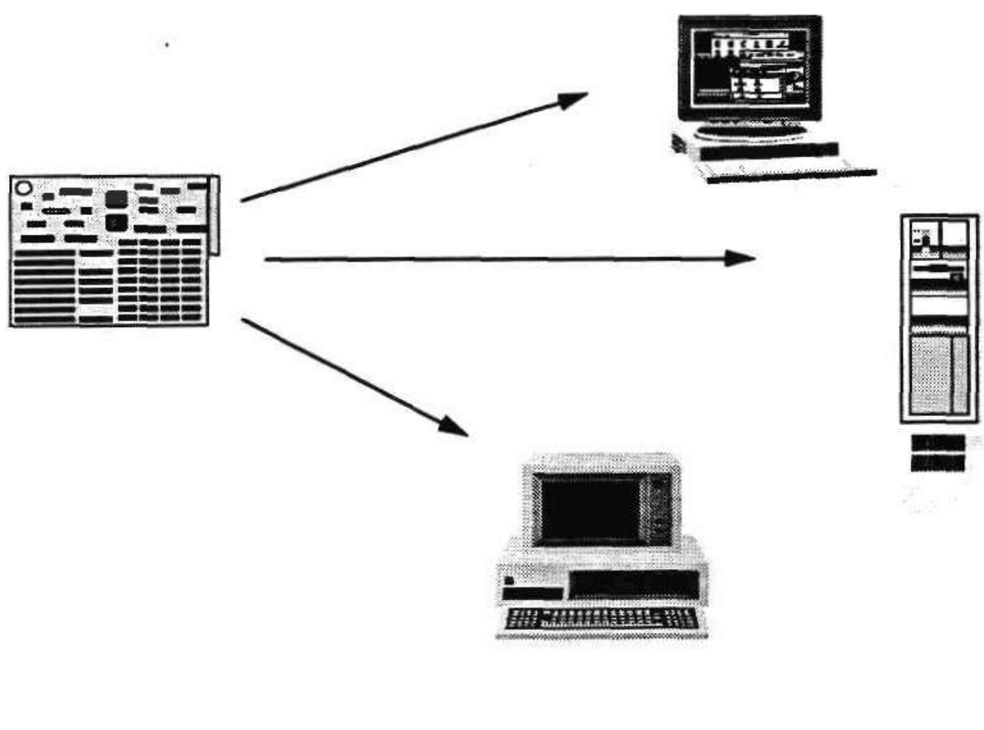
Result: Better Money Flow



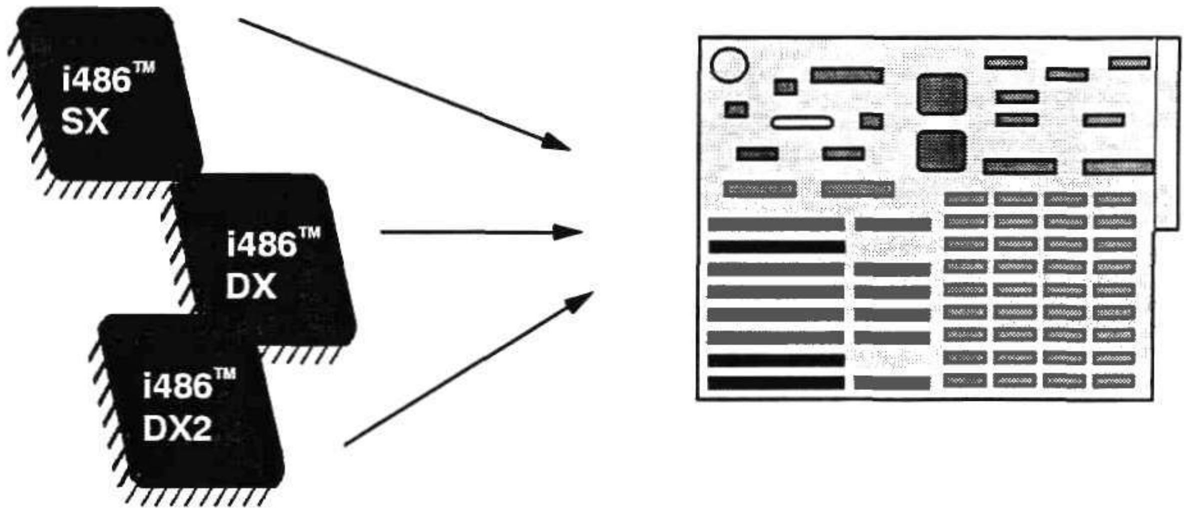
$	$
6 x (1 + 1-2) =	(6 x 1) + 1-2 =
12-18 inv. units	7-8 inv. units

1/2 to 1/3 Inventory Cost Reduction

Customizing At Time Of Purchase



Broad Product Range With Minumum Inventory



Agenda

- PC Market
- Move To The Second Wave
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- Future Of Business Computing
- Manufacturing In Europe

Computer Supported Collaboration

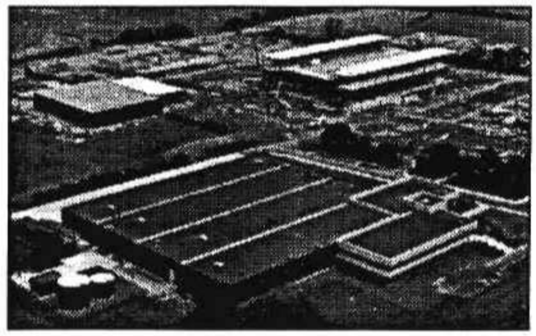
- More Chips
- Higher Performance CPUs

Agenda

- PC Market
- Move To The Second Wave
- European Procurement Trends
- Future Of Business Computing
- → Manufacturing In Europe

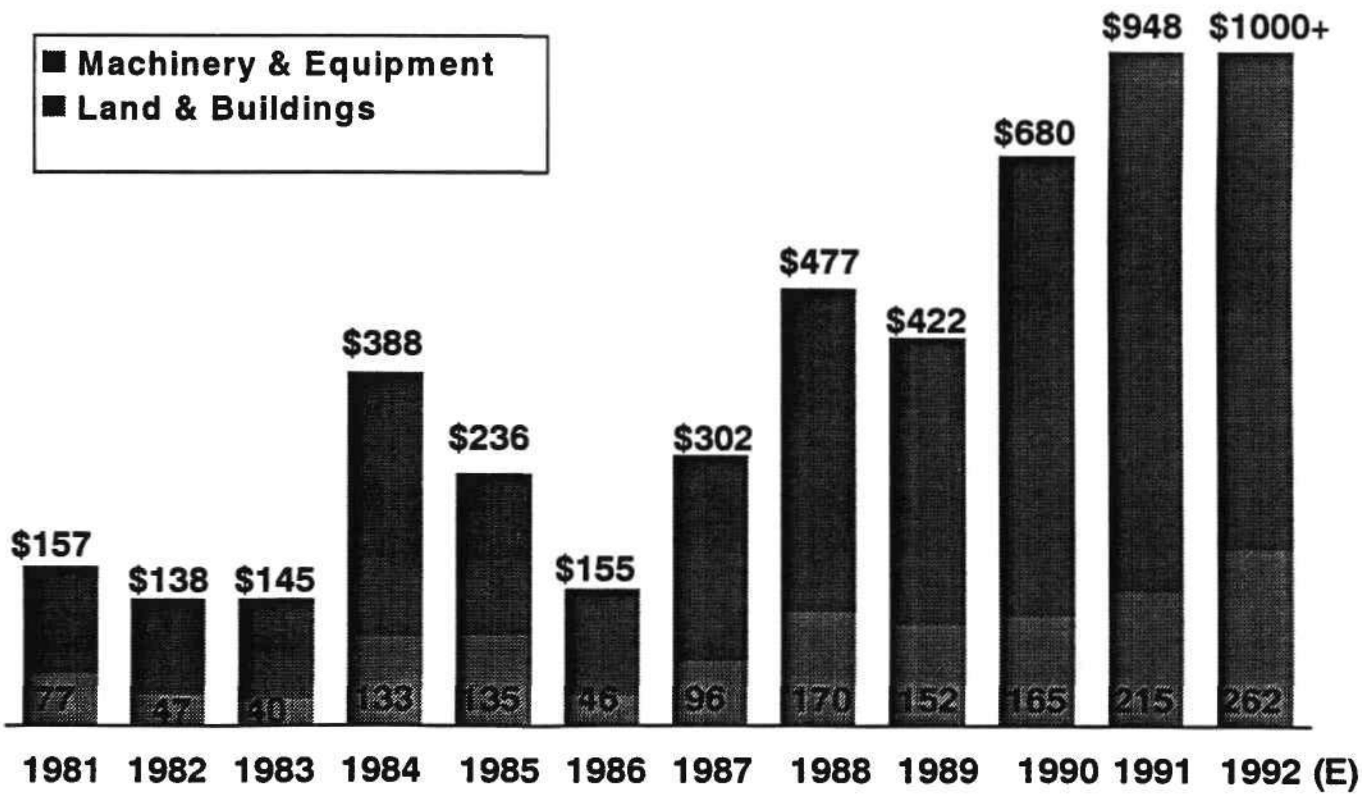
Intel In Ireland

- Our newest technology making our most advanced chips
- First major production facility for 8-inch wafers
- Our largest single clean room
- $800 million investment when fully operational
- Employment of 1,000 Irish nationals



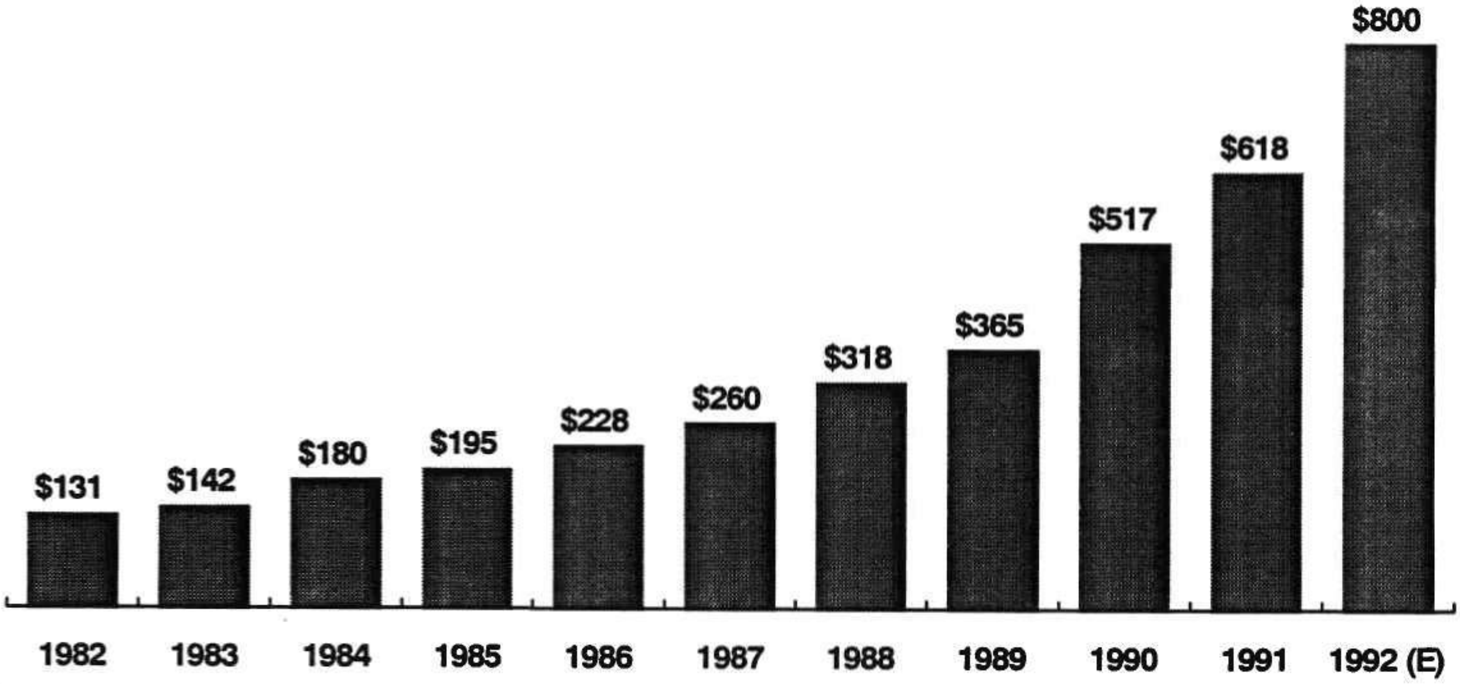
Capital Investment

(Dollars in Millions)



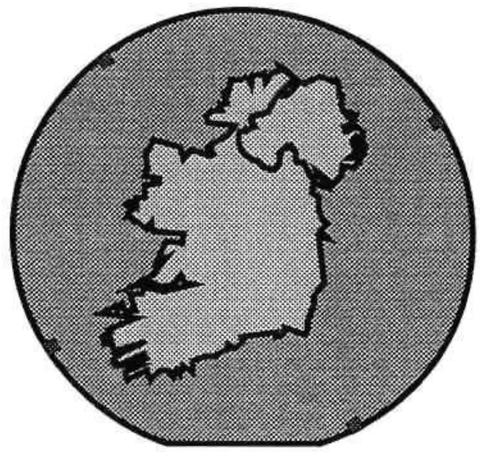
Research and Development

(Dollars in Millions)



Summary

- Intel Is Committed To Manufacturing In Europe
- Intel Is Committed To Moving The Market To The Second Wave



HOW TO SAFEGUARD EUROPE'S HIGH-TECHNOLOGY FUTURE

Heinz W. Hagmeister
Chairman and CEO
Philips Semiconductors International BV

Dataquest Europe Limited, a company of The Dun & Bradstreet Corporation
Roussel House, Broadwater Park, Denham, Uxbridge, Middx UB9 5HP / 0895 835050 / Tlx 266195 / Fax 0895 835260

HOW TO SAFEGUARD EUROPE'S HIGH-TECHNOLOGY FUTURE

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Mr. Hagmeister is Senior Managing Director, Chairman and CEO of Philips Semiconductors Product division. His experience prior to this was gained in a range of engineering and management positions for Philips in Germany and the Netherlands in the field of integrated circuits and discrete semiconductors. Mr. Hagmeister holds an engineering degree in Electronics from Technical University in Aachen, Germany.

Dataquest Europe Limited
EUROPEAN SEMICONDUCTOR INDUSTRY CONFERENCE
June 3–5, 1992
Dublin, Ireland

Dataquest Conference, Dublin, June 1992.

How to safeguard Europe's High-Tech future

H.W. Hagmeister

Philips Semiconductors

In the first part of his presentation Mr. Hagmeister will point out the importance of the European electronics industry and its position compared to other regions.
Subjects addressed are: IC consumption related to GNP, the electronics trade balance, major semiconductor application markets as well as the costs associated with participation in these markets. Among the "challenges of the 90's" are horizontal and vertical partnerships.

In the second part a number of actions will be indicated, considered necessary to safeguard the European participation in current and future electronics markets.

How to safeguard Europe's High-Tech future

H.W. Hagmeister

Dataquest conference 1992

Three level scenario

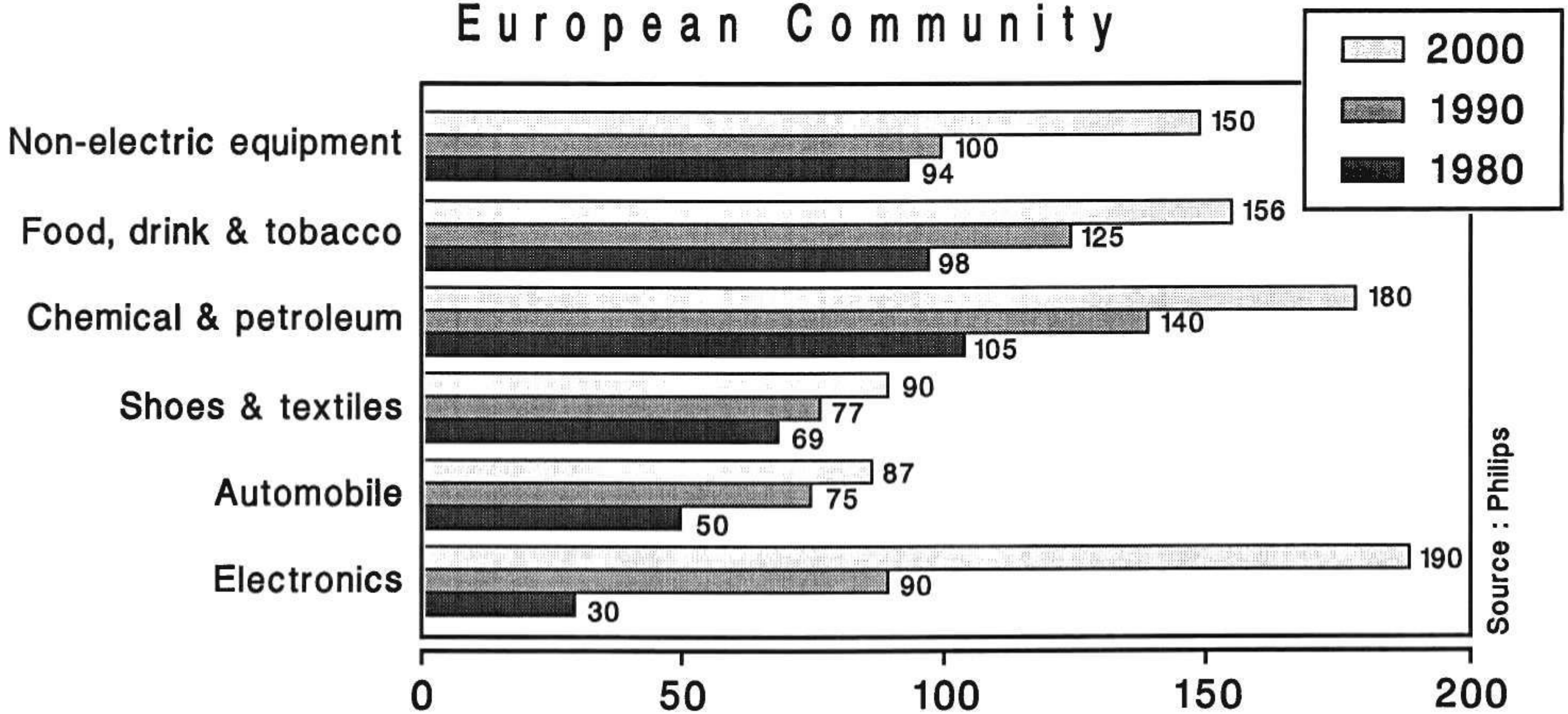
Economics

Electronics

Semiconductors

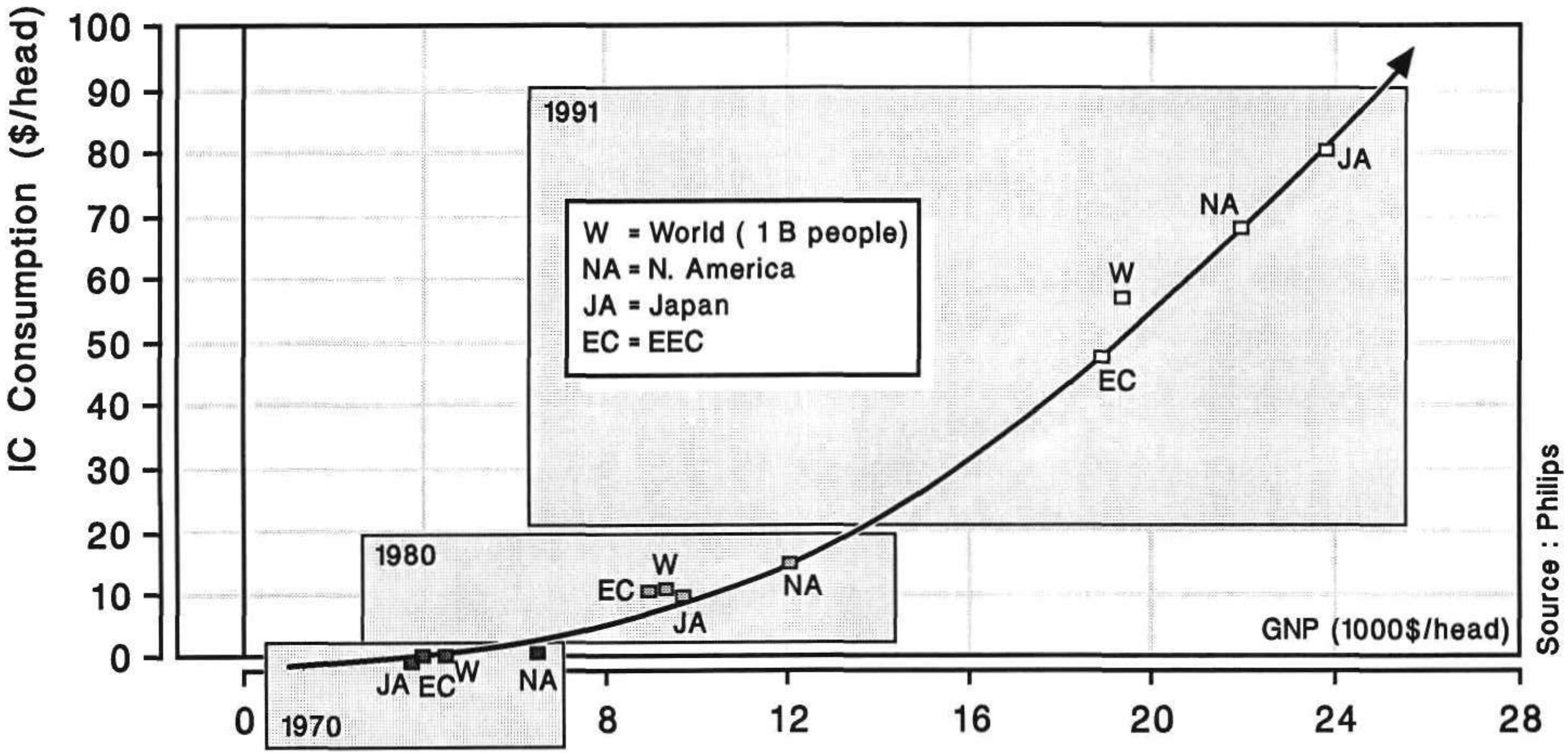
Comparison of electronics (B. $)

With other manufacturing industries in European Community



IC Consumption related to GNP / Capita

1970 - 1980 - 1991

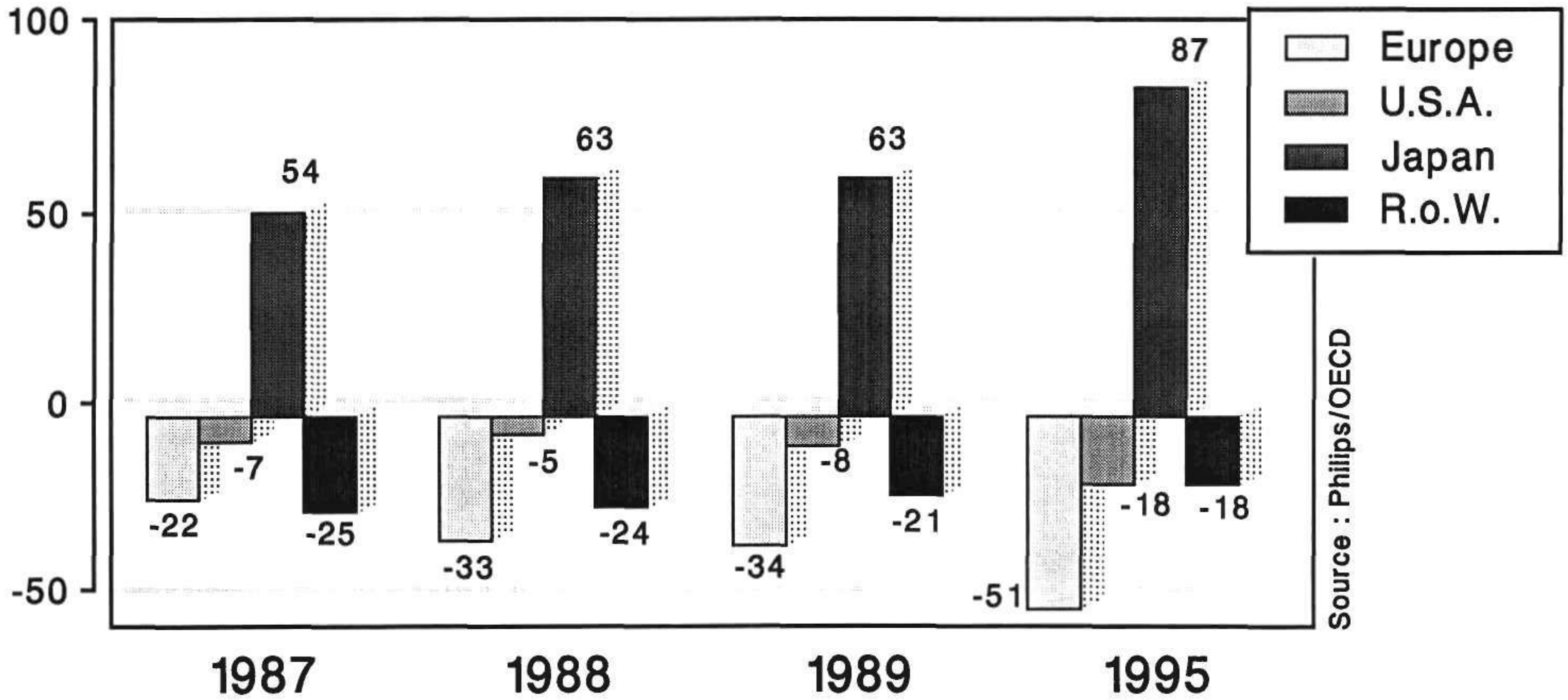


Electronics : a base industry for Europe

- The electronics industry is know-how intensive and fits European demography
- The electronics industry is the cornerstone of an industrial society
- It represents a considerable part of Europe's future wellbeing
- It guarantees future economic and political sovereignty

Tradebalance Electronics Industry

Surplus/deficit in B.$



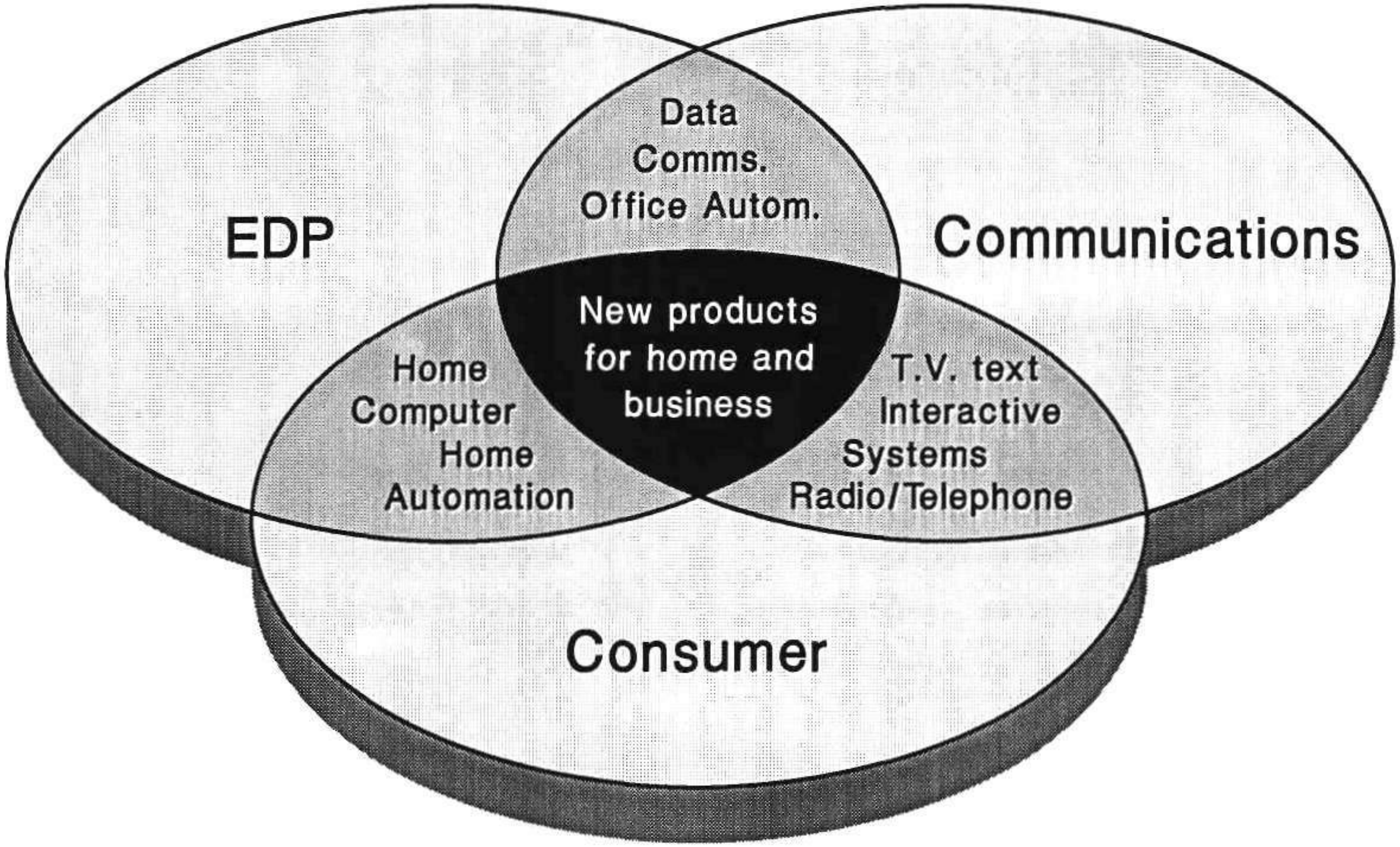
Three level scenario

Economics

Electronics

Semiconductors

Market Evolution of the 90's

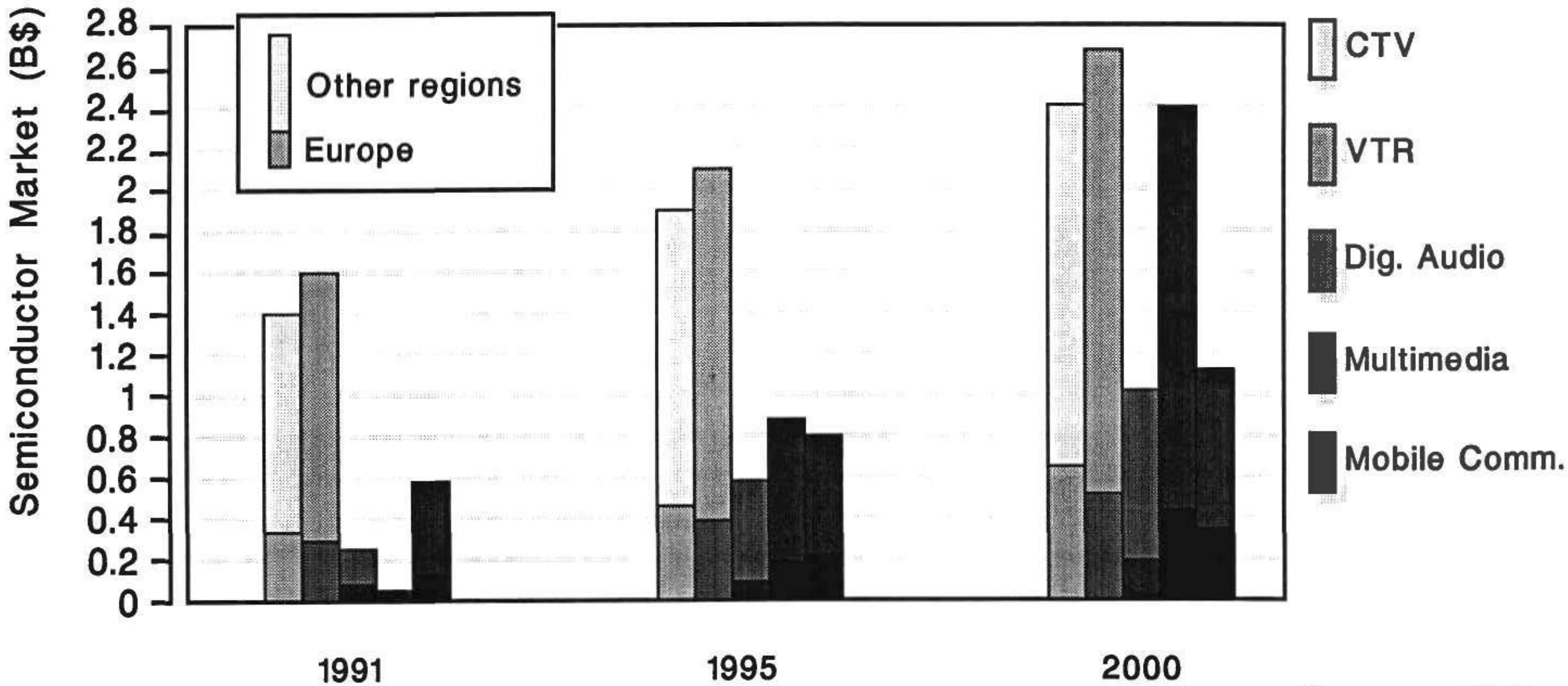


Challenges of the 90's (1)

- High Performance TV
- Telecommunication
- EDP-Multimedia
- Automotive

Semiconductor Markets

Selected Major Applications / Europe vs World



Source : Philips

Three level scenario

Economics

Electronics

Semiconductors

Products and processes

- Linear, logic, memory, micro controllers
- Analog and digital technologies
- Bipolar, CMOS, BiCMOS technology
- Manufacturing equipment
- Miniaturisation of packages

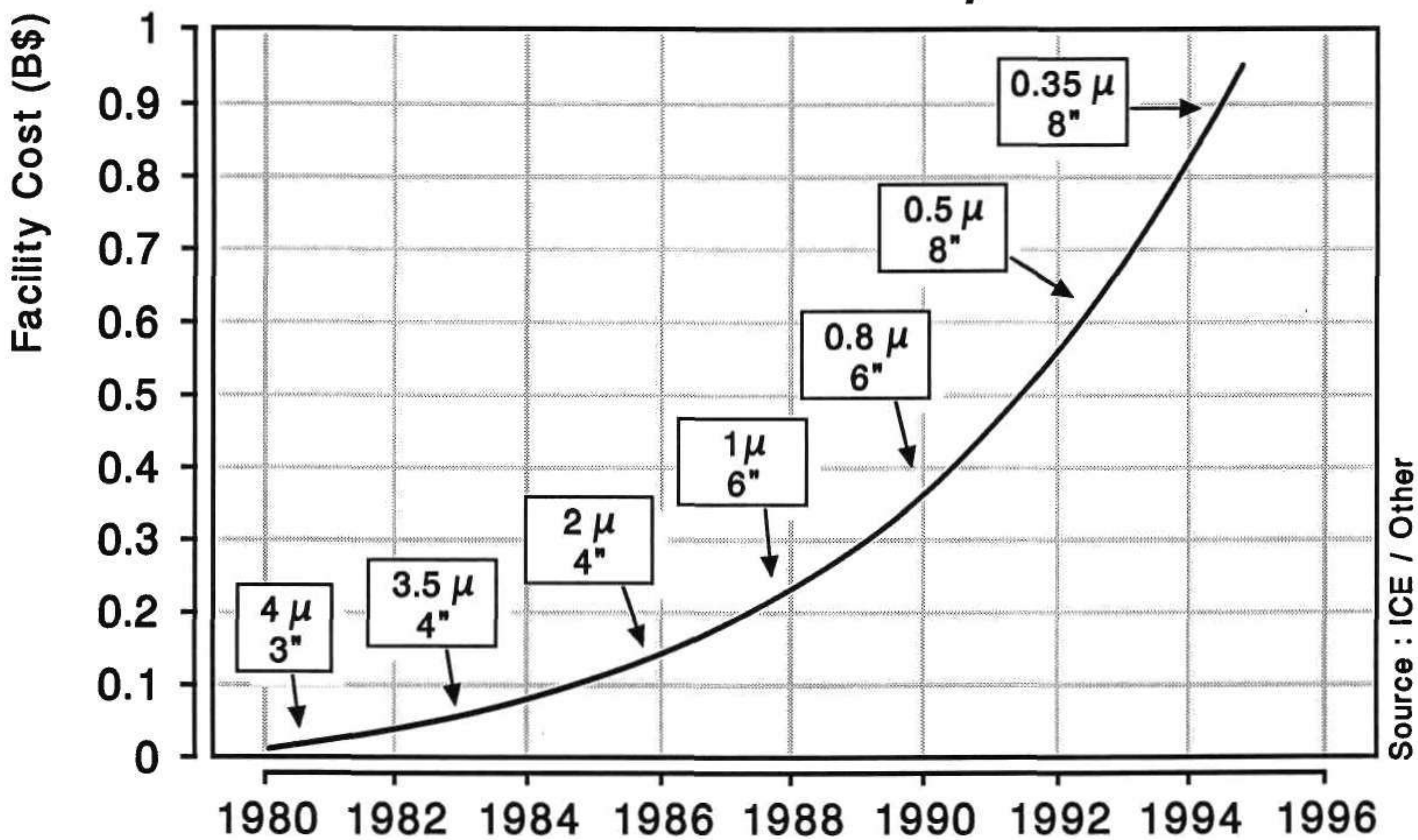
Capabilities & tools

- Design tools / design libraries
- Quality management (ISO 9000, TQE)
- User friendly software
- JIT / STS capability
- Global marketing & sales

Challenges of the 90's (2)

- Partnering
- Manufacturing excellence
- Process technology

Fab Cost Development



Three level scenario

Economics

Electronics

Semiconductors

Actions on Semiconductor industry level

- Relations with Semiconductor equipment and materials suppliers
- Manufacturing Excellence
- Improve competitiveness of setmakers
- Joint process development
- Share CAD tools and libraries
- Create selective European centres of competence

Three level scenario

Economics

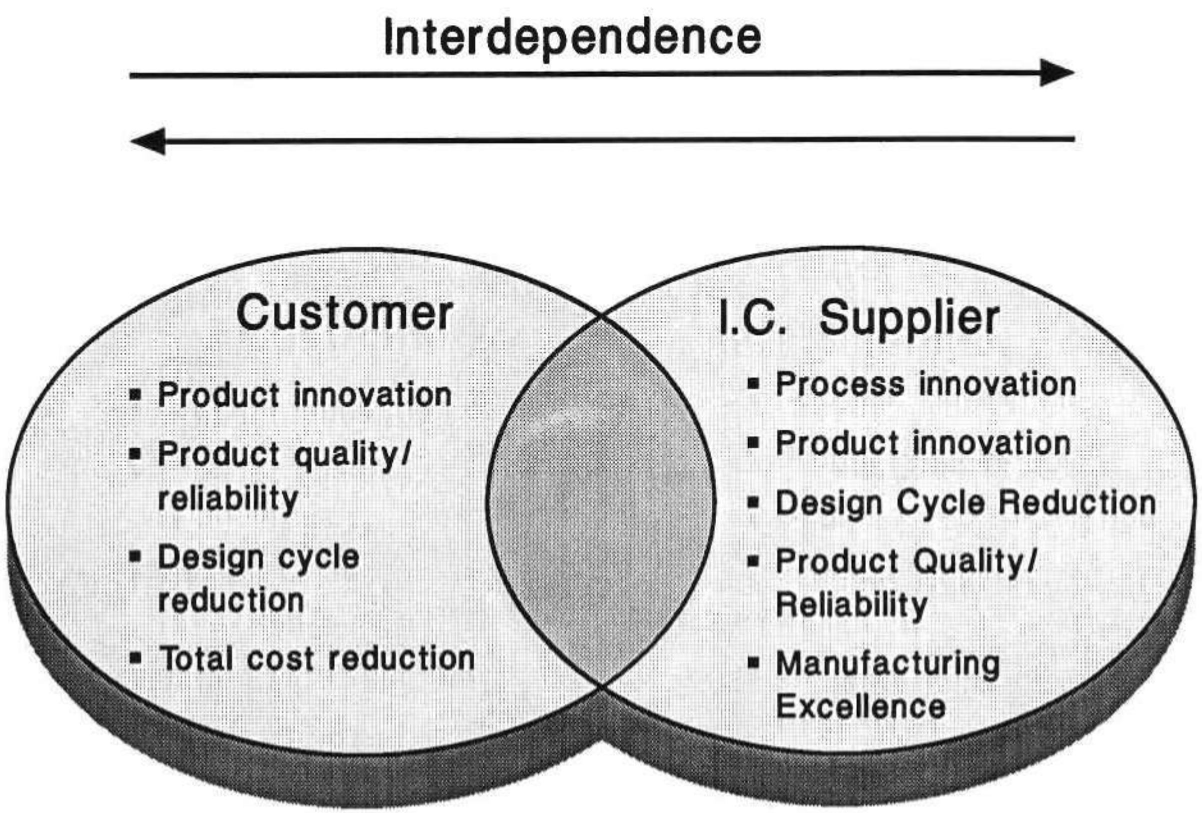
Electronics

Semiconductors

Actions on electronics industry level

- Create common standards
- Create European centres of competence
- Develop user friendliness and software competence
- Form vertical, risk sharing partnerships

Partnering in the 90's



- Quality
  - Ship to Stock
  - Statistical Process Control
- Service
  - JIT
  - Vendor concentration
- Product Definition
  - Systems Intertransfer
  - Mutual Design Cycle Reduction
- Co-production
  - Common tools
  - Foundry Service

Three level scenario

Economics

Electronics

Semiconductors

Economic platform

Active, fast and focussed support policy

- Push policy (R&D programmes)
- Pull policy (Trans-European infrastructural networks)
- Standardisation (economy of scale)
- Skills and education
- Open trade / anti-dumping policy
- Sustainable co-existence with Japan

Awareness of national and European authorities

Electronics :

- Strongest driving force of economy
- Prime weapon for competitiveness
- Key for sovereignty of Europe

Europe - USA - Japan

- Co-operation, not confrontation
- Interdependence, not dependence
- Free trade on a fair basis