Dataquest

A company of The Dun & Bradstreet Corporation

1991 High-Tech Electronics Industry Conference

September 30, 1991
Shilla Hotel, Seoul, Korea

7 : 30 am Registration

9 : 00 am Welcome ..... Yeong Bin Gwan
J.H.Son, General Manager
Dataquest Korea

9 : 10 am Surviving in the Market of the 1990s ..... Yeong Bin Gwan
Geoffery Champion, Corporate Vice President & General Manager,
International & Consulting, Dataquest Incorporated

9 : 40 am Semiconductor Memory Update ..... Yeong Bin Gwan
Sam Young, Director
Dataquest Incorporated

10 : 10 am The HDTV Market and Its Impact on Technology ..... Yeong Bin Gwan
Keiske Yawata, President and Chief Executive Officer
LSI Logic K.K.

10 : 40 am Coffee Break ..... Yeong Bin Gwan

11 : 00 am Computer Systems, Workstations and Servers ..... Yeong Bin Gwan
Andy Seybold, Director
Dataquest Incorporated

11 : 45 am Current Status of Computer Storage Industry ..... Yeong Bin Gwan
Phil Devin, Director
Dataquest Incorporated

12 : 15 pm Lunch & Luncheon Speech ..... Yeong Bin Gwan
Science and Technology in Korea "Today and Tomorrow"
Jung Uck Seo, Ph.D., Vice Minister
Ministry of Science and Technology
(Presented by Dr. Minho Kang, Executive VP of KTA)

1 : 30 pm Portable Computer Market Update ..... Yeong Bin Gwan
Andy Seybold, Director
Dataquest Incorporated

2 : 15 pm Asian PC Market and Industry ..... Yeong Bin Gwan
Nagayoshi Nakano, Senior Industry Analyst
Dataquest Japan

2 : 45pm Strategies to bring up the Korean
Electronics Industry ..... Yeong Bin Gwan
Ki Sung Lee, Director General
Bureau of Electronics and Electric Appliances Industry
Ministry of Trade and Industry

3 : 15 pm Coffee Break ..... Yeong Bin Gwan

3 : 35 pm Lithography Technology Trends ..... Yeong Bin Gwan
Shoichiro Yoshida, Senior Managing Director
Nikon Corporation

4 : 15 pm Personal Communications ..... Yeong Bin Gwan
Victor Krueger, Vice President and Director
Dataquest Incorporated

5 : 00 pm Growth Opportunities in European Telecommunications. ..... Yeong Bin Gwan
Robin Duke-Woolley, Director
Dataquest Europe

5 : 45 pm Cocktail Party ..... Yeong Bin Gwan

7 : 45 pm Conference Adjourns

1991 High-Tech Electronics Industry Conference

September 30, 1991 Shilla Hotel Seoul, Korea

Dataquest

a company of The Dun & Bradstreet Corporation

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1991 High-Tech Electronics Industry Conference

September 30, 1991
Shilla Hotel
Seoul, Korea

7:30 a.m.	**Registration**	
9:00 a.m.	**Welcome**	**Yeong Bin Gwan**
	J. H. Son, General Manager Dataquest Korea	
9:10 a.m.	**Surviving in the Market of the 1990s**	**Yeong Bin Gwan**
	Geoffery Champion, Corporate Vice President and General Manager International and Consulting, Dataquest Incorporated	
9:40 a.m.	**Semiconductor Memory Update**	**Yeong Bin Gwan**
	Sam Young, Director Dataquest Incorporated	
10:10 a.m.	**The HDTV Market and Its Impact on Technology**	**Yeong Bin Gwan**
	Keisuke Yawata, President and Chief Executive Officer LSI Logic K.K.	
10:40 a.m.	**Coffee Break**	**Yeong Bin Gwan**
11:00 a.m.	**Computer Systems, Workstations and Servers**	**Yeong Bin Gwan**
	Carl Flock, Director Dataquest Incorporated	
11:45 a.m.	**Current Status of Computer Storage Industry**	**Yeong Bin Gwan**
	Phil Devin, Director Dataquest Incorporated	
12:15 p.m.	**Lunch and Luncheon Speech**	**Yeong Bin Gwan**
	Science and Technology in Korea "Today and Tomorrow" Jung Uck Seo, Ph.D., Vice Minister Ministry of Science and Technology	
1:30 p.m.	**Portable Computer Market Update**	**Yeong Bin Gwan**
	Andrew Seybold, Associate Director Dataquest Incorporated	
2:15 p.m.	**Asian PC Market and Industry**	**Yeong Bin Gwan**
	Nagayoshi Nakano, Senior Industry Analyst Dataquest Japan Limited	
2:45 p.m.	**Strategies to bring up the Korean Electronics Industry**	**Yeong Bin Gwan**
	Ki Sung Lee, Director General Bureau of Electronics and Electric Appliances Industry Ministry of Trade and Industry	
3:15 p.m.	**Coffee Break**	**Yeong Bin Gwan**
3:35 p.m.	**Lithography Technology Trends**	**Yeong Bin Gwan**
	Shoichiro Yoshida, Senior Managing Director Nikon Corporation	
4:05 p.m.	**Personal Communications**	**Yeong Bin Gwan**
	Victor Krueger, Vice President and Director Dataquest Incorporated	
4:50 p.m.	**Growth Opportunities in European Telecommunications**	**Yeong Bin Gwan**
	Robin Duke-Woolley, Director Dataquest Europe Limited	
5:35 p.m.	**Cocktail Party**	**Yeong Bin Gwan**
7:35 p.m.	**Conference Adjourns**	

1991 High-Tech Electronics
Industry Conference

Surviving in the Market of the 1990s

Geoffery Champion
Corporate Vice President and General Manager
International and Consulting
Dataquest Incorporated

Mr. Champion is the Corporate Vice President and General Manager for Dataquest's International and Consulting. He is based at Dataquest's European headquarters at Denham, England, and is responsible for managing and developing Dataquest's markets outside the United States. Previously, he was responsible for Dataquest's three subsidiary companies in France, the United Kingdom and Germany. Before joining Dataquest Mr. Champion was Director of various operations in the Netherlands, London, Frankfurt, New York and Denver with McDonnell Douglas Information Systems. Mr. Champion received a B.Sc. degree in Engineering from the United States Military Academy at West Point in New York.

1991 High-Tech Electronics
Industry Conference

THIS PRESENTATION NOT AVAILABLE AT

TIME OF CONFERENCE

1991 High-Tech Electronics
Industry Conference

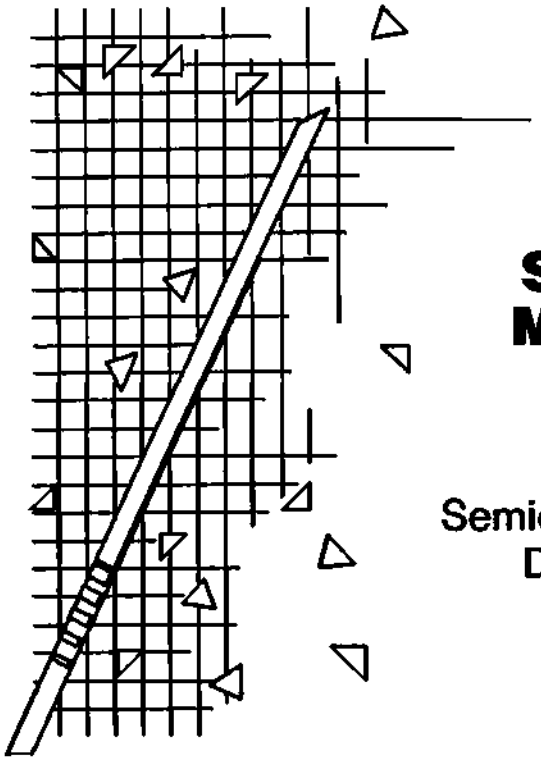
Semiconductor Memory Update

Sam Young
Director
Worldwide Memory Research for Semiconductor Group
Dataquest Incorporated

Mr. Young is Director of Worldwide Memory Research for Dataquest's Semiconductor Group. In this position, he is responsible for directing and managing Dataquest's worldwide activities in memory research.

Mr. Young joined Dataquest from Performance Semiconductor where he was Manager of Memory Marketing. Prior to that, Mr. Young was a founder and Director of Marketing and Sales for Exel Microelectronics. He also held senior marketing of engineering positions at Hitachi, Mostek, Unisys, and Raytheon Corporation. From 1977 to 1981, Mr. Young chaired the EIA JEDEC JC42 standards committee dealing with MOS, bipolar, and bubble memories. He has published more than 20 articles and papers including 4 cover stories in key electronics magazines and has organized, chaired, and presented technical papers at more than 10 technical sessions for the ELECTRO, WESCON, MIDCON, and SOUTHCON program committees.

Mr. Young holds a B.S.E.E. degree from Pratt Institute and did work toward an M.B.A. degree at Seton Hall University.

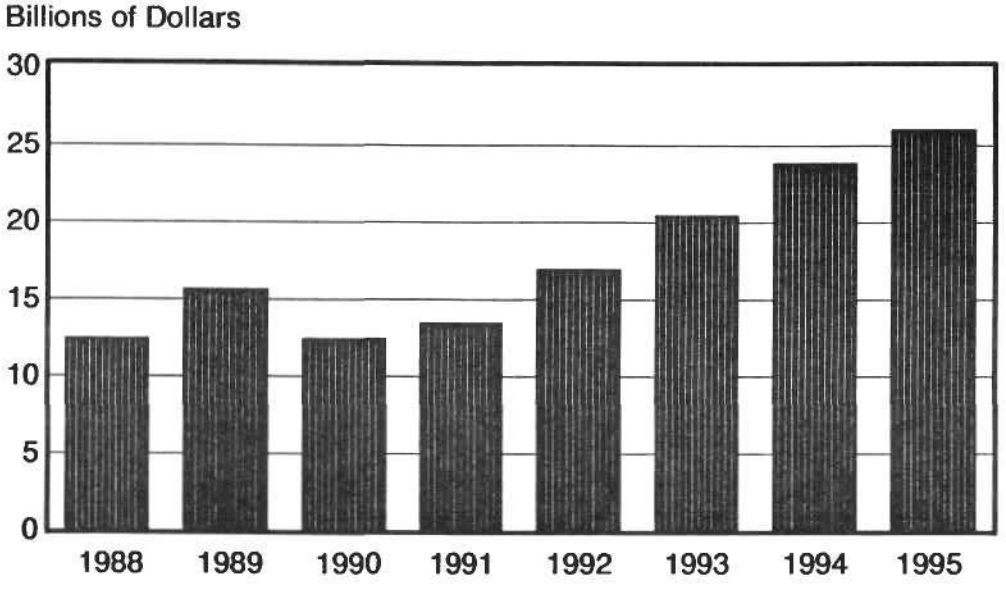


Semiconductor Memory Update

Sam Young

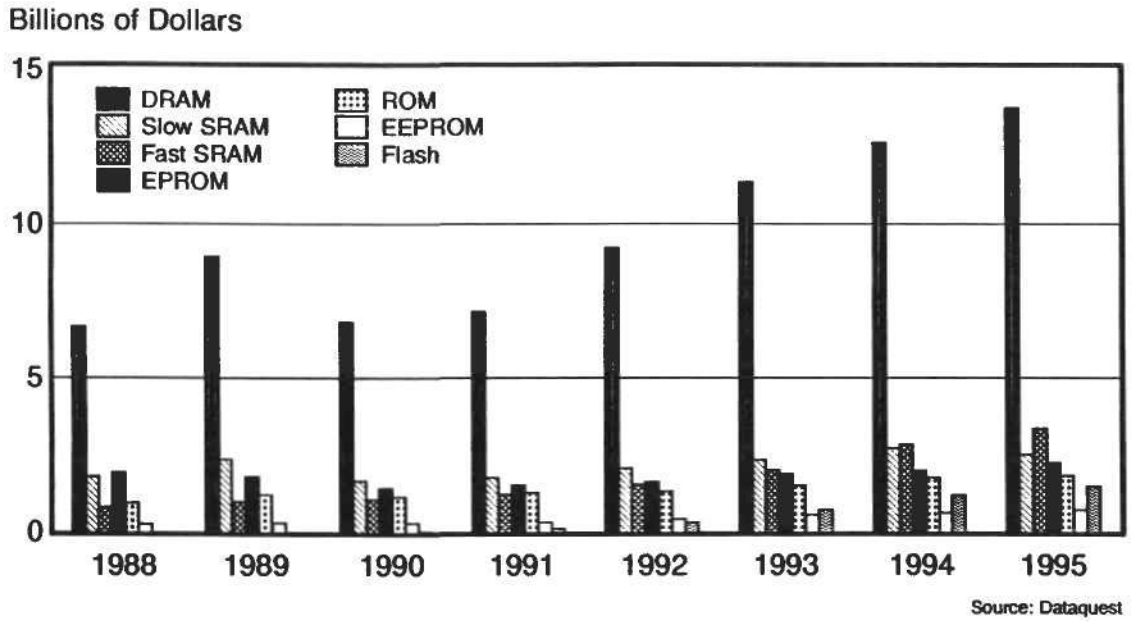
Director
Semiconductor Industry Service
Dataquest Incorporated

MOS MEMORY FORECAST -- REVENUE



Source: Dataquest

MOS MEMORY PRODUCT FORECAST -- REVENUE



Source: Dataquest

DRAM TRENDS -- ASP

Trend

- ASPs rising
  - 1990 -- $4.48
  - 1995 -- $10.14
- Price per bit now declining by a factor of 2, not 4, per generation

Reasons

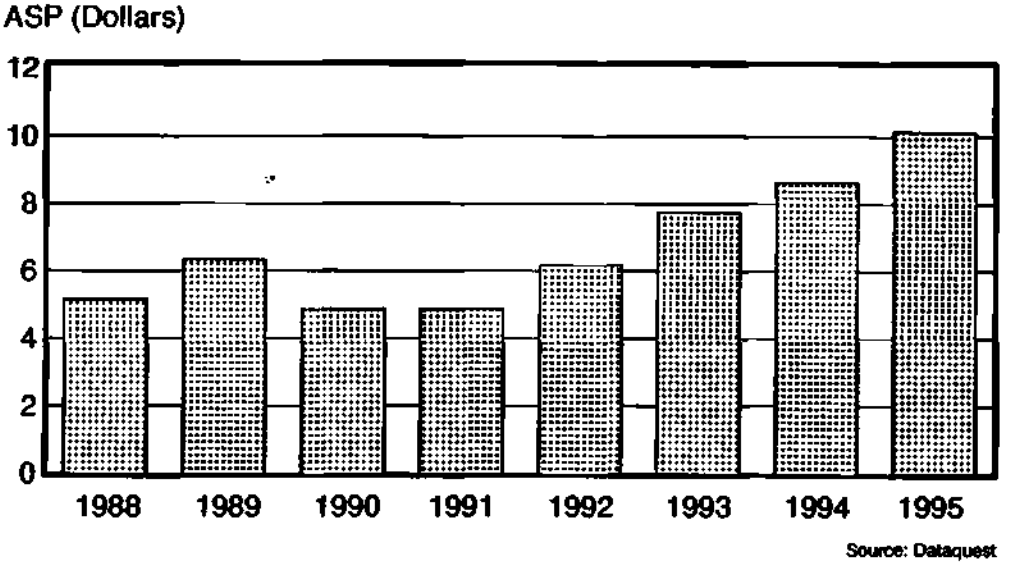
- Die size is increasing 50% for each new generation
- Process complexity is increasing 30% each generation
- Fab cost is increasing (20,000 wafers per month)
  - 256K fabs cost $140 million
  - 4Mb fabs cost $300 million
  - 64Mb fabs cost $570 million to $1,000 million

However, conversion to 8-inch wafers helps reduce costs

Source: Dataquest

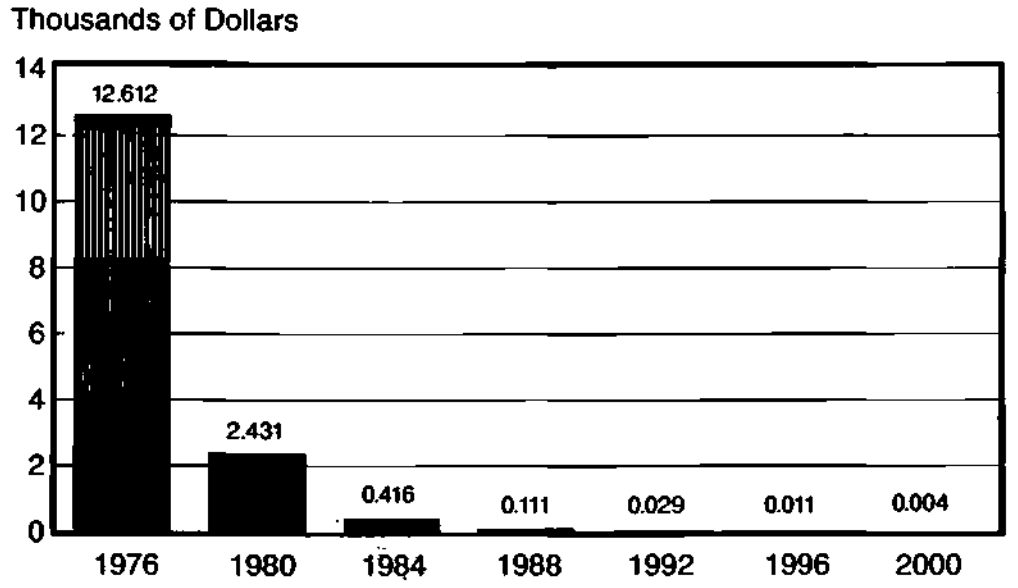
DRAM ASP

ASPs Are Increasing, But So Are Costs



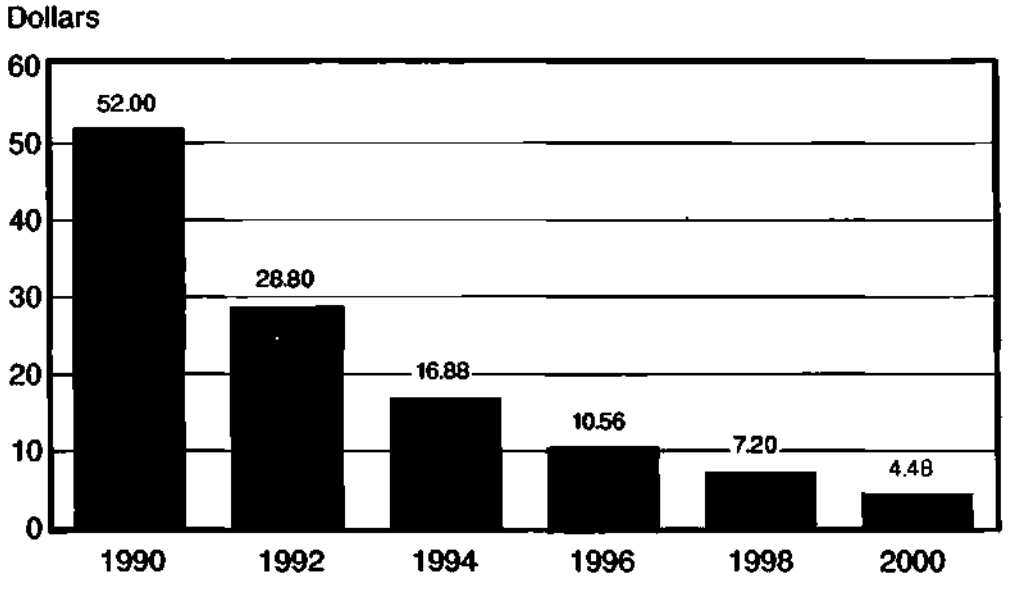
Source: Dataquest

COST PER MEGABYTE



Source: Dataquest

COST PER MEGABYTE



Source: Dataquest

DRAM VOLUME PEAKS

(Units)

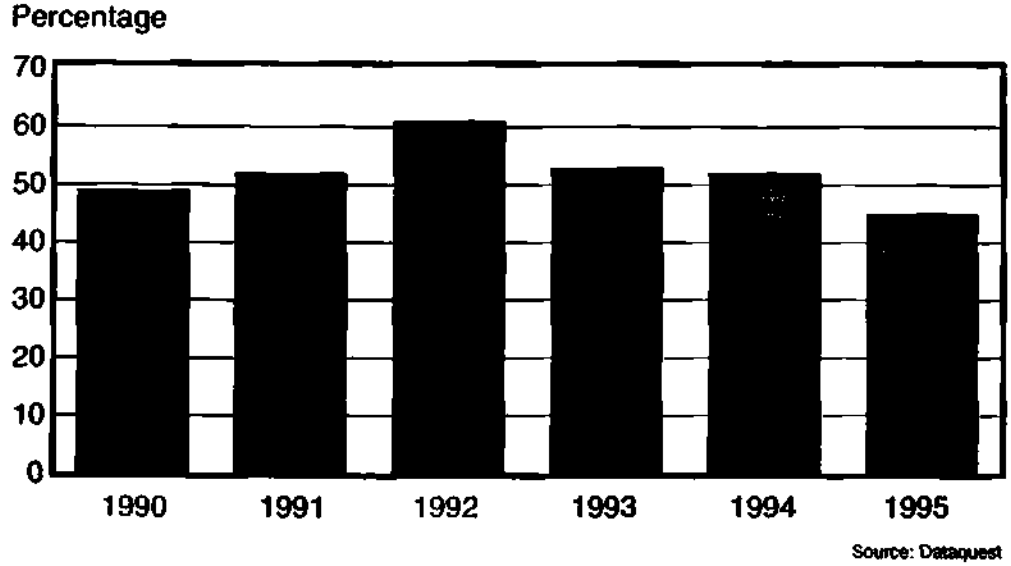
Unit volume peaks are declining for each successive generation -- 256K DRAM is the highest-volume part

Volume Peaks	Year	Volume (Millions of Units)
256K	1988	956
1Mb	1991	880
4Mb	1994	860

Source: Dataquest

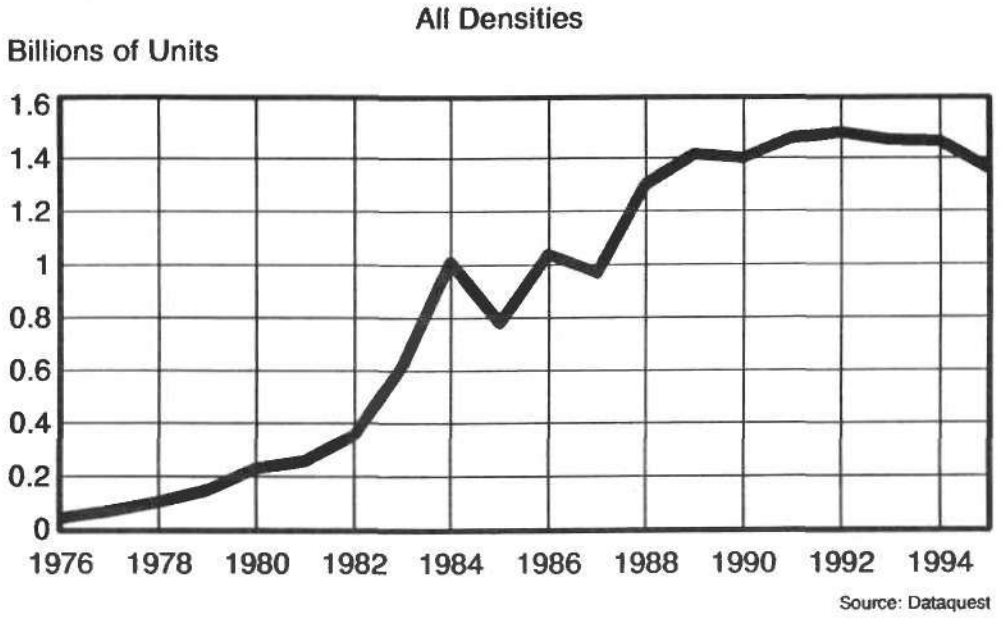
DRAM BIT GROWTH

Bit Growth Rate Is Slowing Down -- Peaked Over 150% in '80s



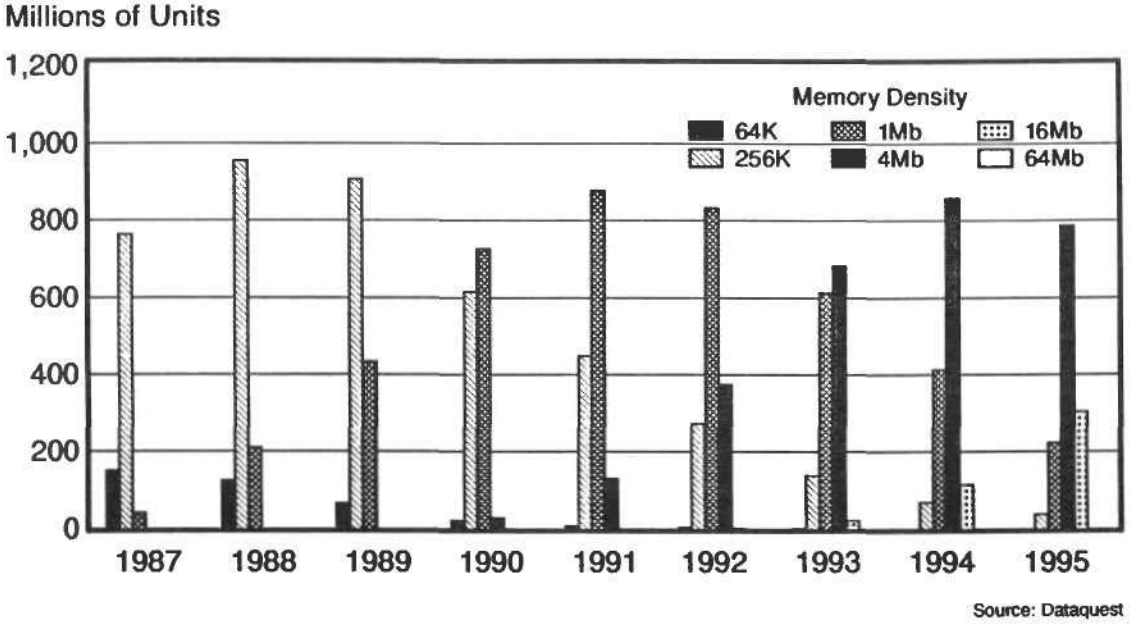
Source: Dataquest

DRAM UNIT VOLUME



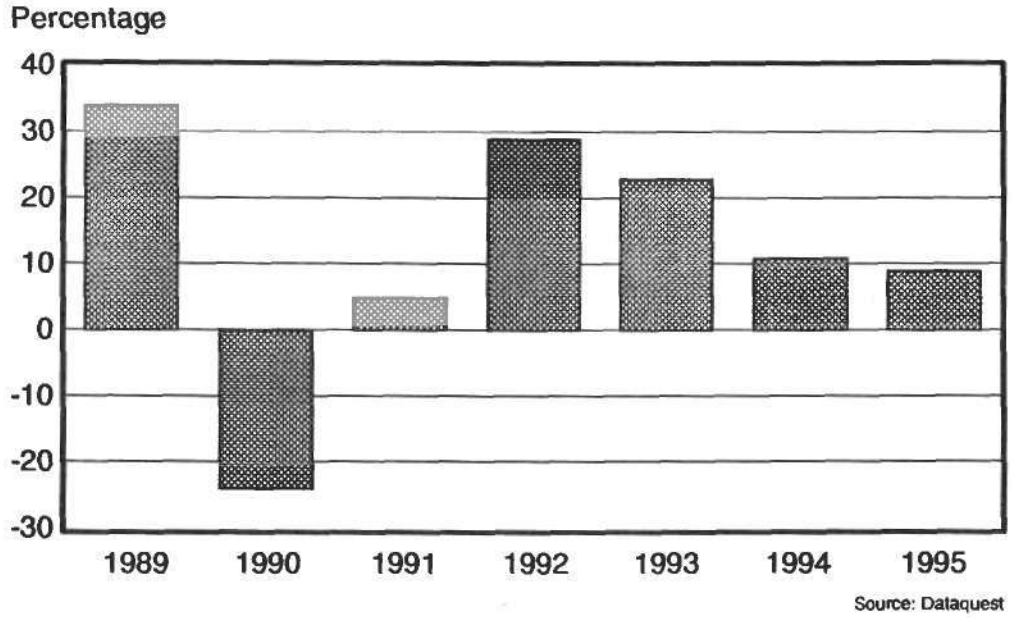
Source: Dataquest

DRAM FORECAST



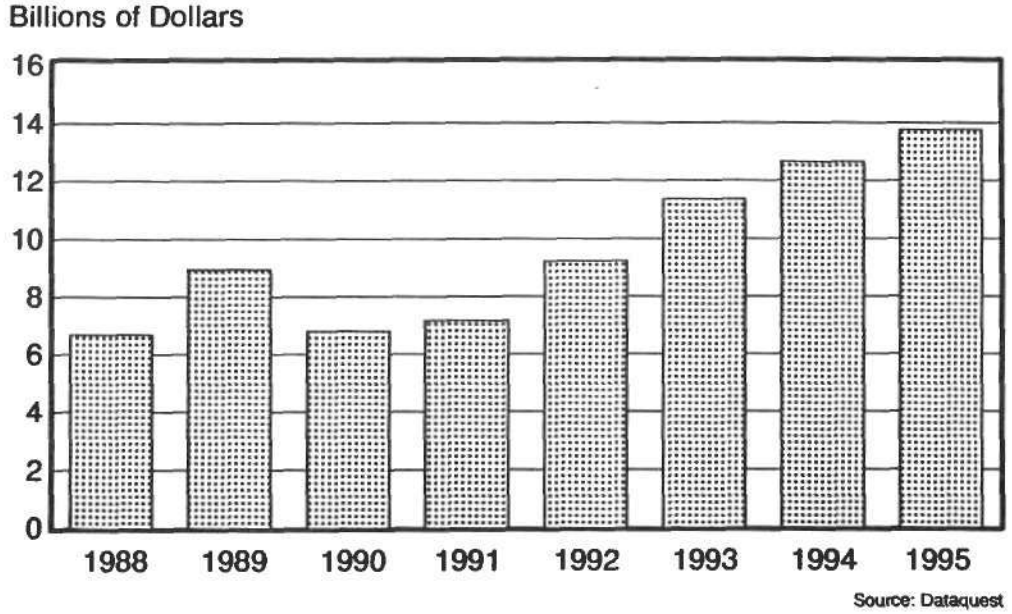
Source: Dataquest

DRAM REVENUE GROWTH



Source: Dataquest

DRAM REVENUE GROWTH

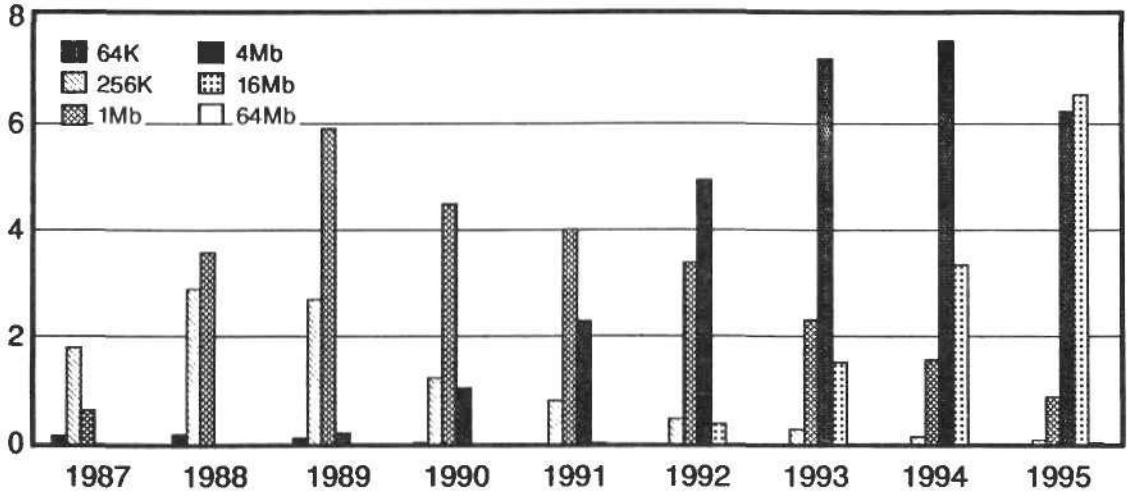


Source: Dataquest

DRAM FORECAST

Revenue

Billions of Dollars

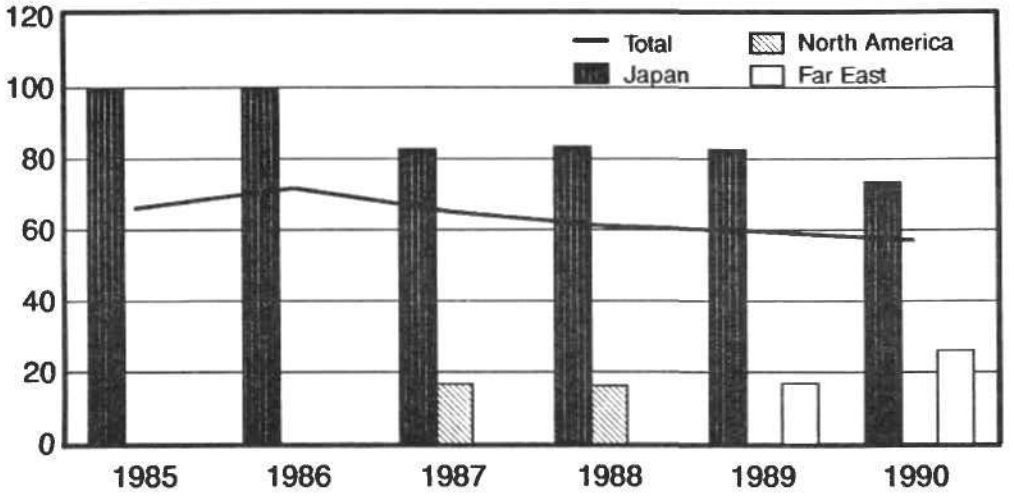


Source: Dataquest

TOP 5 DRAM SUPPLIERS

Market Share

Percentage

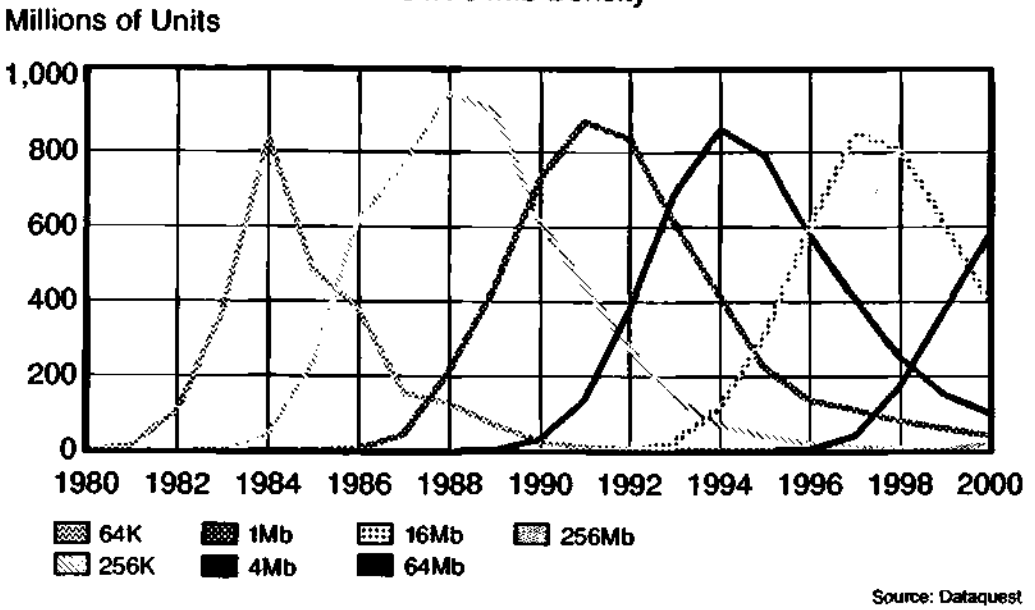


Note: Regions are a percentage of total

Source: Dataquest

UNIT LIFE CYCLES

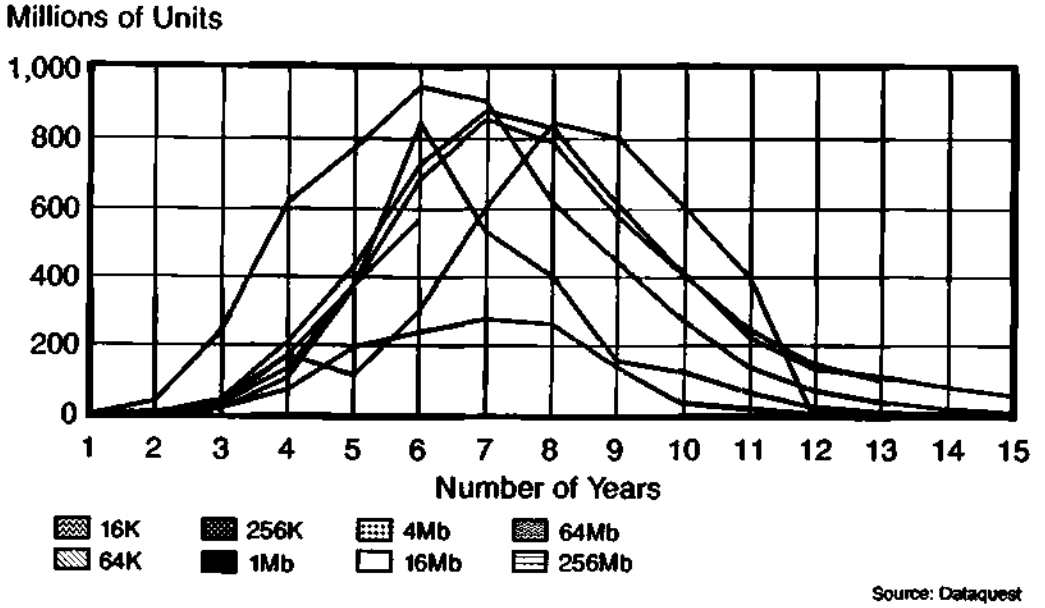
64K-64Mb Density



Source: Dataquest

PRODUCT LIFE CYCLE -- UNIT

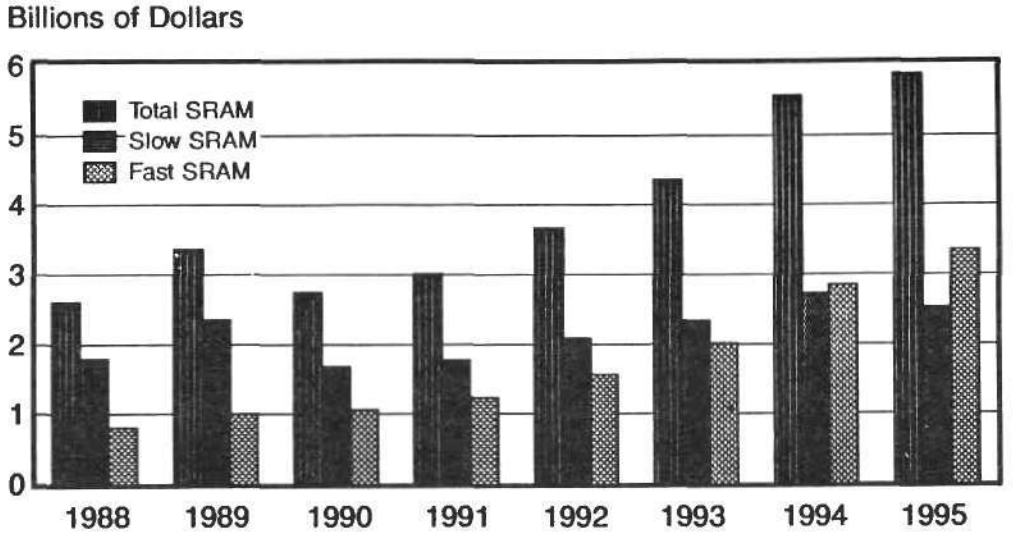
From Introduction Year



Source: Dataquest

SRAM HISTORICAL AND FORECAST

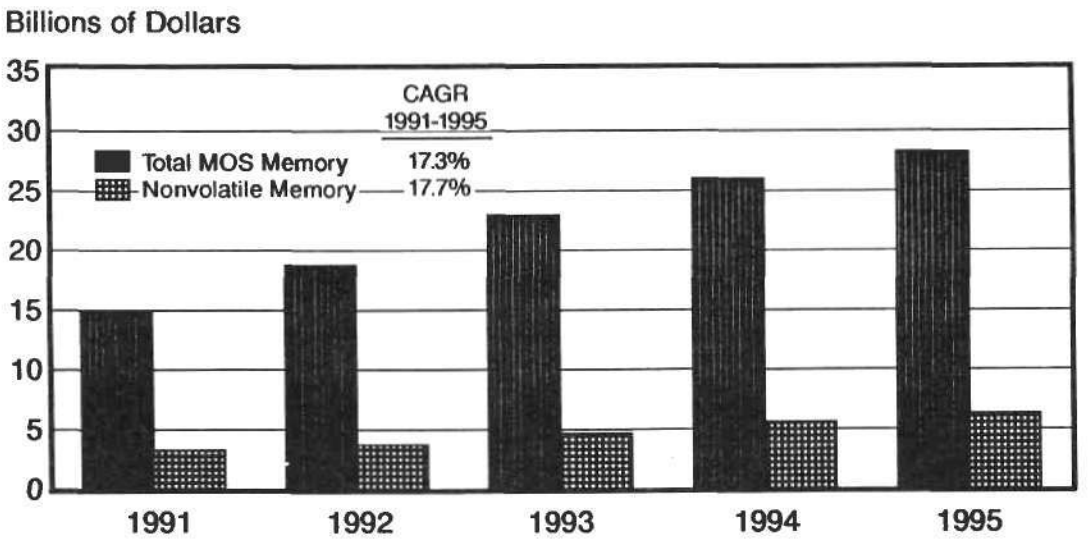
Slow and Fast SRAM



Source: Dataquest

NONVOLATILE MEMORY WORLDWIDE REVENUE

Share of MOS Memory

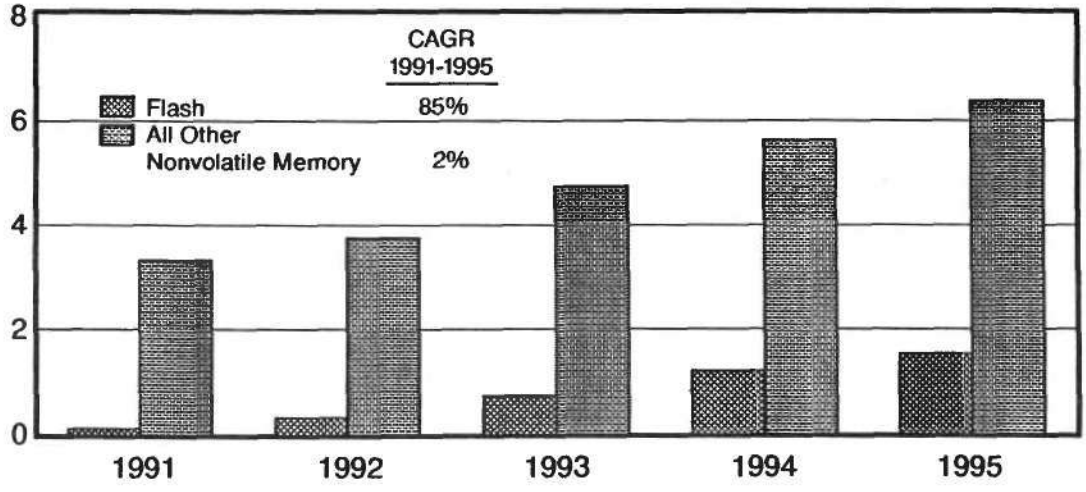


Source: Dataquest

NONVOLATILE MEMORY WORLDWIDE REVENUE

Share of Flash Memory

Billions of Dollars



Source: Dataquest

CHANGING MEMORY MARKET

(Millions of Dollars)

Product Area	1990	1995
Fast SRAM	1,077	3,364
Flash	35	1,500
Wide Word DRAM (>4 bits)	50 (<1%)	5,579 (40%)
Total	1,162	10,443
Total Memory	12,543	26,070
Percent of Total	9.3%	40%

Major revenue shift forecast by 1995

Source: Dataquest

1991 High-Tech Electronics
Industry Conference

The HDTV Market and Its Impact on Technology

Keisuke Yawata
President and Chief Executive Officer
LSI Logic K.K.

Mr. Yawata is President and Chief Executive Officer of LSI Logic K.K., the Japanese affiliate of LSI Logic Corporation. He has been in his present position since 1985. Prior to LSI Logic, he was with NEC Corporation for over 26 years. Mr. Yawata served in the Semiconductor Group of NEC Corporation for a period of 13 years and headed NEC's international Electron Devices Division for eight years. In this capacity, he was responsible for overseas marketing and sales of NEC's electronics components including LSI. From 1981 to 1984, he was President and Chief Executive Officer of NEC Electronics Inc., NEC's affiliate in the United States. He is currently serving as Vice Chairman of SIA Japan Chapter and Director of INSEC. Mr. Yawata holds a B.E. degree in Electrical Communication Engineering from Osaka University and an M.E.E. degree from the Electrical Engineering School of Syracuse University, where he attended on a Fulbright Scholarship. He also received a David Sarnoff Scholarship sponsored by RCA.

HDTV Market and Its Impact on Technology

Keisuke Yawata

President and Chief Executive Officer

LSI Logic K.K.

1. HDTV Market Overview
2. MUSE System and LSI Co-Development
3. ASIC for HDTV
4. ASIC Market Overview

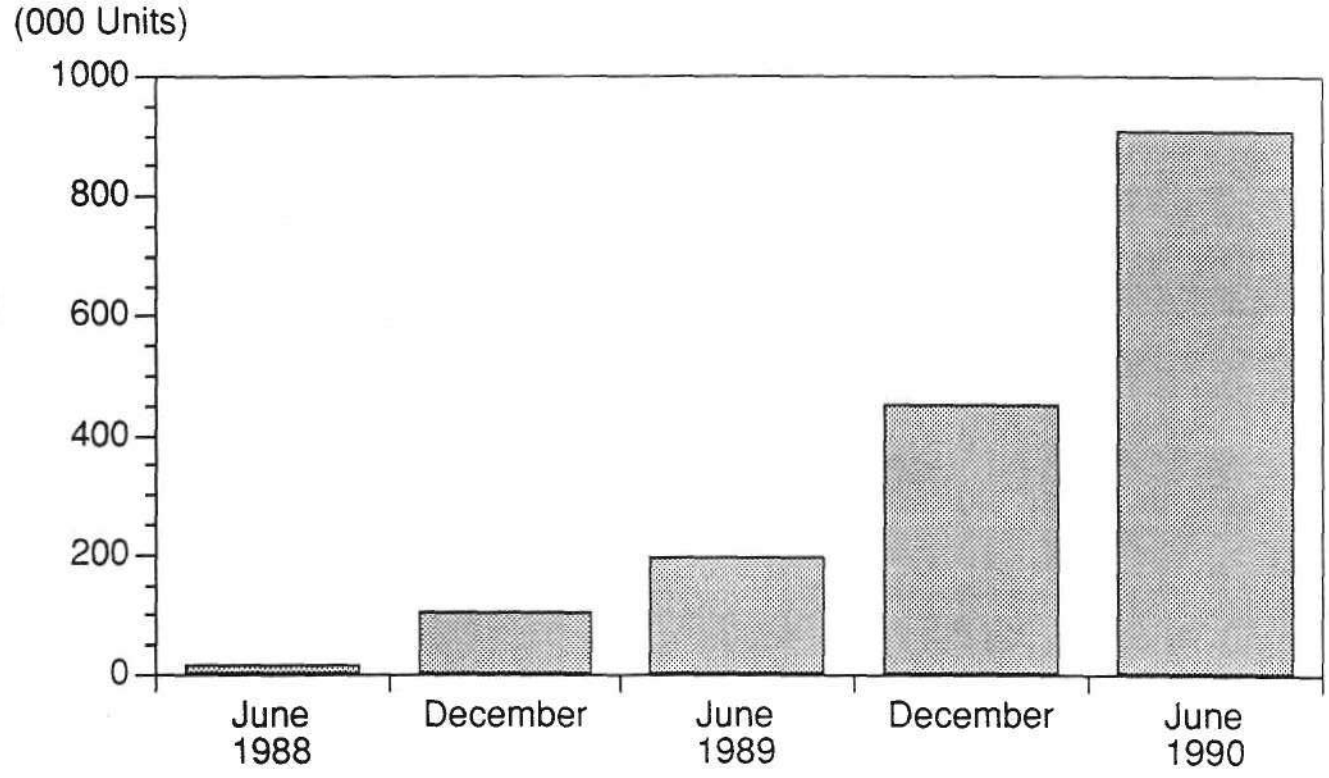
LSI LOGIC

HDTV Market Overview

- High Definition Requires:
  - Digital Technology
  - High Complexity LSI
  - Video Signal Processing
  - High-Resolution Display
  - Low Cost of All of Above

LSI LOGIC

Shipment of TV with Built-In BS Tuner



LSI LOGIC

HDTV Market Overview

- TV Sets with BS Tuner Doubled Every Six Months
- Total Installation 900,000 Sets Mid-1990
- HDTV Set for Home Use Introduced
  - BS-3h and BS-3b Will Assure Commercial HDTV Broadcast
- Promotion Through Olympics, Fairs, Etc.

LSI LOGIC

HDTV Market Overview

- Additional Applications:
  - Medical (Surgery, Endoscope)
  - Education (Art, Bibliography)
  - Entertainment (VCR, Movie Theater, Video Camera)
  - Compressed Laser Disc

LSI LOGIC

HDTV Market Overview

- Standards Issue
- Emerging Technologies Evaluated by FCC
- Software is Key for Entertainment
- Hardware Standardized Through Competition

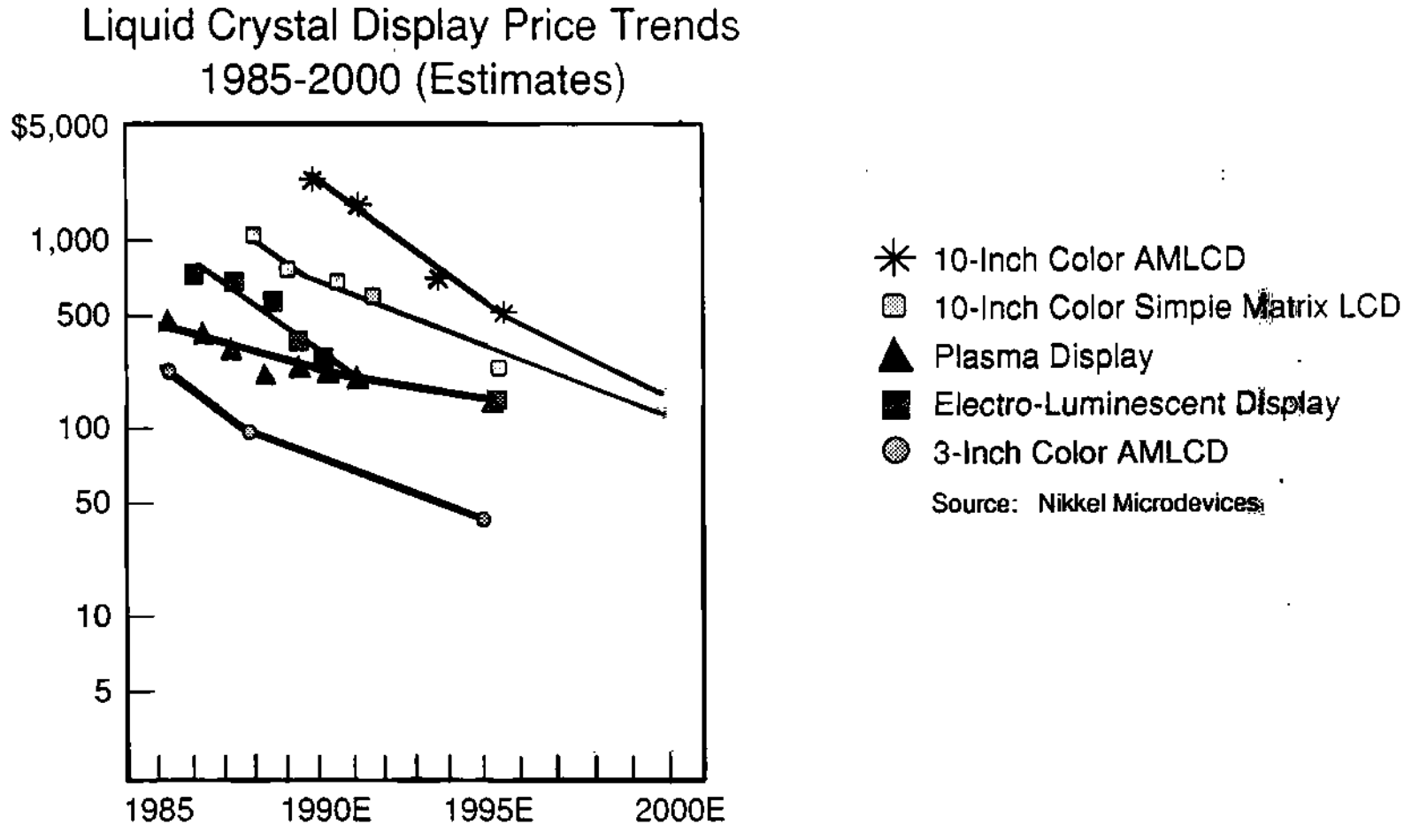
LSI LOGIC

Characteristics of Consumer HDTV

- High-Definition CRT Display
- High Reproducibility (Color, Brightness)
- Clear Picture
- Features for Future Multimedia
- High-Fidelity Sound
- Still Too Expensive for Home Use

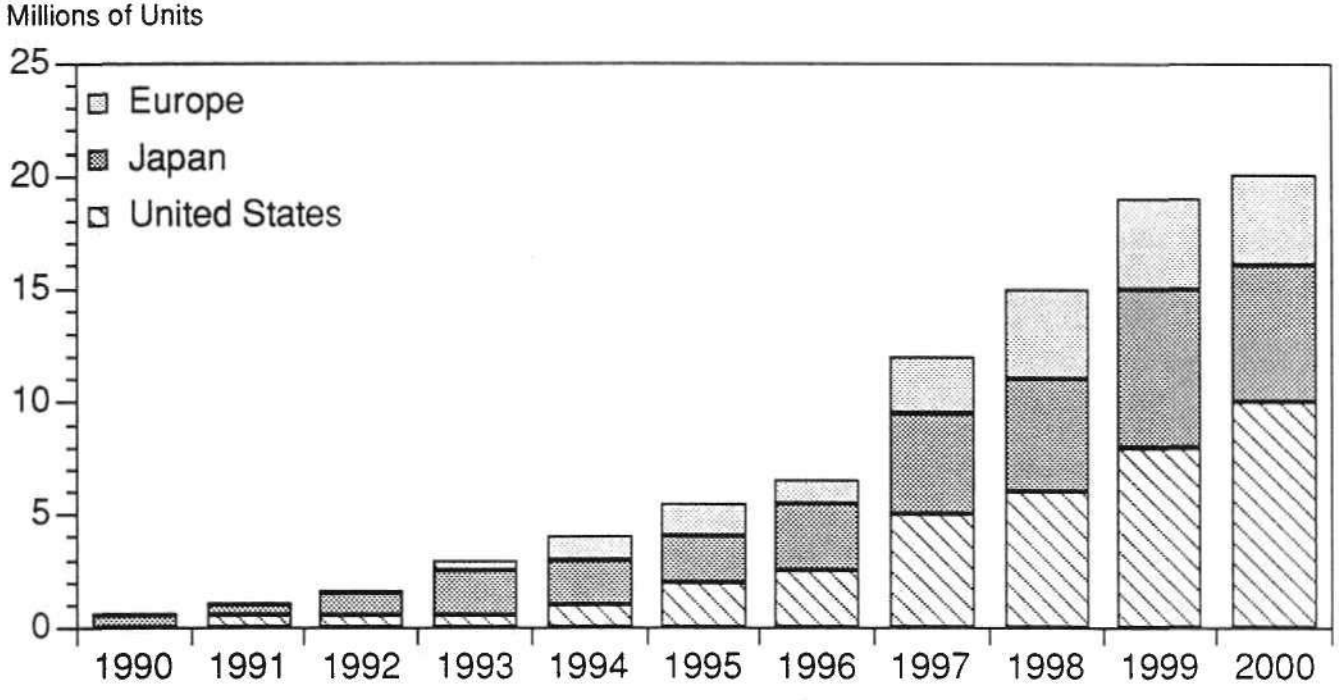
LSI LOGIC

LCD Price Trends



LSI LOGIC

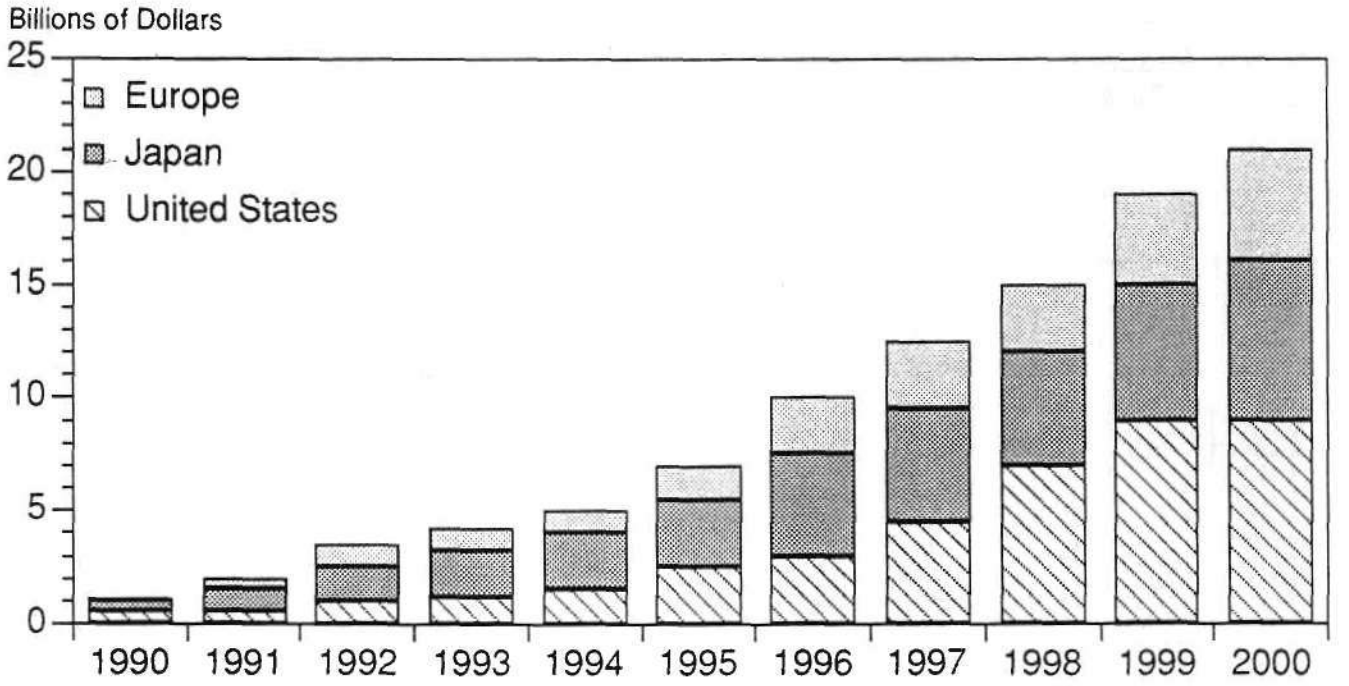
Worldwide HDTV Receiver Unit Forecast



Source: Dataquest

LSI LOGIC

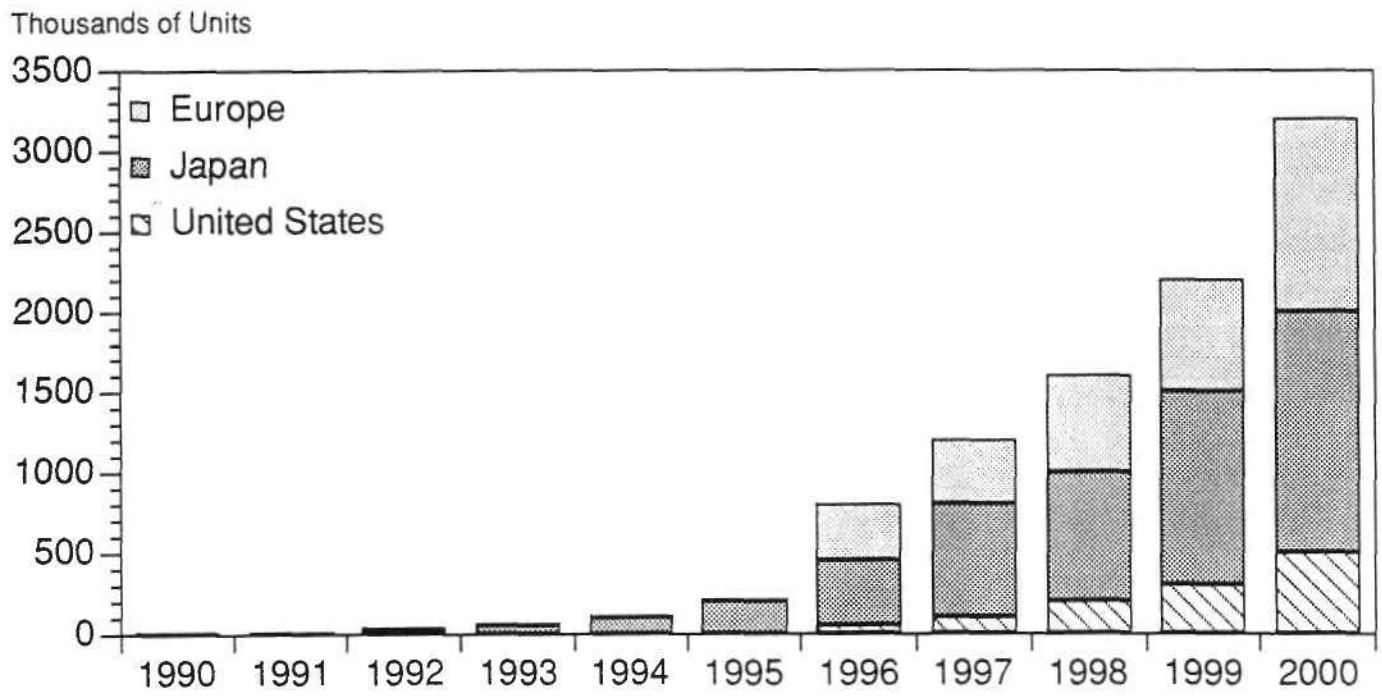
Worldwide HDTV Receiver Revenue Forecast



Source: Dataquest

LSI LOGIC

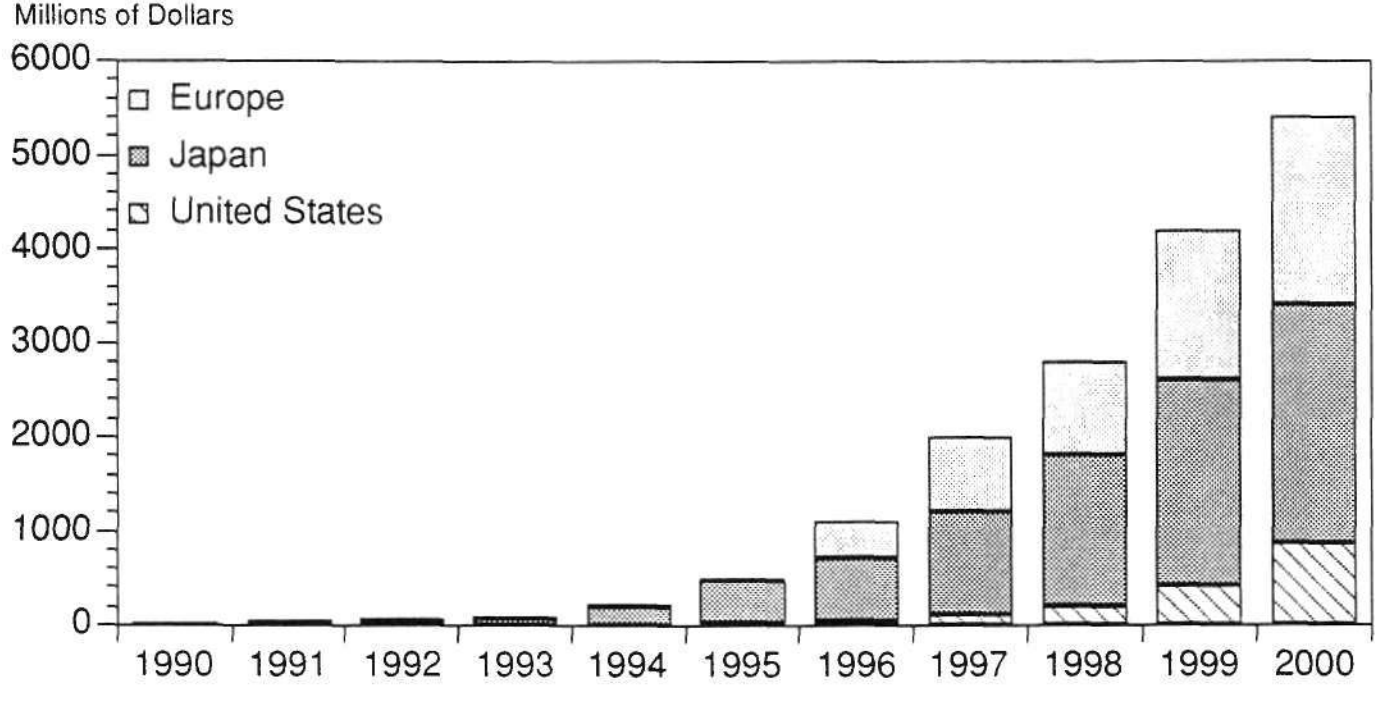
Worldwide HDTV VCR Unit Forecast



Source: Dataquest

LSI LOGIC

Worldwide HDTV Revenue Forecast



Source: Dataquest

LSI LOGIC

MUSE System and LSI Co-Development

- MUSE Technology has been:
  - Shared by Japanese Companies (First Generation)
  - Addressed by HDSCC
  - Introduced at HDTV Symposium
  - Disclosed at Fee by NHK
  - Acquired by a Few Non-Japanese Companies

LSI LOGIC

MUSE System and LSI Co-Development

- Hi-Vision is on Its Way
- Co-Development Efforts Emerging
- HDSCC Motivates Non-Japanese Participation

LSI LOGIC

ASIC for HDTV

- ASIC as Development Tool
- Hi-Vision is in Second Generation
- MUSE Decoder is 95 Percent Digital
- Building-Block Library with Core Circuit
- Digital System on ASIC Accurately Simulated, but. . .

LSI LOGIC

ASIC as Development Tool

- Competition Brings Benefit to Consumer
- Time to Market Key to Success
- Features Change and Addition Easy
- Analog Capabilities Emerging

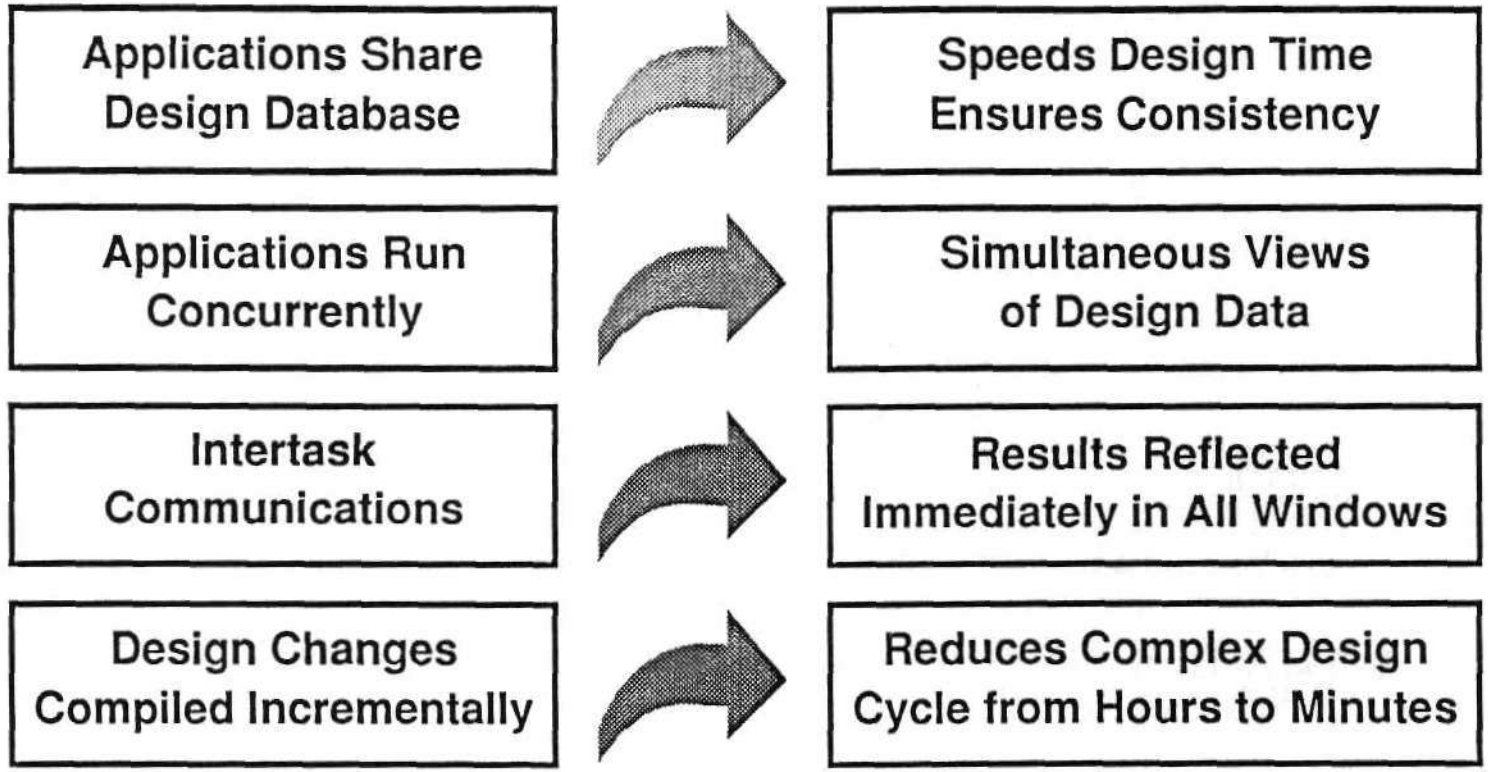
LSI LOGIC

ASIC Market Overview

- Software Capability Expands
- ASIC as Development Tool is Value Added
- ASIC is Total Solution for System
- Both Gate Array and Cell-Based Grow

LSI LOGIC

C-MDE™ System Enhancements



LSI LOGIC

Silicon 1076: A Canvas for Product Creation

- Silicon Systems are Described at High Level in VHDL
- Technology Abstraction Allows Design Tradeoffs to be Evaluated at Early Stages in the Design Process
- Simulation Verifies Subsystem Operation

LSI LOGIC

Silicon 1076: A Canvas (cont'd)

- Designs are Documented in an Orderly Fashion that is Visible to Management
- Final Stages of the Design Process "Bind" the VHDL Description to Physical Silicon Technology through C-MDE™
- Result: Designs can be Re-Targeted to New Technologies or Modified with a Fraction of the Effort Required Previously

LSI LOGIC

ASIC is Total Solution for System

- Software to Simulate System Performance
- Building Blocks to Eliminate Logic Design
- Reduce Total Cost
- Design History Kept in Computer
- System Concept to Product for Market
- Minimum Time to Market
- System Redesign Very Fast

LSI LOGIC

Estimated Worldwide Gate Array Consumption by Region

(Millions of Dollars)

	1987	1988	1989	1990	1991	1992	1993	1994
Worldwide Total	$2,274.9	$2,992.5	$3,766.2	$4,294.6	$5,573.4	$7,187.6	$9,198.5	$10,641.9
MOS	1,408.8	1,940.5	2,500.4	2,789.2	3,634.6	4,612.9	5,716.8	6,400.0
Bipolar	825.1	965.2	1,092.2	1,193.0	1,360.7	1,534.1	1,712.8	1,889.2
BiCMOS	41.0	86.8	173.6	312.4	578.1	1,040.6	1,768.9	2,352.7
Japan	$ 957.7	$1,344.2	$1,717.3	$1,980.1	$2,573.5	$3,307.8	$4,196.3	$4,723.2
MOS	601.5	866.3	1,101.3	1,217.4	1,568.1	1,961.1	2,404.2	2,653.8
Bipolar	321.9	412.4	491.4	551.3	640.3	743.1	846.2	946.7
BiCMOS	34.3	65.5	124.6	211.4	365.1	603.6	945.9	1,122.7
Growth Rate (WW)	31.5%	25.8%	14.0%	30.0%	29.0%	28.0%	15.7%	

Source: Dataquest

LSI LOGIC

Estimated Worldwide Cell-Based IC Consumption by Region

(Millions of Dollars)

	1987	1988	1989	1990	1991	1992	1993	1994
Worldwide Total	$949.5	$1,266.2	$1,551.0	$1,753.1	$2,298.8	$3,094.4	$3,994.2	$4,731.7
MOS	912.9	1,214.4	1,481.5	1,659.4	2,153.9	2,843.1	3,553.7	4,015.8
Bipolar	36.6	50.8	64.5	74.7	93.9	126.3	159.2	181.5
BiCMOS	0	1.0	5.0	19.0	51.0	125.0	281.3	534.4
Japan	$141.3	$206.5	$264.2	$301.8	$406.8	$566.4	$759.3	$937.1
MOS	136.2	198.4	253.0	283.8	373.7	499.0	627.3	703.3
Bipolar	5.1	8.1	10.2	13.0	17.1	24.1	32.7	39.4
BiCMOS	0	0	1.0	5.0	16.0	43.3	99.3	194.4
Growth Rate (WW)	33.3%	22.5%	13.0%	31.1%	34.6%	29.1%	18.5%	

CCA108P, 15
02/26/91

LSI LOGIC

1991 High-Tech Electronics
Industry Conference

Computer Systems, Workstations and Servers

Carl Flock
Director
Computer Systems Group
Dataquest Incorporated

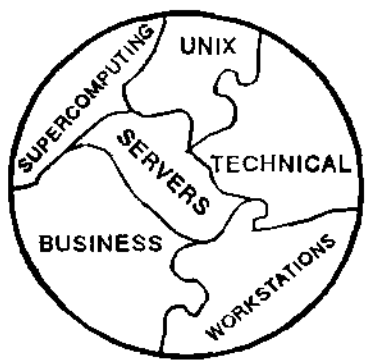
Mr. Flock, Director of Dataquest's Computer Systems Group (CSG), is responsible for the Business Computer Systems Industry Service (BCSIS), Technical Computer Systems Industry Service (TCSIS), and UNIX Systems Software Service (USSS).

Before joining Dataquest, Mr. Flock spent 17 years at Hewlett-Packard (HP) Company, most recently as Marketing Manager of the Technical Computer Group. In that position, he led strategic planning and product management for the introduction of HP's RISC architecture-based UNIX computers. Previously at HP, he held various positions in marketing management and product marketing management dealing with technical systems, commercial systems, personal computers, and peripherals. Prior to joining HP, Mr. Flock was a Sales District Manager for Com-Share, Inc., and a Senior Sales Representative for General Electric Computer Time-Sharing.

Mr. Flock received a B.S. degree in Physics from the University of Washington and an M.B.A degree from the Graduate School of Management at Brigham Young University.

DATAQUEST'S COMPUTER SYSTEMS SERVICES

COMPUTER SYSTEMS, WORKSTATIONS AND SERVERS



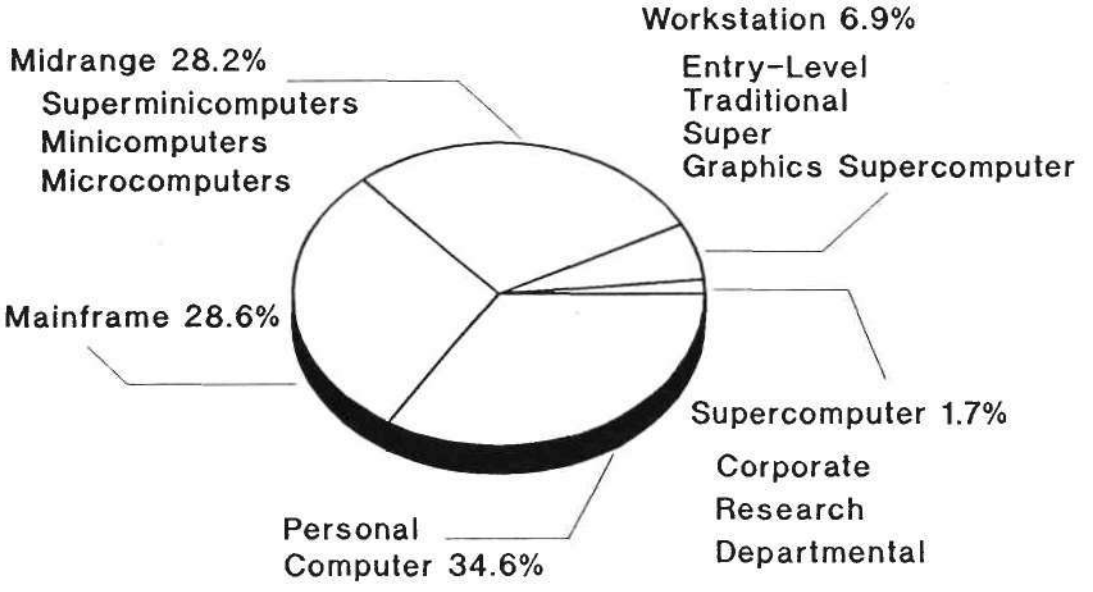
Carl Flock
Director
Computer Systems Services
Dataquest Incorporated

COMPUTER SYSTEMS, WORKSTATIONS AND SERVERS

- Computer Systems
  - Industry evolution
  - Supercomputers
  - Mainframes
  - Midrange
- Workstations
  - Background Information and definitions
  - Current trends and issues
  - Vendor analysis
- Servers
  - Background Information and definitions
  - Market size
  - Trends and issues

THE COMPUTER INDUSTRY

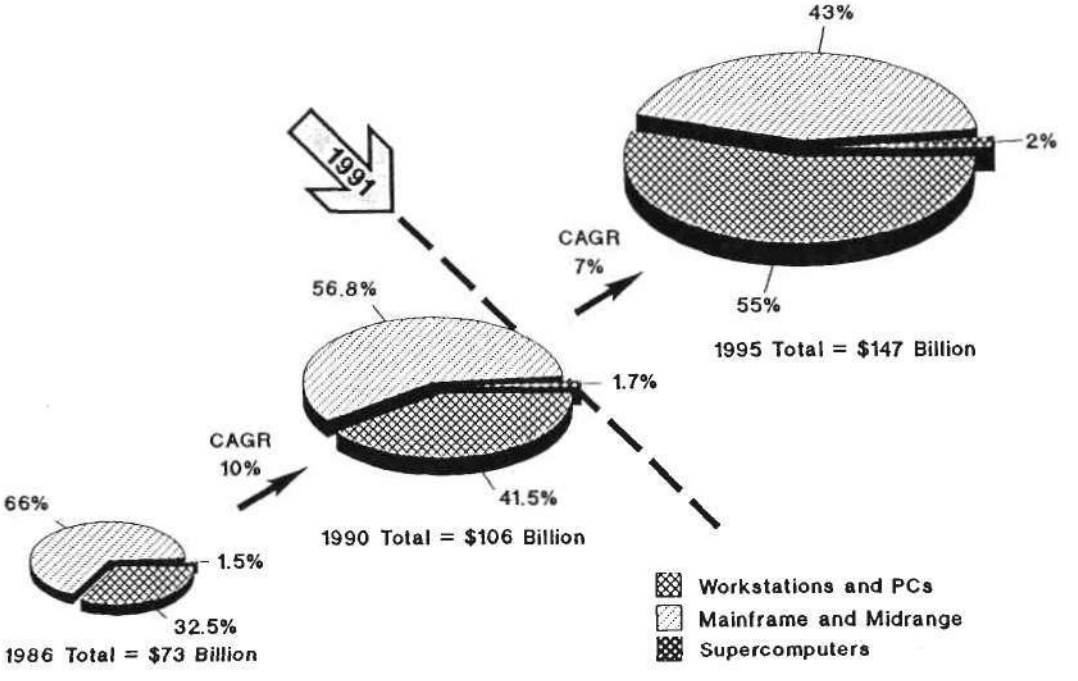
1990 Worldwide Factory Revenue



Total = $106 Billion

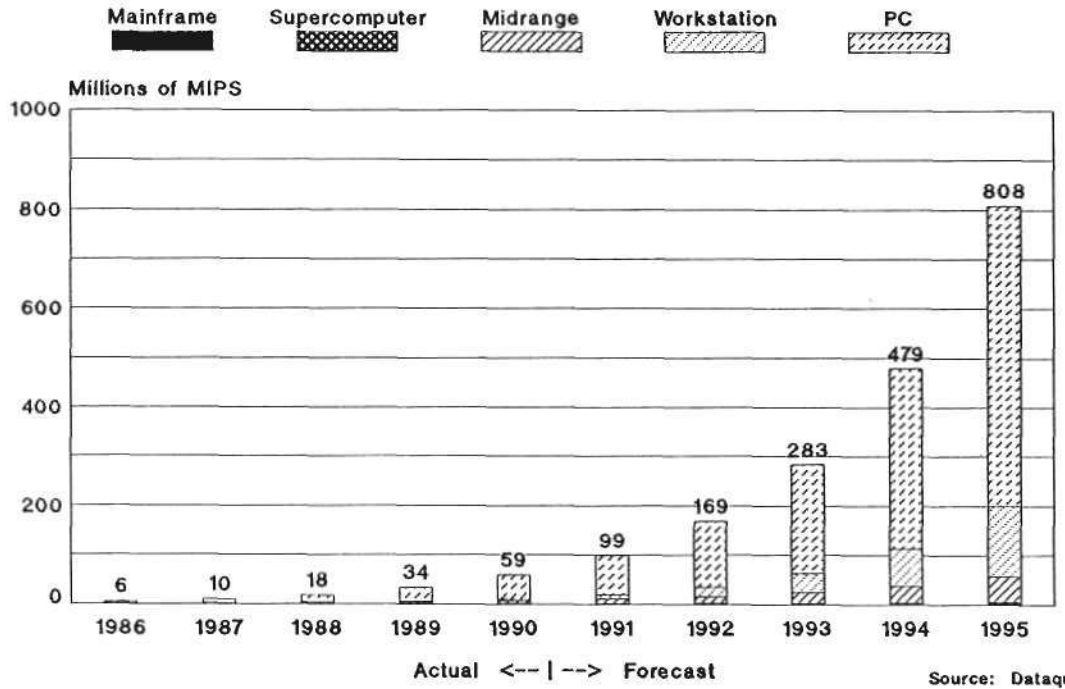
Source: Dataquest

PROJECTED GROWTH IN COMPUTING



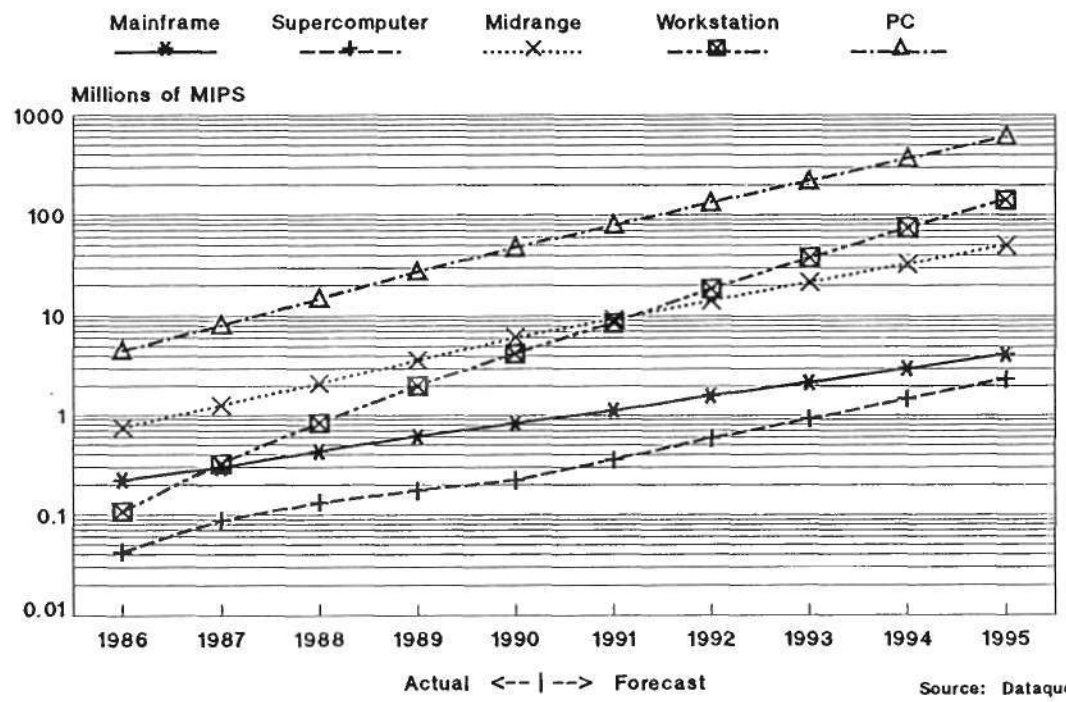
Source: Dataquest

WORLDWIDE COMPUTER SYSTEMS
MIPS Shipped



Source: Dataquest

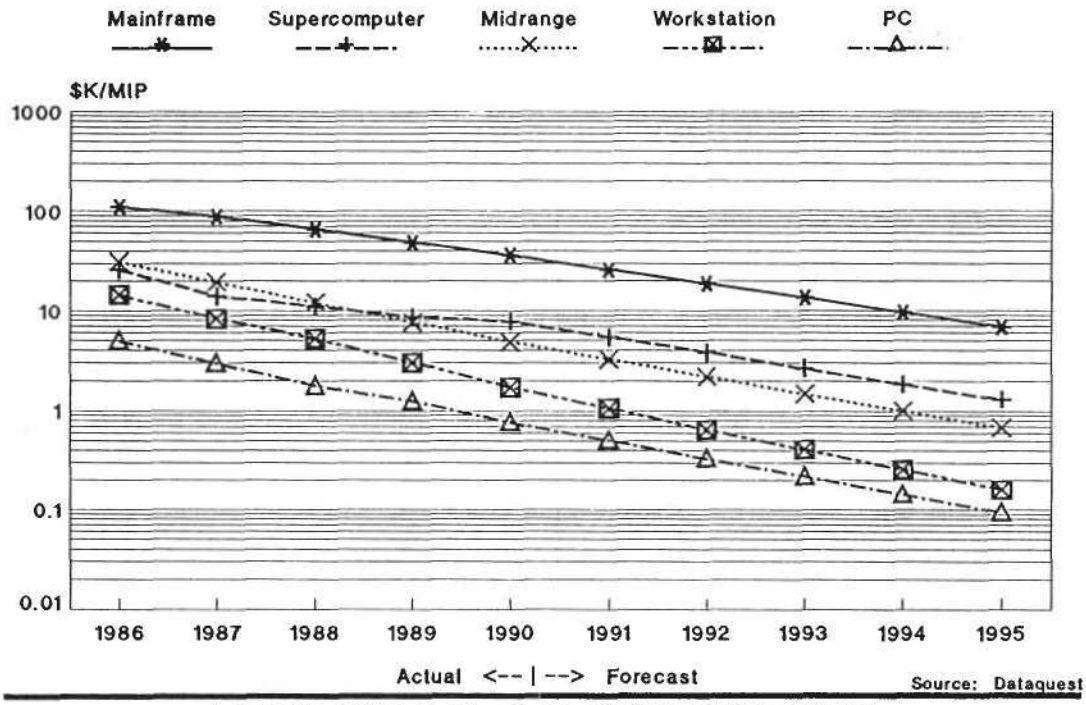
WORLDWIDE COMPUTER SYSTEMS
MIPS Shipped



Source: Dataquest

WORLDWIDE COMPUTER SYSTEMS

$K Per MIP

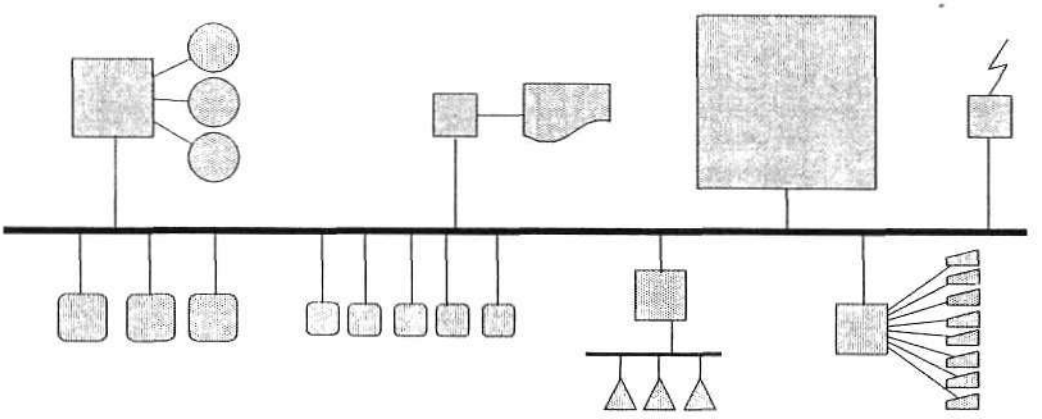


Source: Dataquest

EVOLUTION OF COMPUTING

- Batch--1960s
  - ▲ Jobs submitted and run once/day or once/month
  - ▲ Example: IBM mainframes in accounting or payroll
- Time-sharing--1970s
  - ▲ Perceived by user as a one-user system
  - ▲ Example: Digital's VAX for order entry
- Personal--1980s
  - ▲ Individual control of computer resources
  - ▲ Example: IBM PS/2 doing spreadsheets
- Client/Server--1990s
  - ▲ Combination of all computing styles
  - ▲ Based on standards

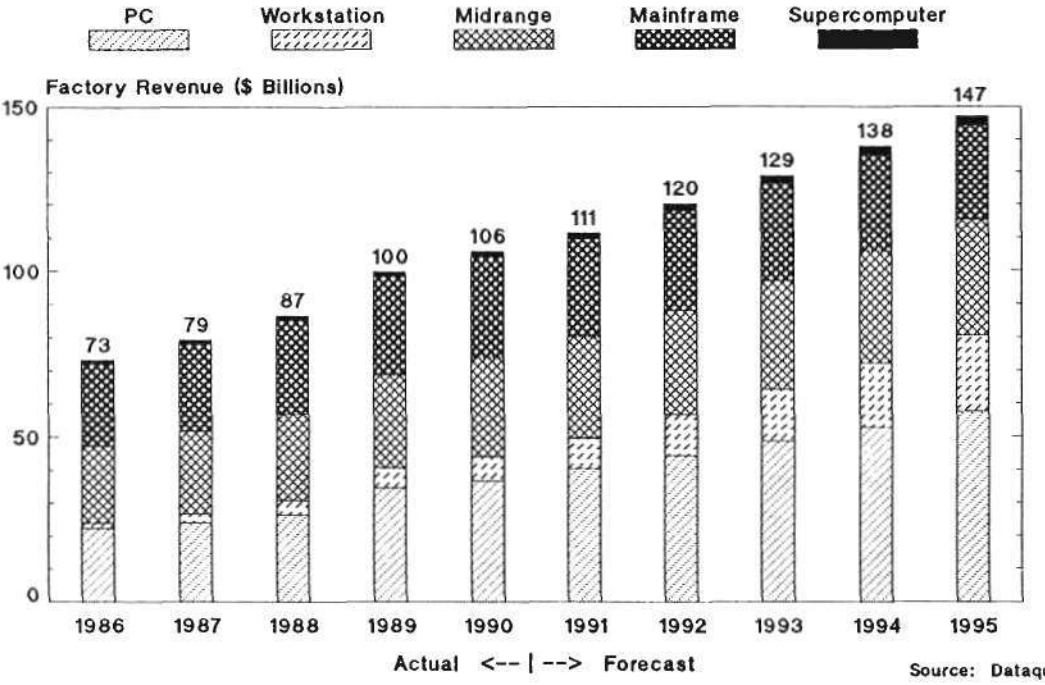
CLIENT/SERVER COMPUTING STYLE



Source: Dataquest

WORLDWIDE COMPUTER SYSTEMS

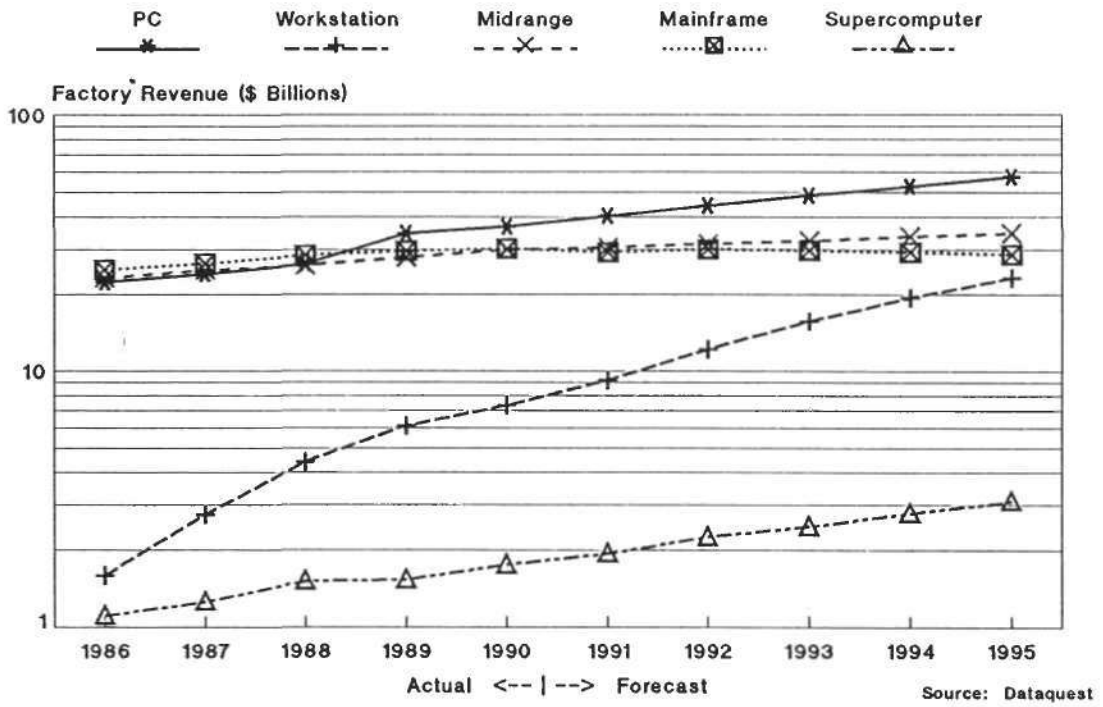
Product Segmentation



Source: Dataquest

WORLDWIDE COMPUTER SYSTEMS

Product Segmentation

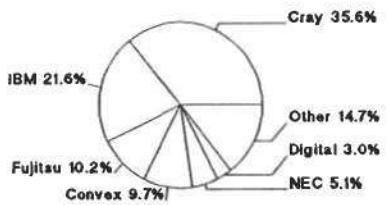


Source: Dataquest

WORLDWIDE COMPUTER SYSTEMS

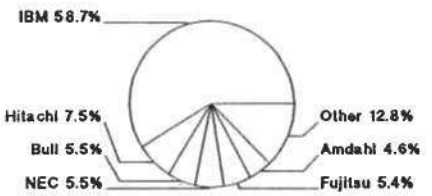
1990 Revenue Share

Supercomputer



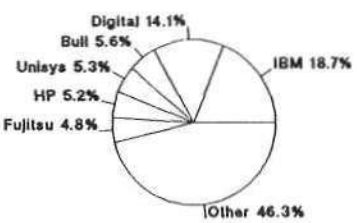
Total Revenue = $1.76 Billion

Mainframe



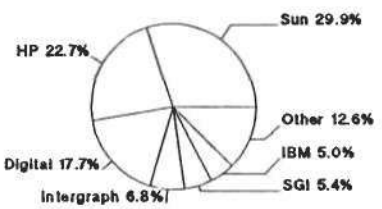
Total Revenue = $30.30 Billion

Midrange



Total Revenue = $29.93 Billion

Workstation



Total Revenue = $7.36 Billion

Source: Dataquest

SUPERCOMPUTING PERSPECTIVE

- Primary competition is "wet bench" science and engineering
- Applications software is key to growth
- Integration into larger computing environment required
- Identity of supercomputers vs. general systems is blurring

MAINFRAME PERSPECTIVE

- Facing market maturity
- Realigning of roles
- Downsizing not an issue, but people are experimenting
- Consolidating data centers is key trend
- Growing emphasis on transactions
- Ramp-up of IBM's ES/9000
- Experiencing a lot of price pressure

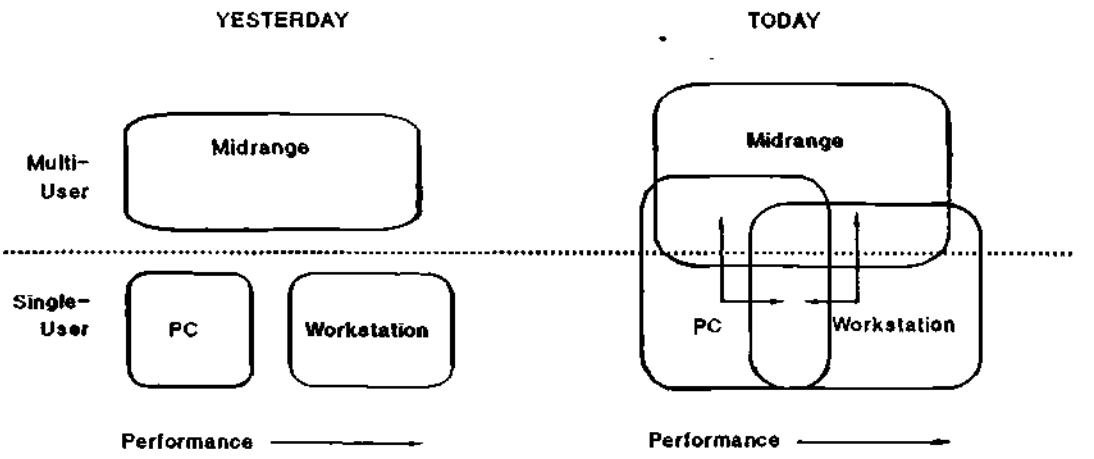
MIDRANGE PERSPECTIVE

- Many new technologies raced into marketplace
- Solution selling will help maintain proprietary
- Standards are here, and proprietary systems are being drawn in
- Servers will be a cornerstone

WORKSTATIONS

- Background Information and Definitions
- Current Trends and Issues
- Vendor Analysis

PROBLEMS WITH DEFINITIONS



DEFINITION OF "WORKSTATION"

What's included?

- Workstations used as clients
- Workstations used as servers

What's Not?

- Systems designed to be servers
- Workstations sold as multi-user systems
- PCs

WHAT IS A WORKSTATION?

A complete standalone computer with ***standard:***

- Integrated graphics
- Integrated floating-point processor
- Distributed networking
- Windows, keyboard, mouse, etc.
- UNIX or other demand-paged virtual memory operating system (eg. VMS)

WHAT IS A PERSONAL COMPUTER?

A complete standalone computer with ***optional:***

- Integrated graphics
- Integrated floating-point processor
- Distributed networking
- Windows, keyboard, mouse, etc.
- DOS, Mac, OS/2, (or UNIX) operating system.

WORKSTATIONS TRENDS AND ISSUES

- Battle for dominance on the desktop
- Growth in business applications
- Software revenue plays a greater role
- Technological innovations

BATTLE FOR DOMINANCE ON THE DESKTOP

- Intel x86 DOS based PCs
- Apple Mac PCs
- ACE (Compaq, MIPS, Digital, Microsoft and others)
- SPARC
- Other (HP-PA, Clipper, IBM POWER, 88000)

SPARC–BASED SYSTEMS

SPARC Clone Vendors

- AFE Computers
- Chicony
- CompuAdd
- DCM Data Products
- DTK Computer
- Fusion Systems
- Goldstar
- Hyundai
- Intelecsis
- Opus Systems
- Sampo
- Tatung
- TriGem
- Twinhead

SPARC Value-Added Vendors

- Mars Microsystem/Tantung
- RDI/TriGem
- Solarix
- Solbourne
- Sun Microsystems
- Tadpole Technologies
- Toshiba

SPARC Midrange Server Vendors

- Amdahl
- FPS Computing
- ICL
- Meiko
- Solbourne
- Sun Microsystems
- Star Technology

SPARC A PC CLONE REPLAY?

Growth Factors:

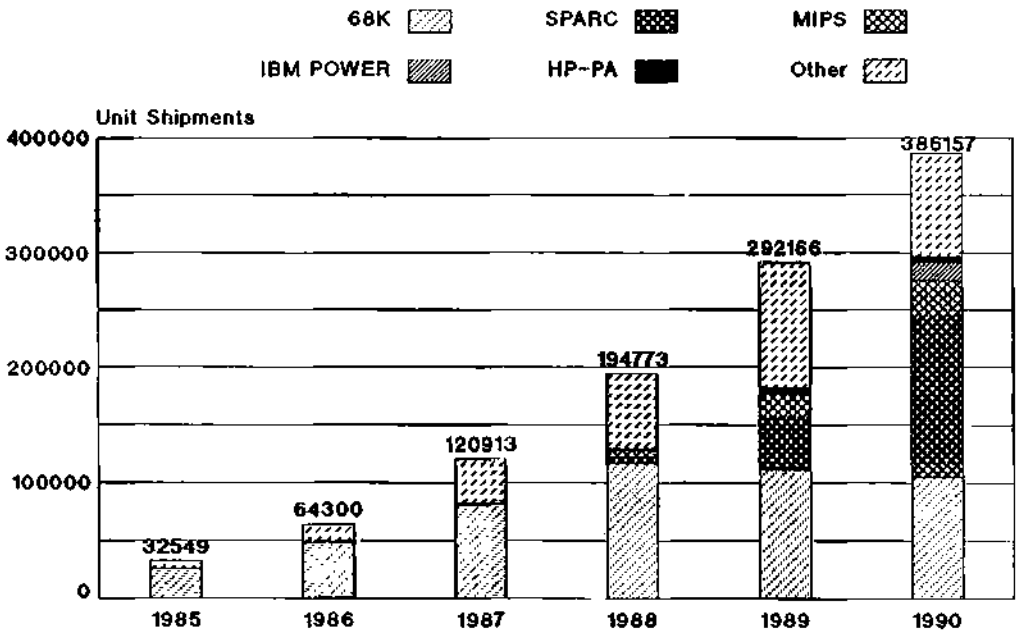
- Sun's market leadership
- Number of clone vendors
- Manufacturing capabilities
- Intel/IBM x86/PS2 proprietary
- Rapid time to market
- Chipset
- Sun OS/SVR4
- Software availability

Drag Factors:

- Installed base of 115+ million PCs
- Competitive architectures: Intel, MIPS, IBM etc.
- More than 20,000 DOS-based software applications
- Not UNIX savvy
- Lack of distribution channels
- UNIX software application pricing and availability

WORLDWIDE WORKSTATIONS

By Processor



Source: Dataquest

RISC WORKSTATIONS

	1990 Revenue ($K)		1990 Unit Shipments	
HP-PA	323.9	7.6%	6079	2.8%
IBM Power	353.1	8.3%	15410	7.1%
MIPS	790.7	18.6%	31496	14.6%
SPARC	2155.3	50.6%	139580	64.5%
Other	635.1	14.9%	23733	11.0%
TOTAL	4258.1	100.0%	216298	100.0%

Source: Dataquest

BUSINESS MARKETS--HYPE OR REALITY?

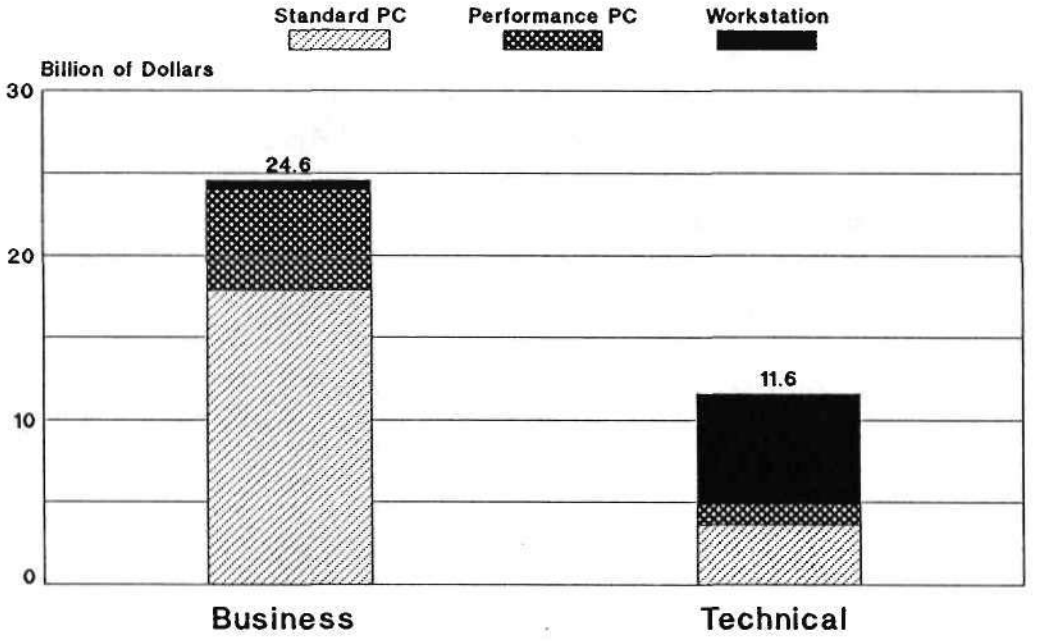
- Small market for workstations today
- Biggest opportunity for future
- Ease-of-use features and software by 1992/1993
- Systems Integrators, VARs and Dealers by 1992/93

CURRENT "BUSINESS" APPLICATIONS

- High-end applications
  - Stock trader workstations
  - Insurance companies
  - Document imaging
- Software development

WORLDWIDE WORKSTATIONS AND PC'S

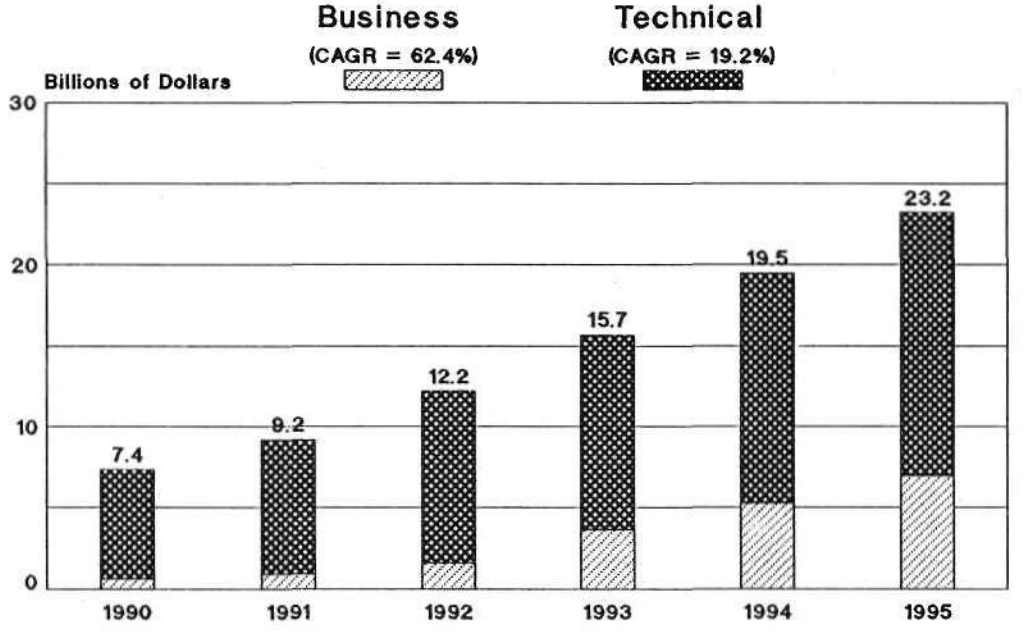
1990 Factory Revenue



Source: Dataquest

WORLDWIDE WORKSTATIONS

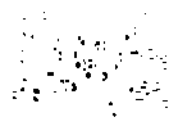
Technical/Business Revenue Forecast



Source: Dataquest

SOFTWARE REVENUE PLAYES GREATER ROLE

- HP reorganizes
  - Ports SoftBench and HP VUE to SPARCstations
- Sun reorganizes
  - Creates SunSoft and SunTech
- Intergraph port CAD software to SPARCstations

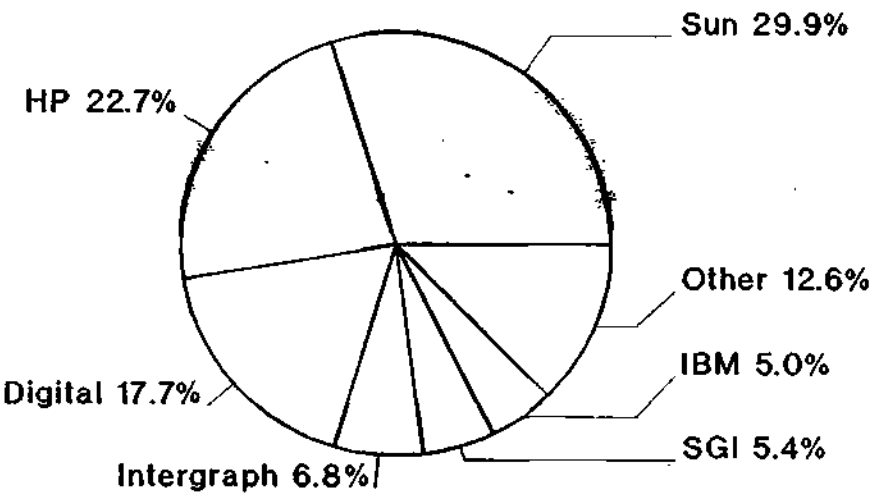


TECHNOLOGICAL INNOVATIONS

- LAPstations
- Superscalar, superpipeline architectures
- Better upgradability
  - Processor cards
  - MBus
  - Multiprocessing

WORKSTATION VENDOR ANALYSIS

1990 REVENUE SHARE



Total Revenue = $7.36 Billion

Source: Dataquest

SUN MICROSYSTEMS, INC.

Strengths 1990:

- Market leader
- SPARC clone strategy
- Full family of low-end desktop poducts
- Improved 3D graphics capabilities

Challanges 1991 and beyond:

- Develop distribution channels for business markets
- Not lose market share to SPARC clones or IBM
- Improve service and support
- Multiprocessor servers

HEWLETT–PACKARD COMPANY

Strengths 1990:

- Maintained its #2 position
- Multinational presence
- High quality/high reliability products
- 3D graphics capabilities

Challanges 1991 and beyond:

- Eliminate product transition problems
- Eliminate problems with integration of Apollo with HP
- Transition from Motorola to HP-PA
- Keep its new price/performance lead

DIGITAL EQUIPMENT CORPORATION

Strengths 1990:

- Agressive ISV program (1700+ packages)
- 3D graphics improvements
- Full family of MIPS based products

Challanges 1991 and beyond:

- Support of two architectures (VAX & MIPS)
- Need attention grabbing announcement
- Not to lose installed base in technical environment
- Sales incentive to push MIPS product family

INTERGRAPH CORPORATION

Strengths 1990:

- Strong presence in CAD/CAM and Mapping
- Customer service and support
- Excellent software business

Challanges 1991 and beyond:

- Support of two architectures (Clipper & SPARC)
- Maintain growth from software revenue

SILICON GRAPHICS, INC.

Strengths 1990:

- Maintained leadership in high-end graphics
- High growth workstation vendor
- Focused business strategy

Challanges 1991 and beyond:

- Increased competition in low-end 3D graphics
- Capitalize on 3D supremancy
- Push the low-end price barrier
- Add general purpose applications to software base

IBM CORPORATION

Strengths 1990:

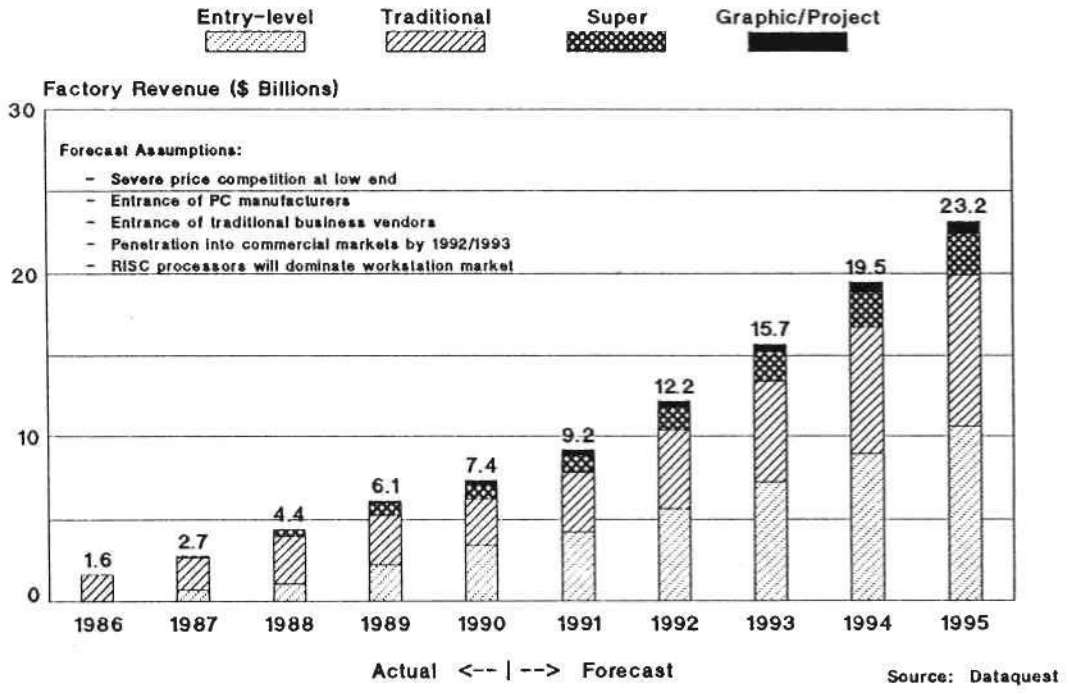
- Excellent price/performance ("HOT" box of 1990)
- ISV support (3000+ packages)
- Acceptance of RS6000 by marketplace
- Demand from both corporate and engineers

Challanges 1991 and beyond:

- Not to impact AS400 and high-end PS/2 sales
- Offer low-end workstation

WORLDWIDE WORKSTATIONS

Product Segmentation



WORKSTATION PERSPECTIVE

- Continued fast market growth
- Price pressure--upward and downward
- Product migration across full range
- 1 to 30 performance and price span
- Migration from technical to business markets
- PC collision
- Rapidly growing server market

SERVERS

- Background information and definitions
- Market size
- Trends and issues

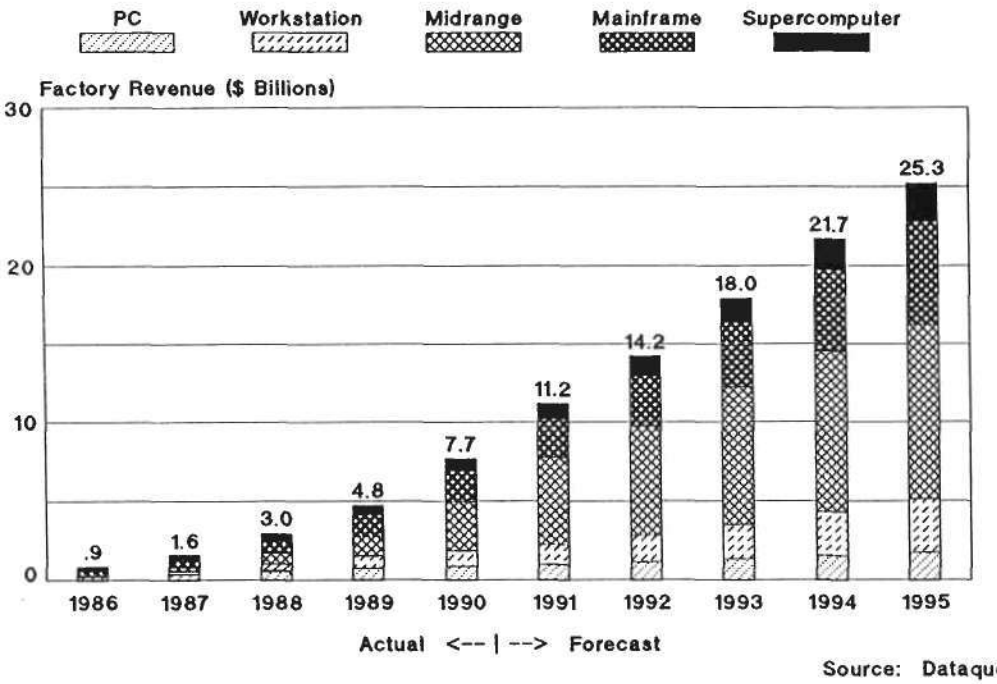
DEFINITIONS

- A server is a computer system that can transparently provide its resources to other computer systems. It is a system, on a network, that provides specific to other computer systems: the clients. Functions include file storage, database access, compute capability, as well as others.

- A client is a computer system that can extend its capabilities by drawing on the resources of the server(s). Client processors provide the point of entry for users. The client accesses the server in an on-demand basis, usually transparently to the client's user.

WORLDWIDE SERVERS

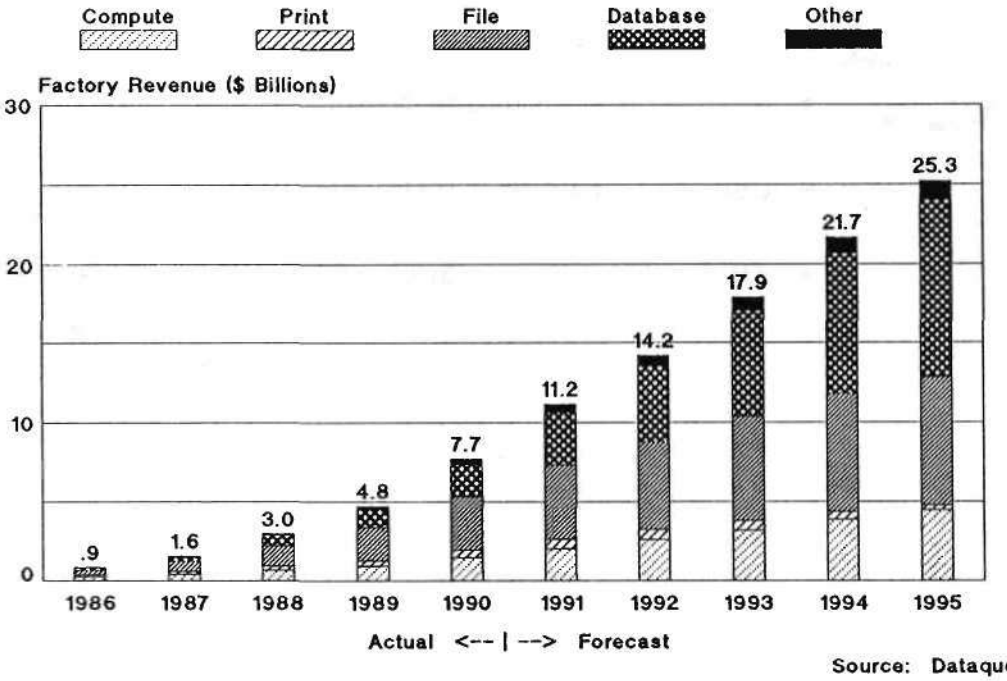
Product Segmentation



Source: Dataquest

WORLDWIDE SERVERS

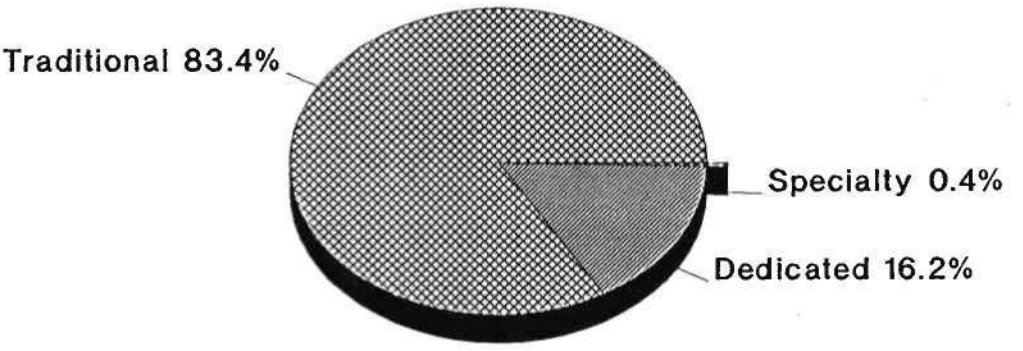
Server Sub-segments



Source: Dataquest

WHERE IS THE MONEY?

1990 Worldwide Revenue



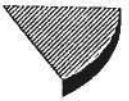
Total Revenue = $7.7 Billion

Source: Dataquest

TRADITIONAL SERVERS – TRENDS & ISSUES

- Measured on a usage basis
- Usually retro-fitted to be servers
- Although market is declining in relative size this reflects decline in traditional computing style
- A lot of companies are in the server business by default
- Some companies are lumbering to define a strategy, some are rewriting history

DEDICATED SERVERS – TRENDS & ISSUES

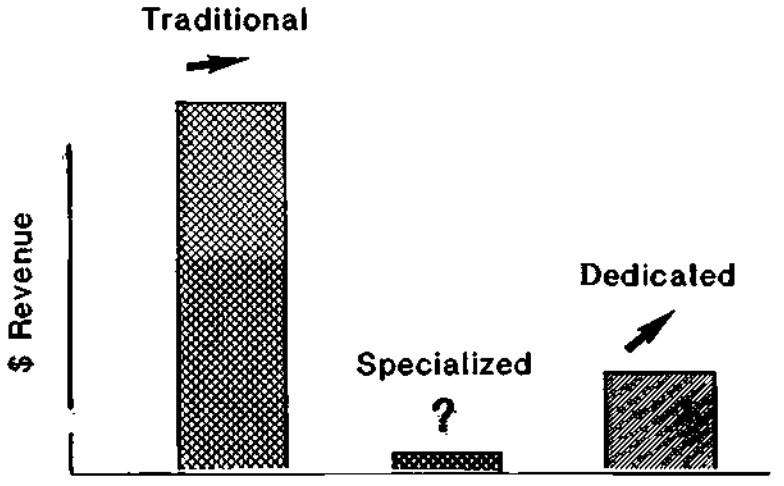


- Huge success and biggest growth opportunity
- Fastest growing segment
- Easy to leverage into installed base
- Product differences are mainly configuration and S/W
- Provides good measure for company server business
- Good PR tool for depicting progressive company image

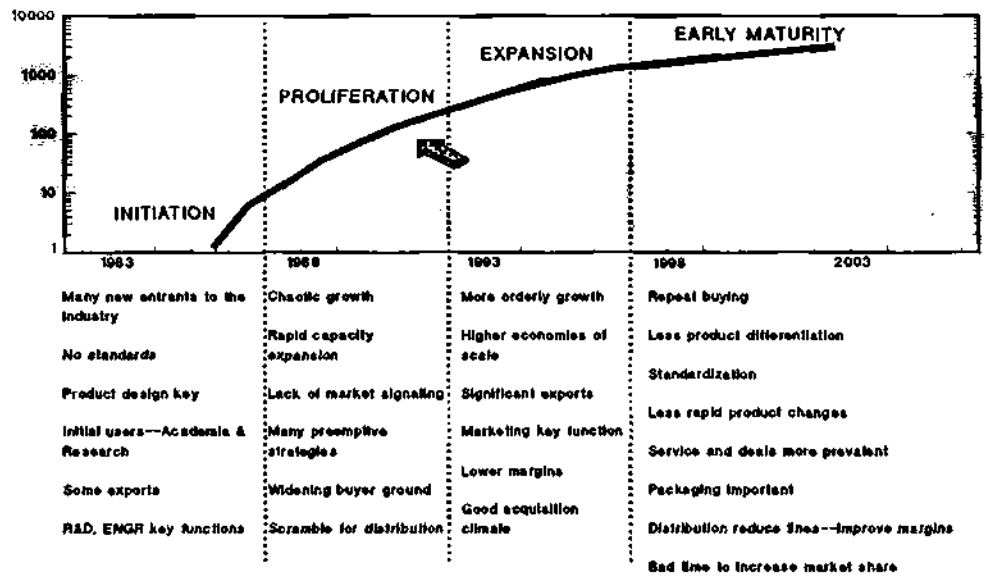
SPECIALIZED SERVERS – TRENDS & ISSUES

- Have all the media attention
- At one time, some thought this market would hit a grand slam--some are still waiting
- Haven't resolved distribution issues yet
- Has the market passed them by?

AREA FOR FUTURE INVESTMENT



SERVER MARKET EVOLUTION



SERVER MARKET SHARE

Product Segmentation

#	Supercomputer	Mainframe	Midrange	Workstation
1	Cray	IBM	DEC	Sun
2	IBM	Hitachi	IBM	HP
3	Fujitsu	Amdahl	HP	DEC
4	Convex	NEC	Compaq	SGI

Source: Dataquest

SERVER MARKET SHARE

Server Sub-segments

#	Database	File	Print	Compute	Other
1	IBM	IBM	Low PC	IBM	IBM
2	DEC	DEC	High PC	Cray	DEC
3	HP	HP	DEC	Sun	HP
4	NEC	Sun	IBM	DEC	SGI

Source: Dataquest

SERVER PERSPECTIVE

- Server definition needs to be meaningful
- Server markets cross all technologies
- General-purpose vendors are leading revenue earners, but often by default
- Biggest incremental revenue is in dedicated systems
- Users are buying but are waiting to be led
- Industry is on cusp between market stages of growth, significant market issues result from this
- 1991 is a make or break year for specialty companies

OVERALL PERSPECTIVE

- Mainframes and Midrange realign as database and file servers
- Solution selling is hope for proprietary systems
- PCs and workstations used to extend human mind to the computer system
- Standards are here
- Client/Server computing is the style in 1990s
- Global presence directly or through alliance is required

1991 High-Tech Electronics
Industry Conference

Current Status of Computer Storage Industry

Phil Devin
Director
Computer Storage Industry Service
Dataquest Incorporated

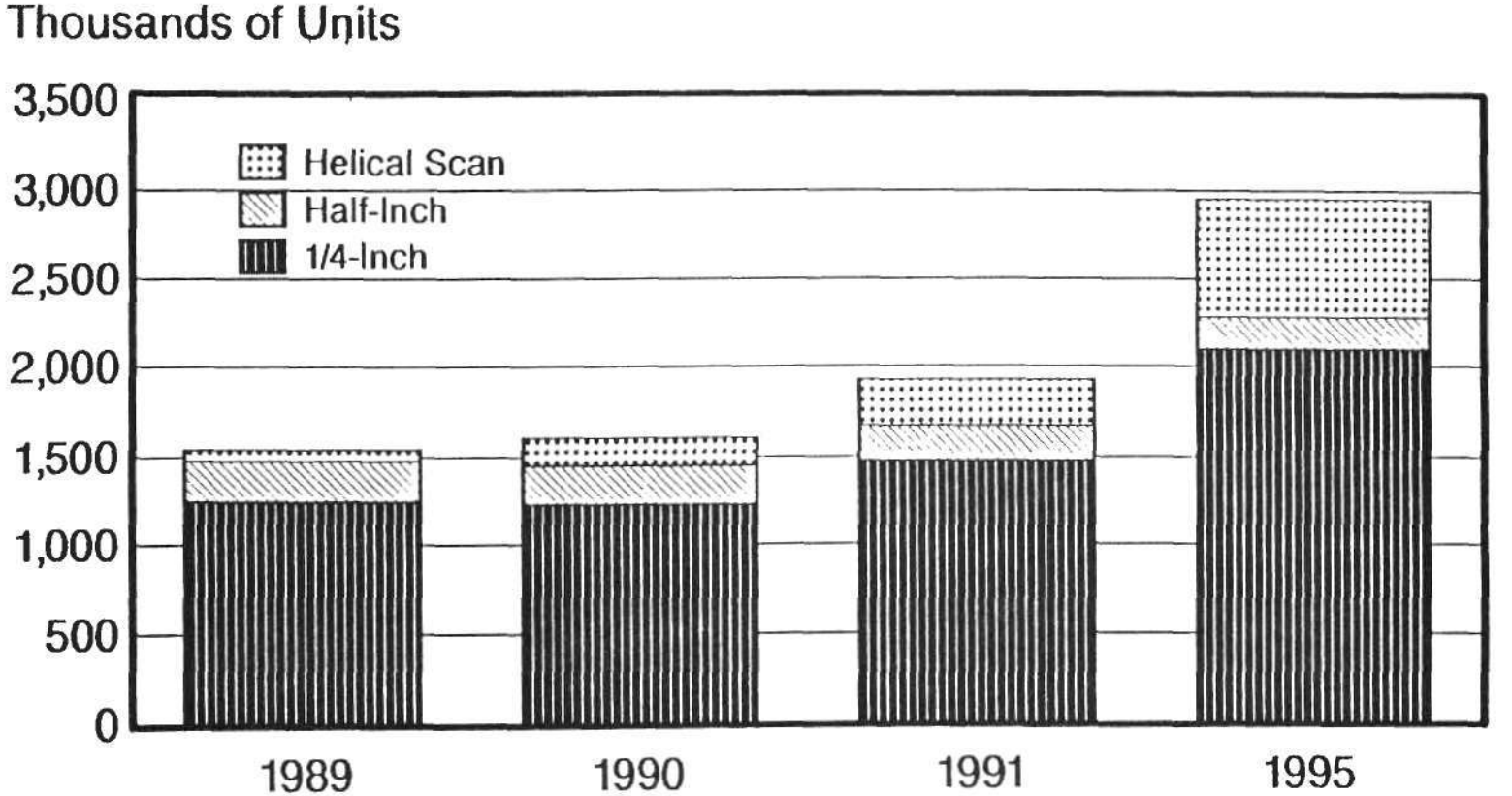
Mr. Devin is Director of Dataquest's Computer Storage industry service. His primary responsibilities are analyses of small-diameter rigid disk drives in the computer storage industry. He also handles company analyses, consulting reports, and client projects. Mr. Devin has 27 years of experience in the computer industry, in positions ranging from early process control system design to marketing management in the computer storage industry. He has been an active member of ANSI subcommittees. Mr. Devin received a bachelor's degree in Engineering from Iowa State University.

AGENDA

- Forecasts and trends
- Total tape market
- 1/4-inch cartridge
- Helical scan
- Half-inch R/R and cartridge
- Summary and conclusions

TOTAL TAPE DRIVE MARKET

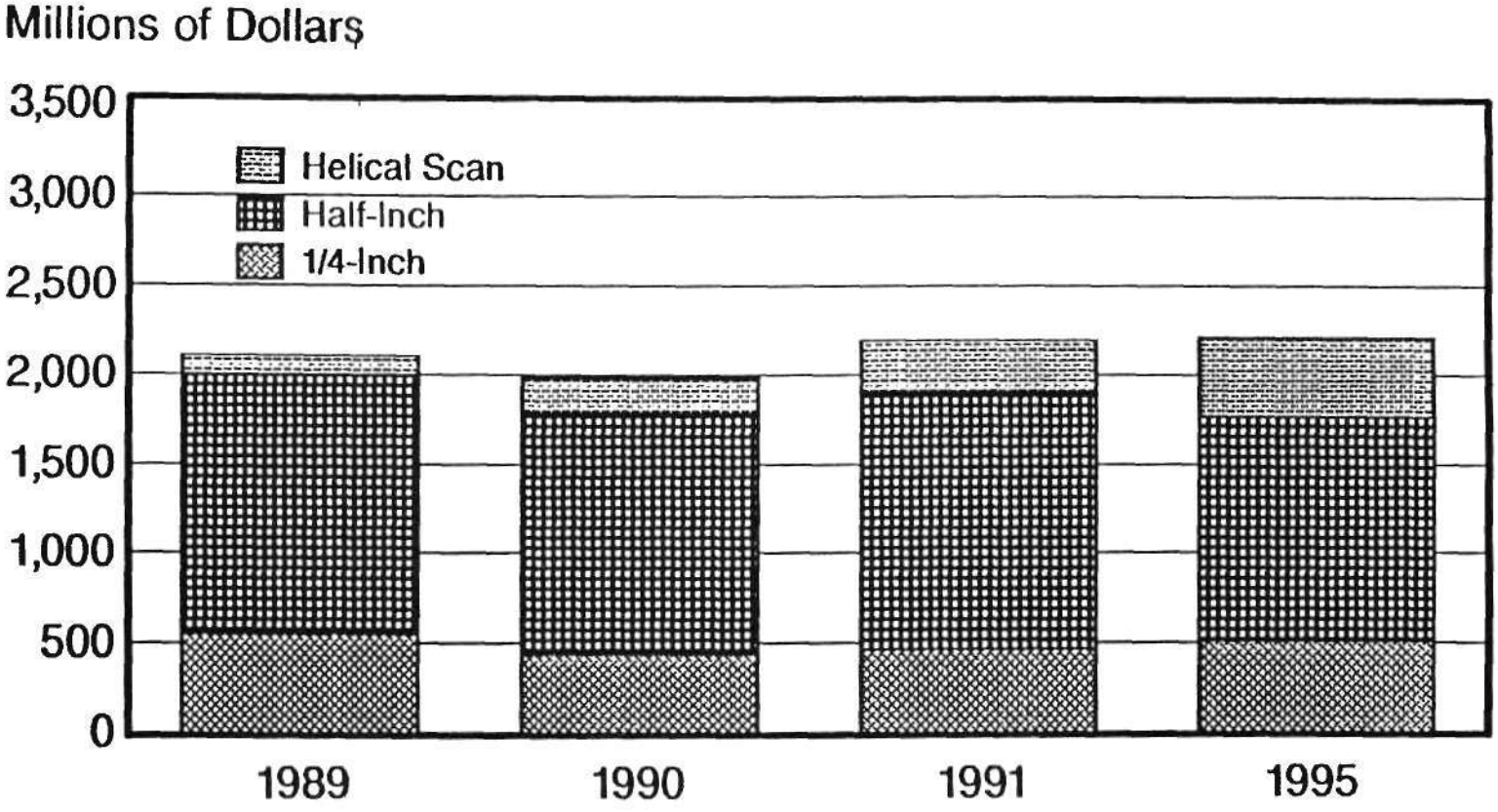
Estimated Worldwide Unit Shipments



Source: Dataquest

TOTAL TAPE DRIVE MARKET

Estimated Worldwide Factory Revenue



Source: Dataquest

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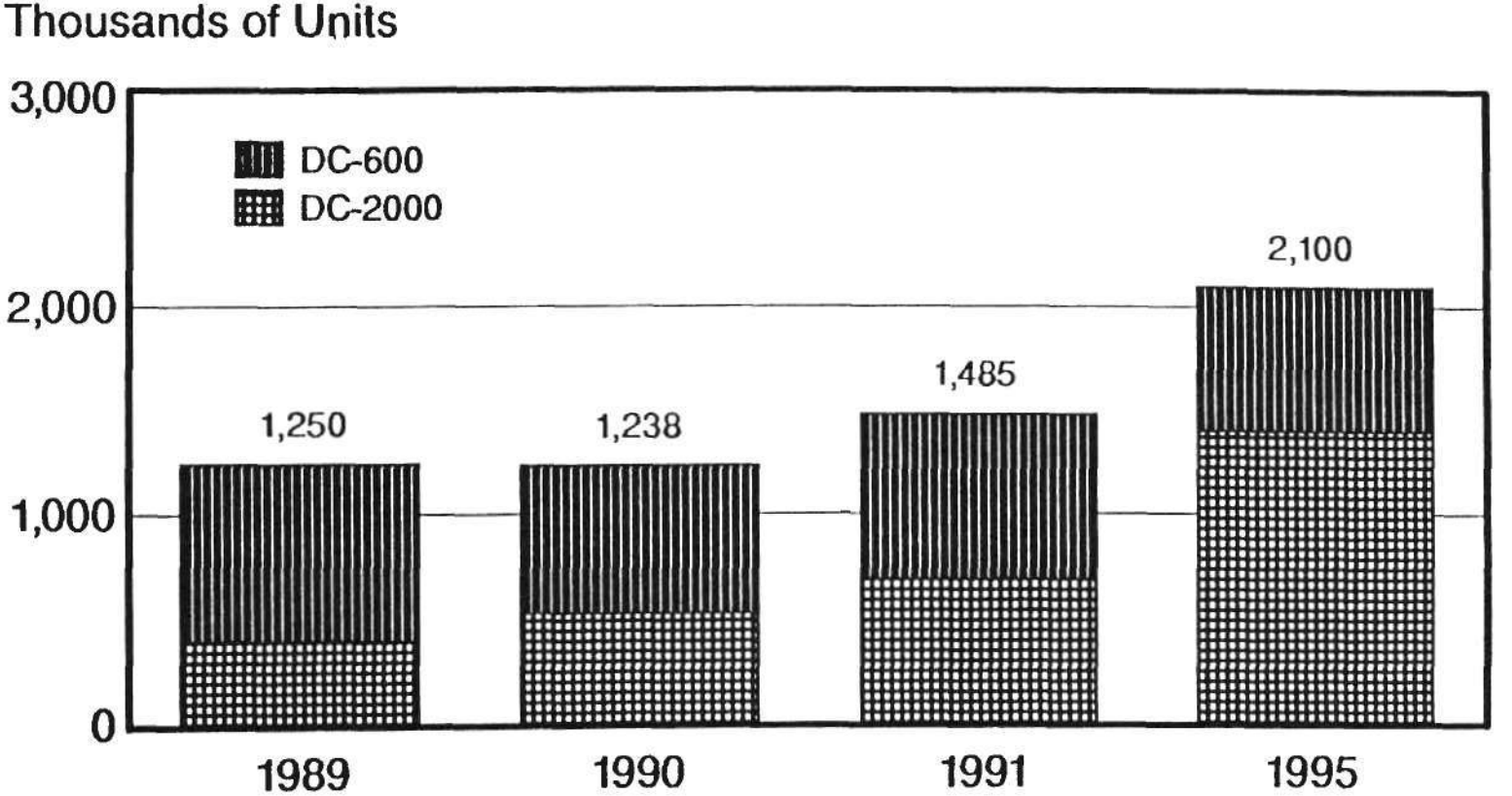
1/4-INCH CARTRIDGE TAPE DRIVES

Estimated Worldwide Unit Shipments



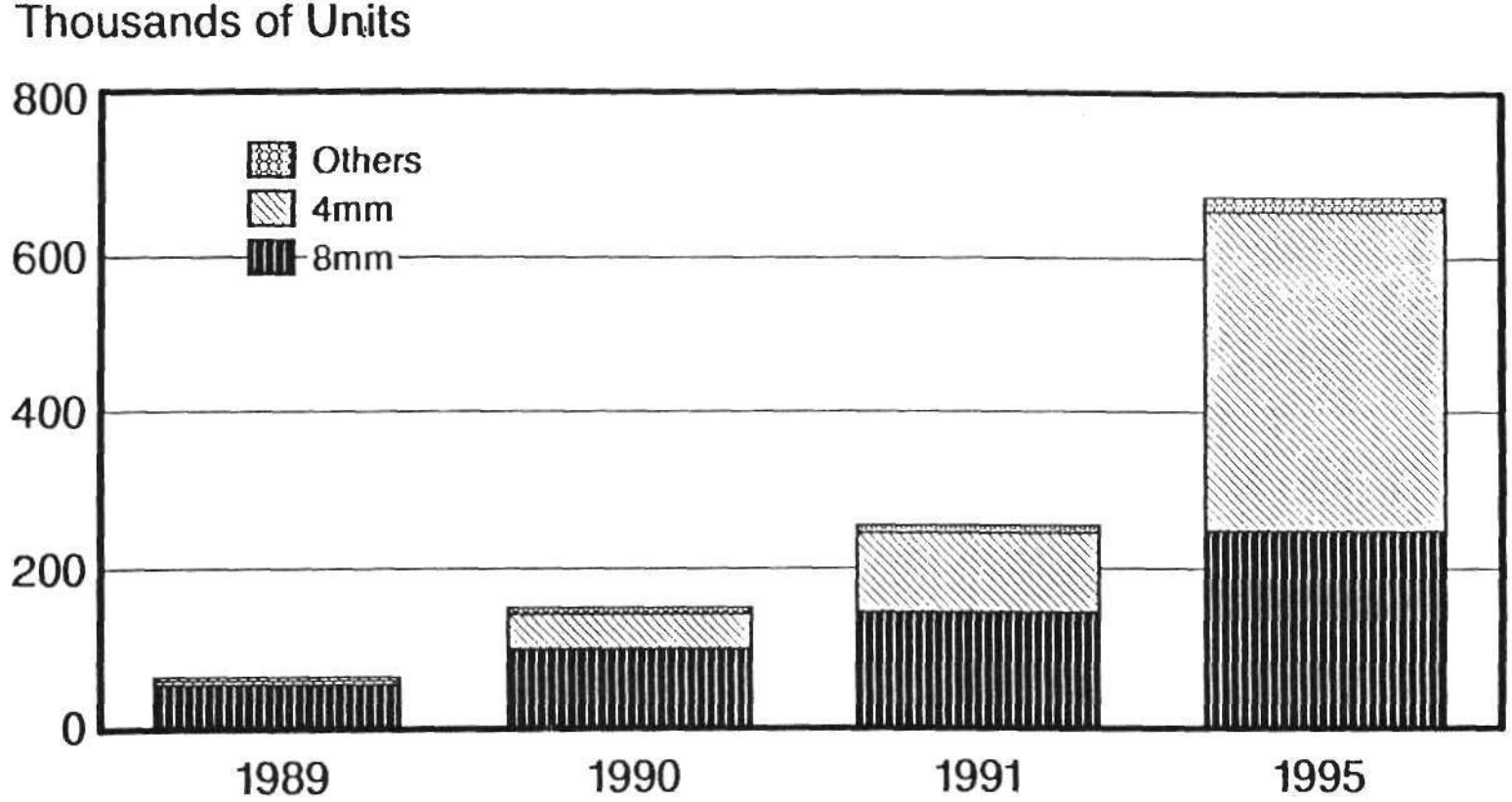
Source: Dataquest

1/4-INCH CARTRIDGE TRENDS AND ISSUES

- DC-600
  - Low end of market going away
  - Market entry delays impact shipments
  - Under siege from other technologies
  - Major system companies continue support
- DC-2000
  - Positioned for high growth
  - Additional vendors will enter market
  - Increased competition

HELICAL SCAN TAPE DRIVE MARKET

Estimated Worldwide Unit Shipments



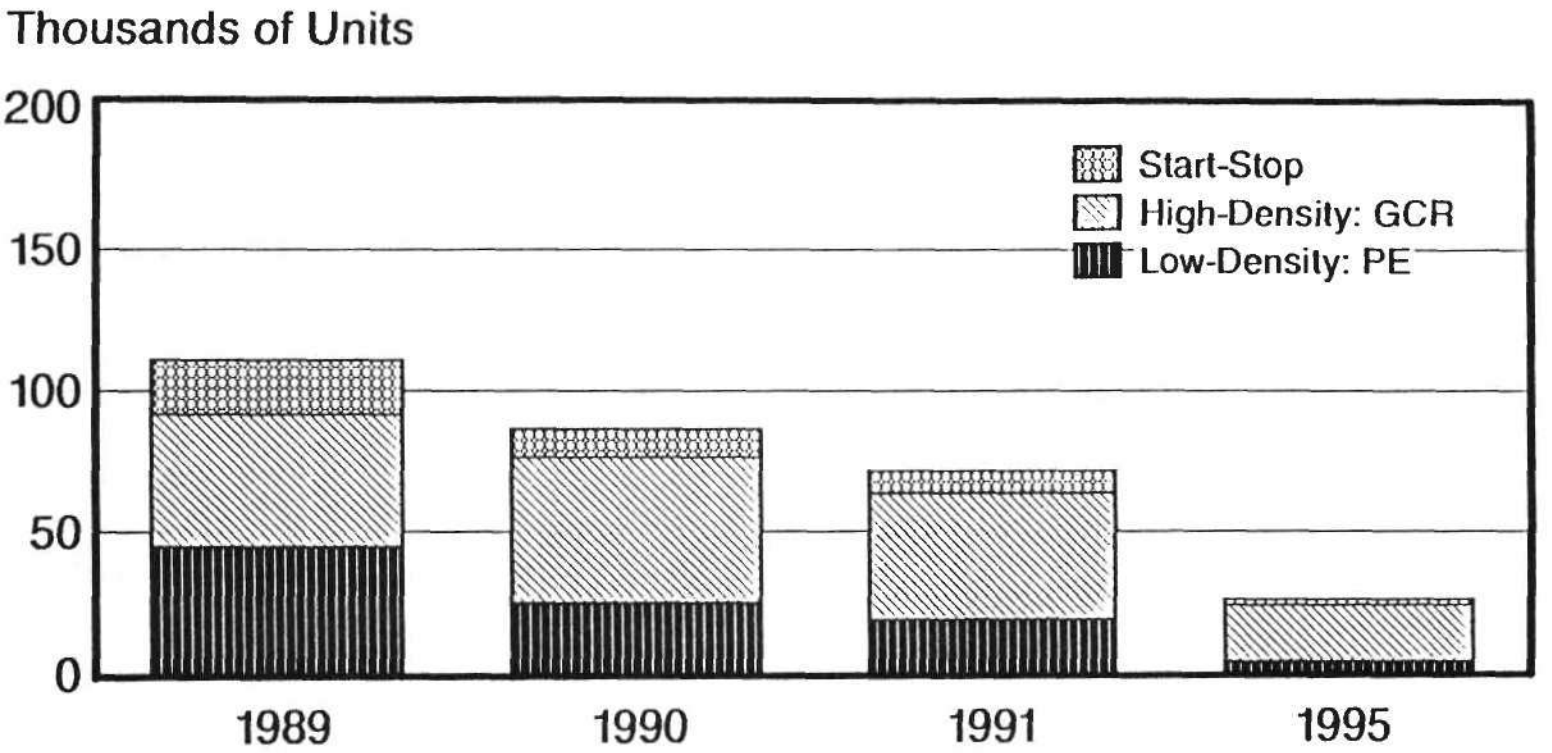
Source: Dataquest

HELICAL SCAN MARKET TRENDS AND ISSUES

- 4mm
  - Pricing eroding rapidly
  - 3.5-inch drives beginning to ship
  - Competition continues strong
  - OEM acceptance, but volumes still low
- 8mm
  - Moving upscale
  - Increased threat from DAT
  - Widely endorsed by OEM and distribution channels
- Others
  - New products may stimulate market

HALF-INCH REEL-TO-REEL TAPE DRIVE MARKET

Estimated Worldwide Unit Shipments



Source: Dataquest

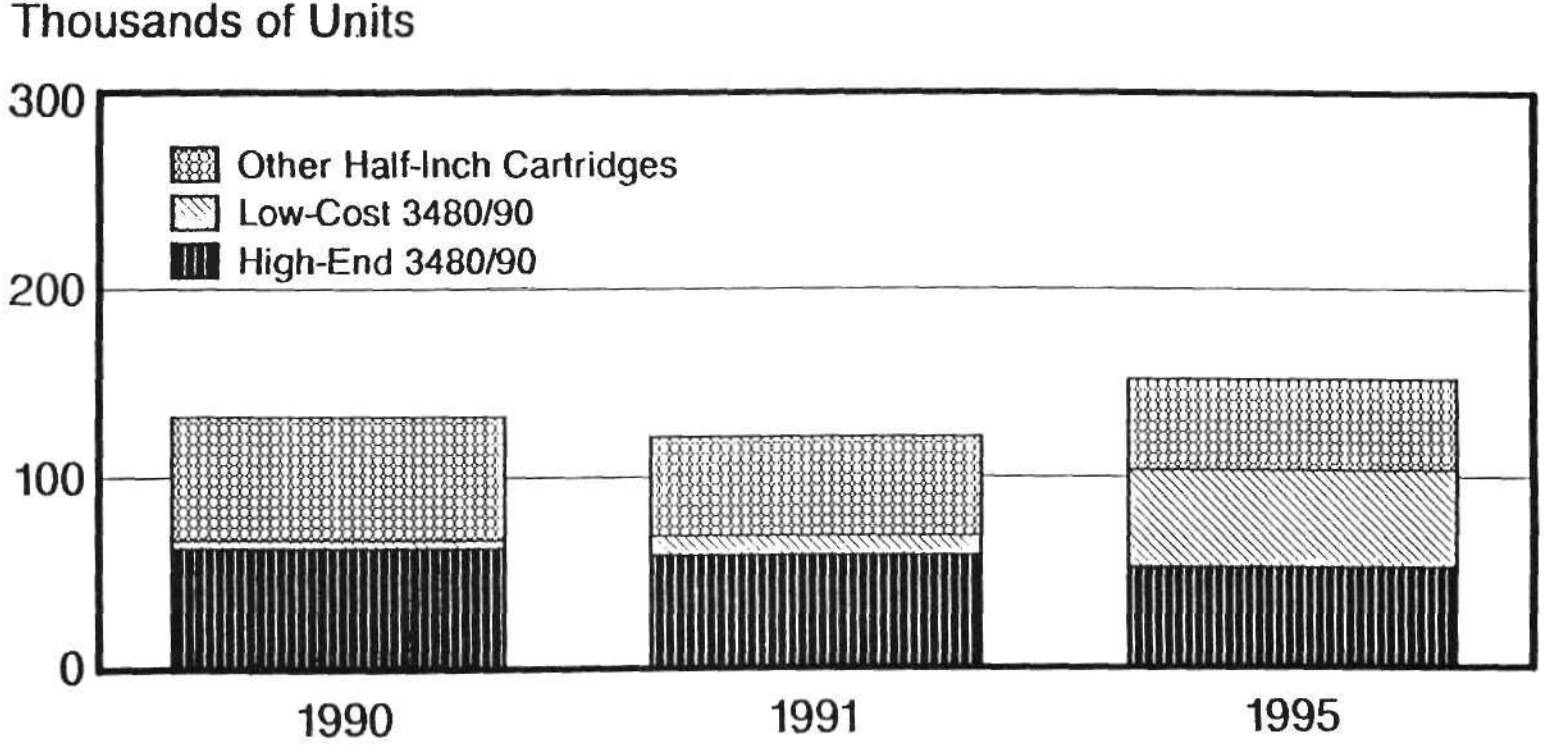
HALF-INCH REEL-TO-REEL MARKET TRENDS AND ISSUES

- Declining, but still considered an interchange standard
- Start-stop -- New markets in Eastern Bloc
- 1991 -- Last year of R&D and new product introductions
- 1990 -- Peak year for GCR, significant decline in PE drives

B3020020 IMG 06/09/91 YAL

HALF-INCH CARTRIDGE TAPE DRIVE MARKET

Estimated Worldwide Unit Shipments



Source: Dataquest

HALF-INCH CARTRIDGE MARKET TRENDS AND ISSUES -- HIGH END 3480/90

- Declining market
  - Negative mainframe growth
  - Low-cost drives in midrange
- IBM increases cartridge capacity
- 3480 phasing out in 1991
- PCMs increase share of market

HALF-INCH CARTRIDGE MARKET TRENDS AND ISSUES -- LOW-COST 3480/90

- Slow ramp in shipments -- future optimistic
- Sales channels have new requirements
- OEM sales slow but growing
- Expect price erosion from more competition

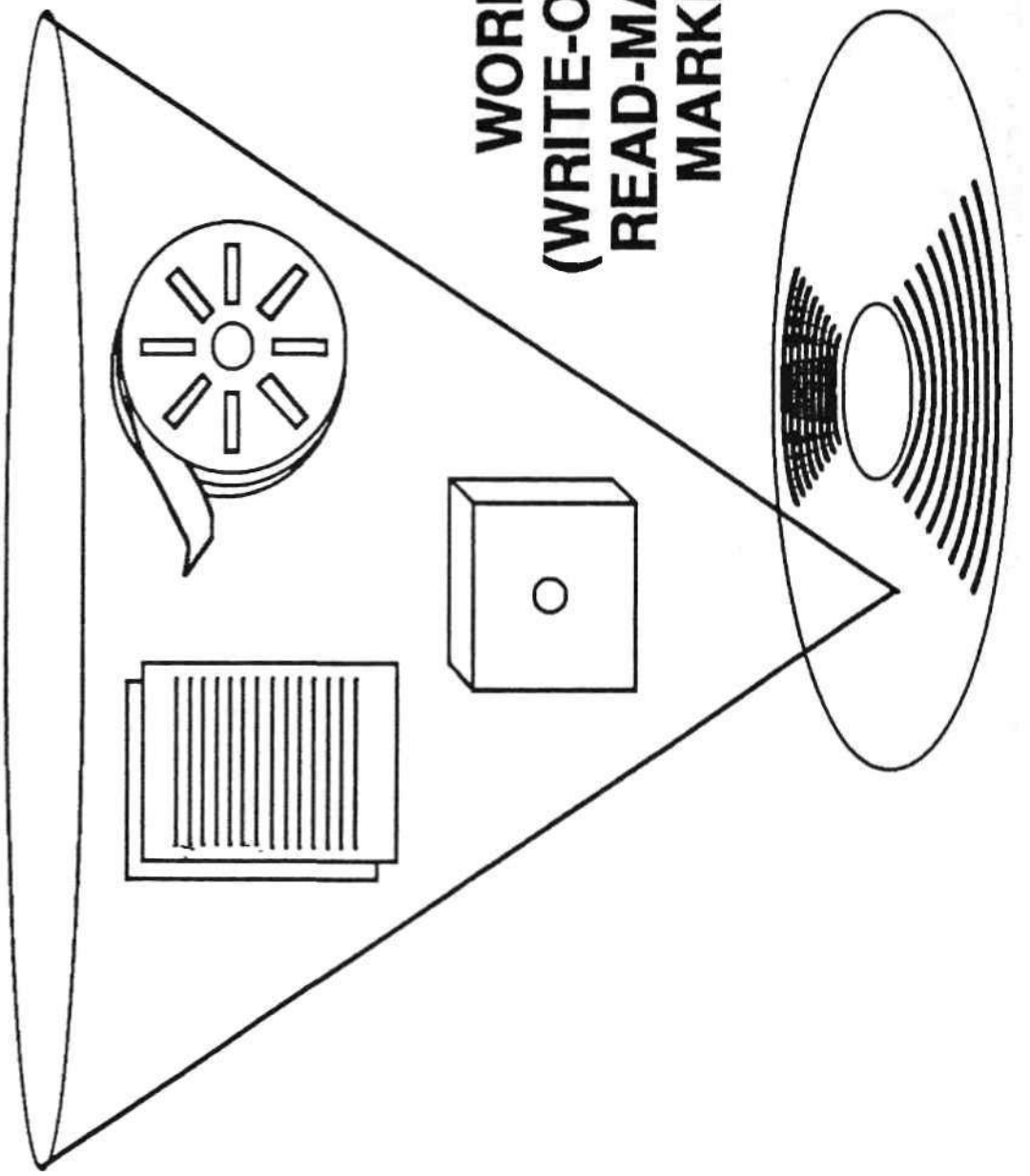
SUMMARY

- Wide range of products, competition among technologies will continue
- System vendors required to offer users a choice
- 1/4-inch cartridge sales impacted by 4mm and 8mm and market delays
- Half-inch reel -- long life expected
- 4mm gaining ground with OEM acceptance

CONCLUSIONS

- LAN server and workstations will be a battleground for 2GB technologies
- Half-inch cartridge: IBM and Digital standards dominate
- Vendors must get closer to the end user
- No other technology will be as universally accepted as reel-to-reel
- Capacities match disk capacities
- If you can't decide on a flavor, buy two drives

B0648002.IMG 04/23/90 GAS



WORM TRENDS AND ISSUES

- 12-inch market showing flat to very modest growth
- Expected to continue this way
- 12-inch drive and media price appropriate only to minicomputer systems
- 12-inch drive and media size contrary to current trends

WORM TRENDS AND ISSUES

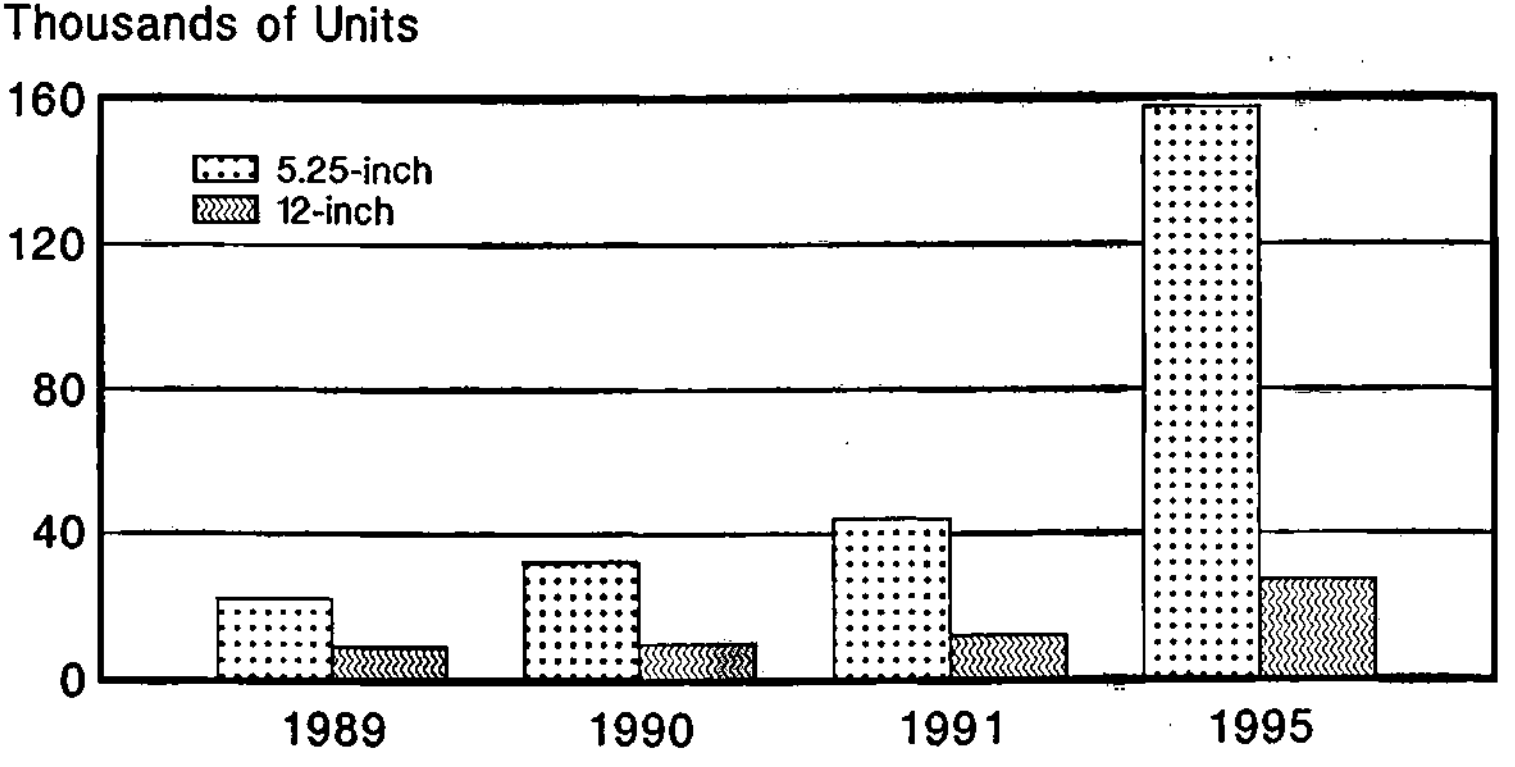
- ATG, Hitachi, Kodak (14-inch), Sony, and Toshiba increased storage capacity/side
- LMSI uses dual heads for minimum time to data
- Market will choose

WORM TRENDS AND ISSUES

- Automated libraries (jukeboxes)
  - Leverage the usefulness of WORM drives
  - Most applications are image management/ archiving
- Available sizes now vary from 5 cartridges to more than 2,000 cartridges
- More than 20 companies now in library business

WORLDWIDE OPTICAL DISK DRIVE FORECAST

WORM Drive Shipments



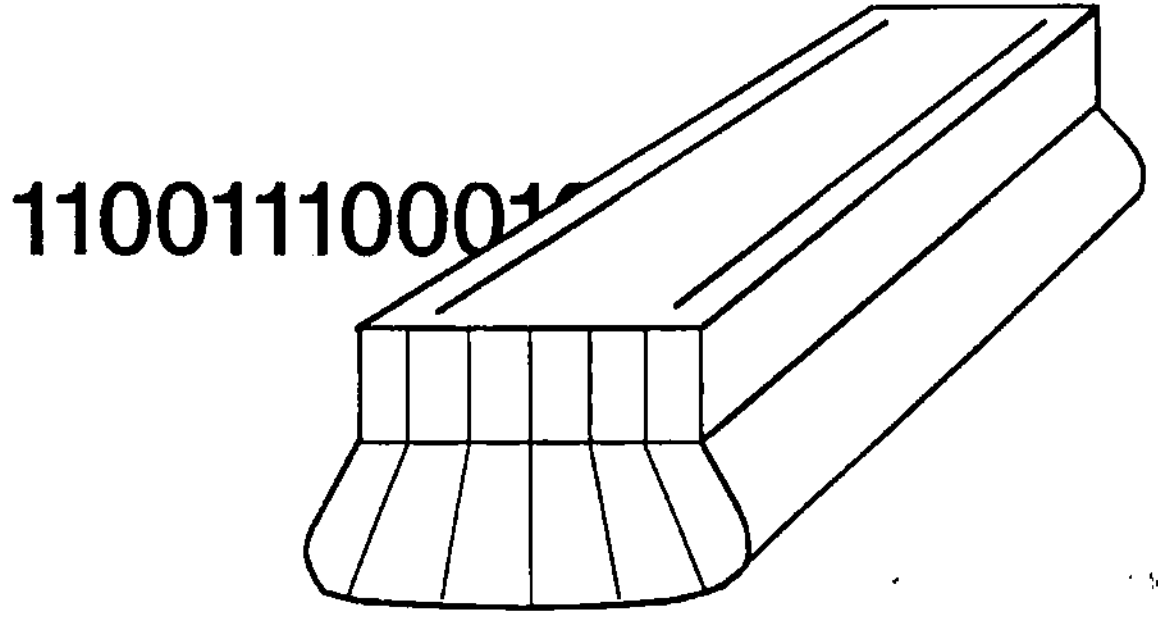
Source: Dataquest

WORM MARKET CONCLUSIONS

- 12-inch market will grow very slowly because of device size, cost, and lack of standards
- 5.25-inch market will grow at a better pace but is also limited by lack of standards and impact of rewritable drives
- Write-inhibited rewritable drives may fill the need for write-once drives by also filling the need for standard format
- Automated libraries (jukeboxes) will continue to grow in importance in this market

B0646014.IMG 04/23/90 GAS

THE REWRITABLE MARKET



REWRITABLE TRENDS AND ISSUES

- 5.25-inch magneto-optical drives
  - Sony, Ricoh price/volume leaders
  - HP, Maxoptix performance leaders
- Performance
  - Still far slower than Winchester drives
  - Little danger to Winchester market
- Direct overwrite -- still elusive in MO drives
  - Panasonic has it on phase change

FORECAST ASSUMPTIONS

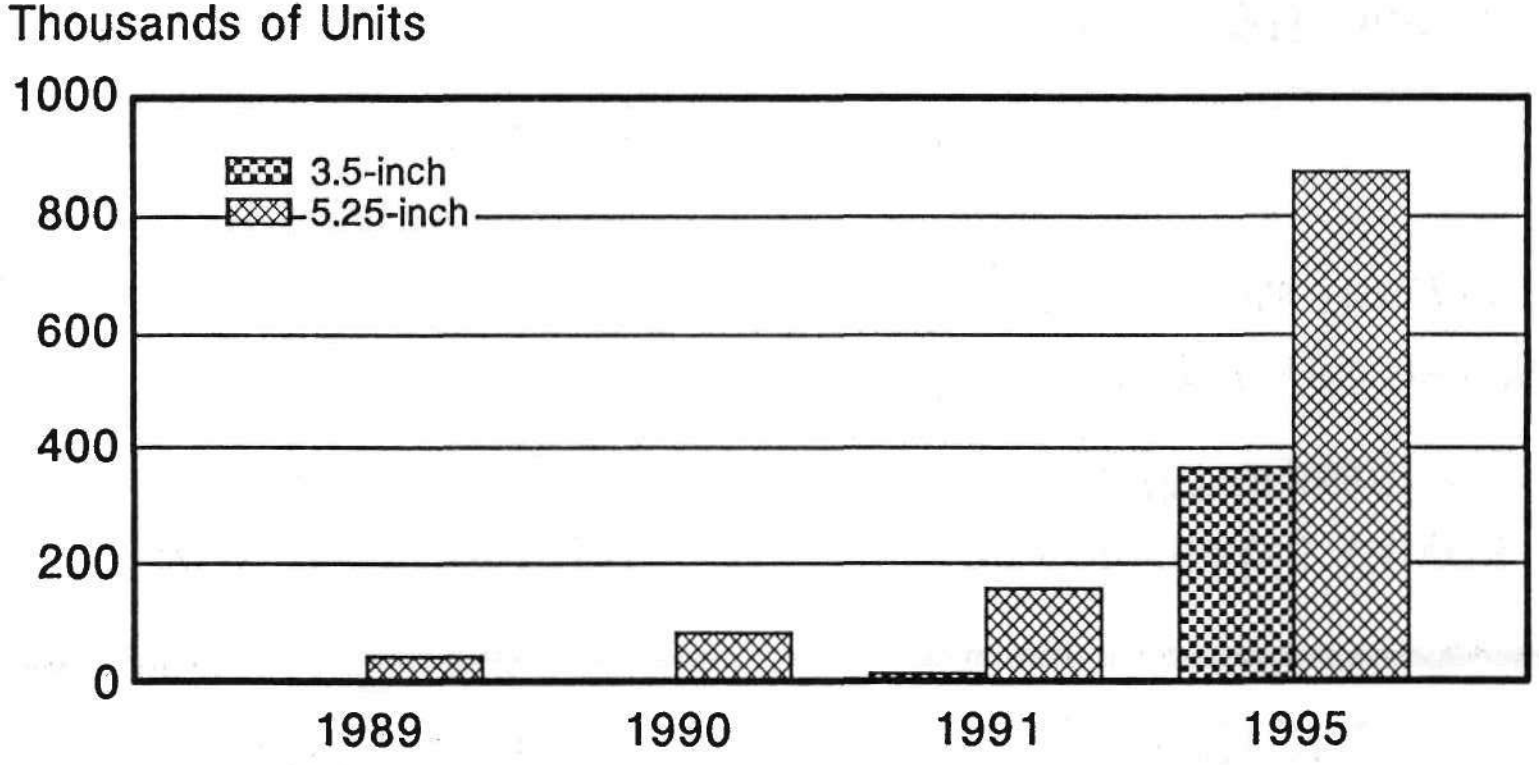
- No direct overwrite on MO drives until 1994-1995
- Phase change erasures stay limited to approximately 100K
- 3.5-inch media price less than half 5.25 price

FORECAST ASSUMPTIONS

- 5.25-inch drives
  - Head start
  - CAGR = 61% (units)
- 3.5-inch drives
  - Late start
  - CAGR = 134% (units)
- ASP declines 20% per year

WORLDWIDE OPTICAL DISK DRIVE FORECAST

Rewritable Disk Drive Shipments



Source: Dataquest

REWRITABLE MARKET CONCLUSIONS

- Market acceptance of 5.25-inch rewritable drives has been good compared with WORM drives
- Performance of rewritable drives is still well below Winchester drives -- does not impact this market to any significant degree
- 3.5-inch market starts in 1991
- 3.5-inch market growth rate exceeds 5.25-inch -- principal impact on removable magnetic products

B0648025.IMG 04/23/90 GAS

CD-ROM TRENDS AND ISSUES

- CD-ROM drive shipments continue to accelerate toward 3 million-units-per-year level by 1995
- Publication titles activity is very heavy in the public and private sectors
- Government is emerging as one of the most active producers as well as users of CD-ROM data

CD-ROM TRENDS AND ISSUES

- Number of titles is in the thousands including corporate data distribution
- Desktop publishing systems now available to create CD-ROMs -- prices dropping
- By 1994, no desktop PC in business environment will be considered complete unless it has a CD-ROM
- CD-ROMs available below $500 retail price

FORECAST ASSUMPTIONS

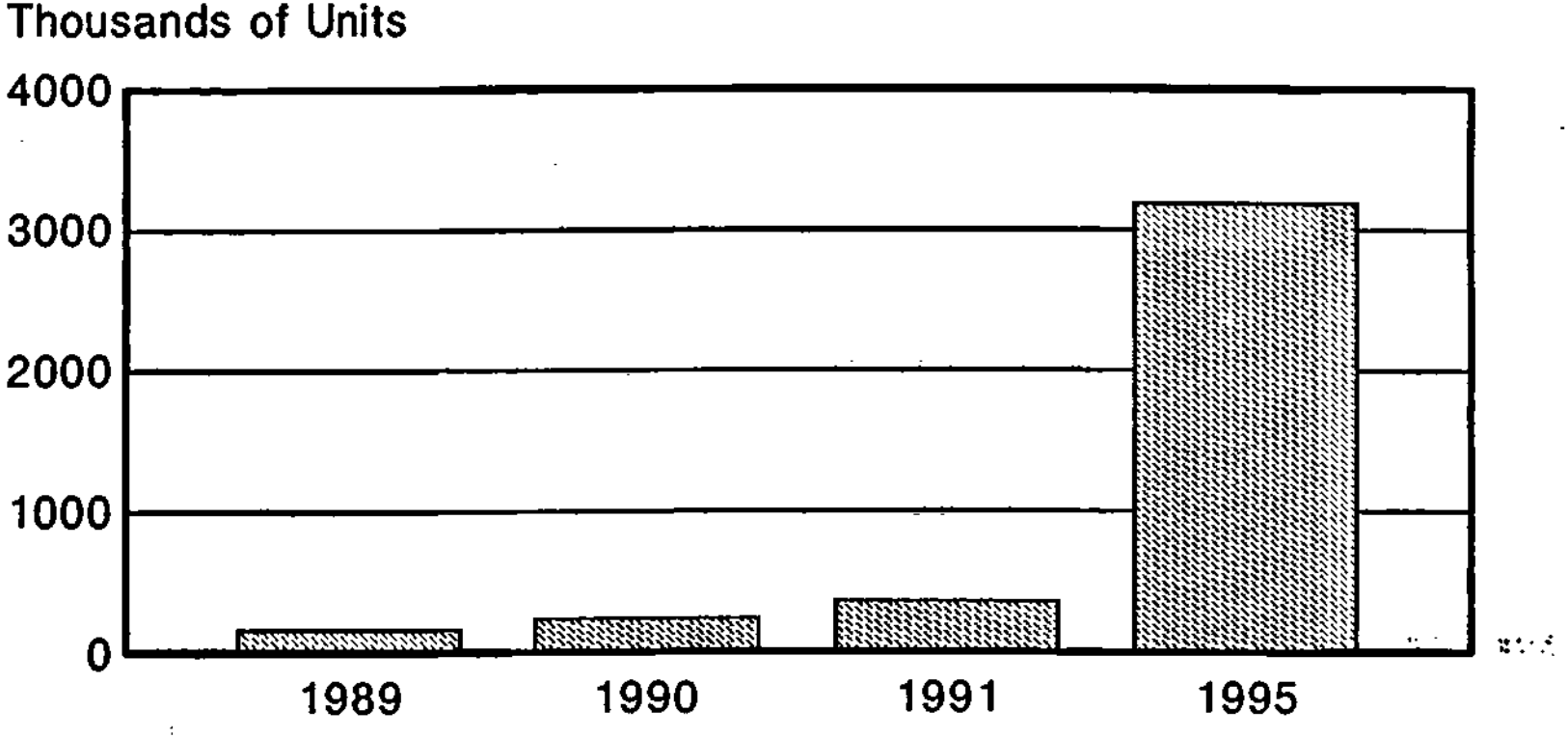
- When most desktop PCs have CD-ROM drives, a critical mass will lead to next growth stage
- Then, CD-ROMs will be used for software distribution
  - Operating systems
  - Application programs
  - Multimedia interactive instruction and games
- CD-ROM disk format is universally accepted
  - Ideal for interchange of software

FORECAST ASSUMPTIONS

- In like quantities, CD-ROM disks will cost no more than microfloppies
  - Probably less
- In like quantities, CD-ROM drives will cost no more than FDDs
- CD-ROM will be multipurpose
  - Reference library
  - Corporate data distribution
  - Software library
  - Multimedia interactive instruction and games
- Too much capacity?
  - No such thing

WORLDWIDE OPTICAL DISK DRIVE FORECAST

CD-ROM Shipments

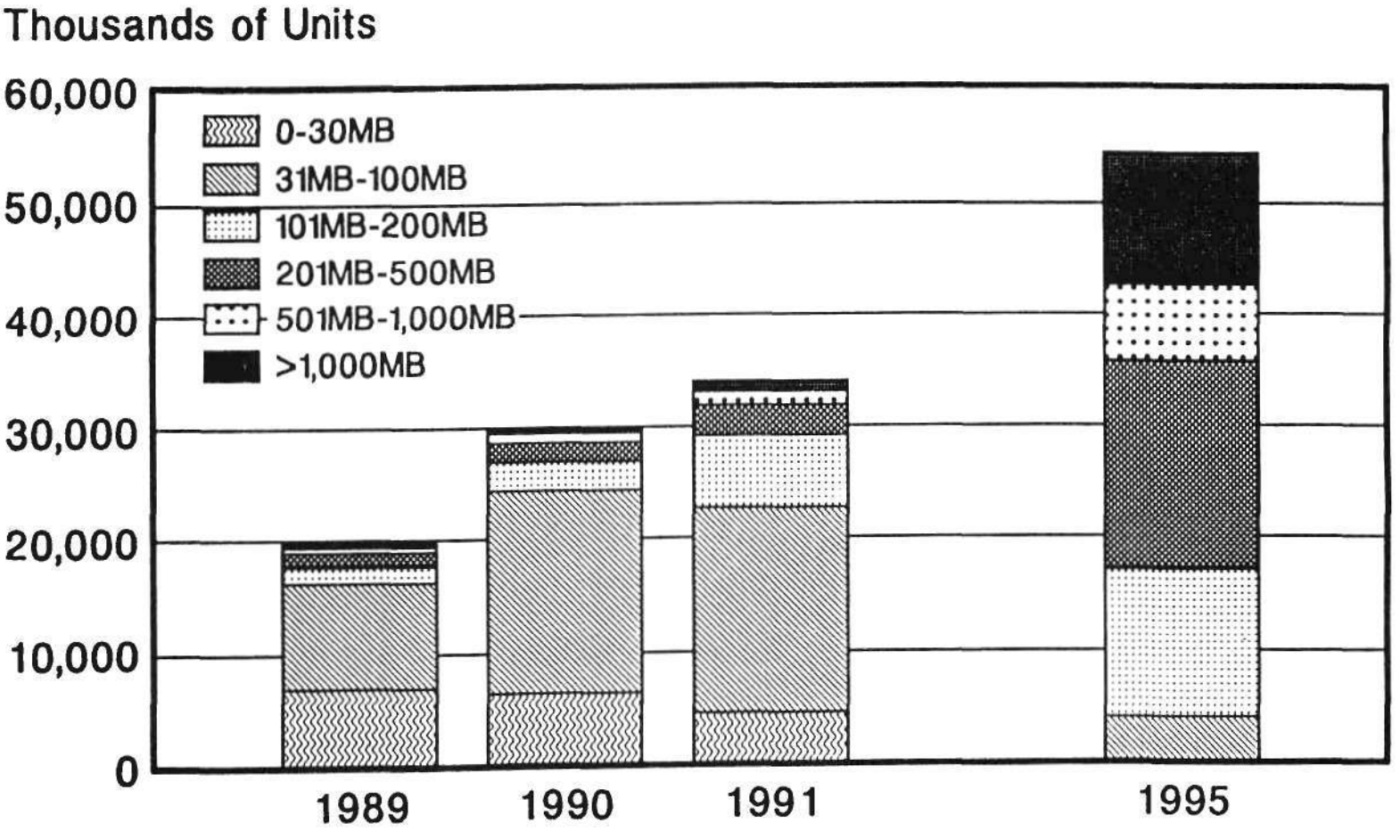


Source: Dataquest

CD-ROM MARKET CONCLUSIONS

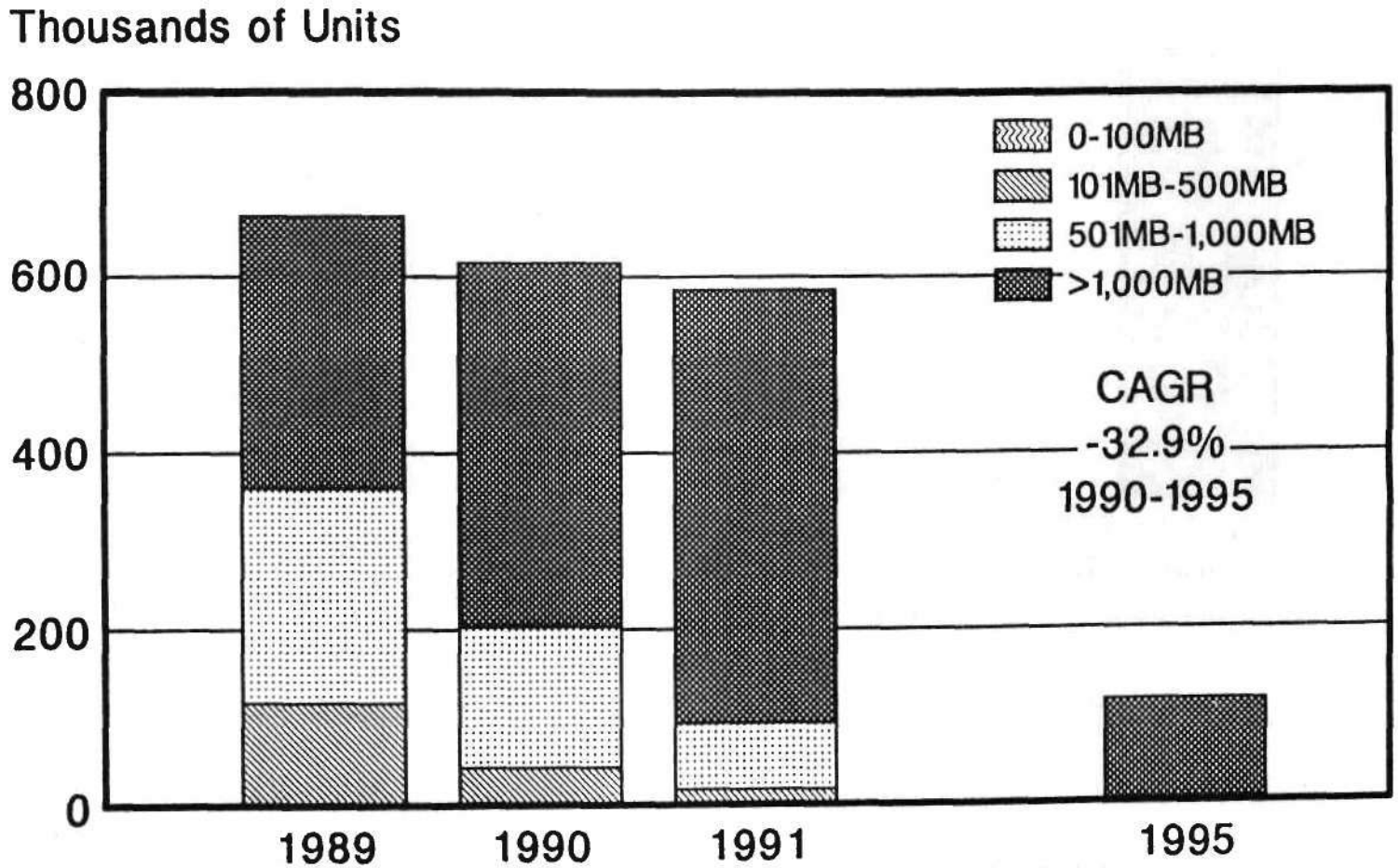
- CD-ROM drive and publication industries are growing well
- Widespread availability of publications and corporate data will make CD-ROMs essential on PCs in business use by 1993-1994
- Drive population will hit critical mass at that point -- hockey stick
- Mass market at that point will be software distribution and home entertainment systems -- 3 million units in 1995
- CD-ROM drive demand will soar to 40 million units/year by end of decade

ALL RIGID DRIVES BY CAPACITY



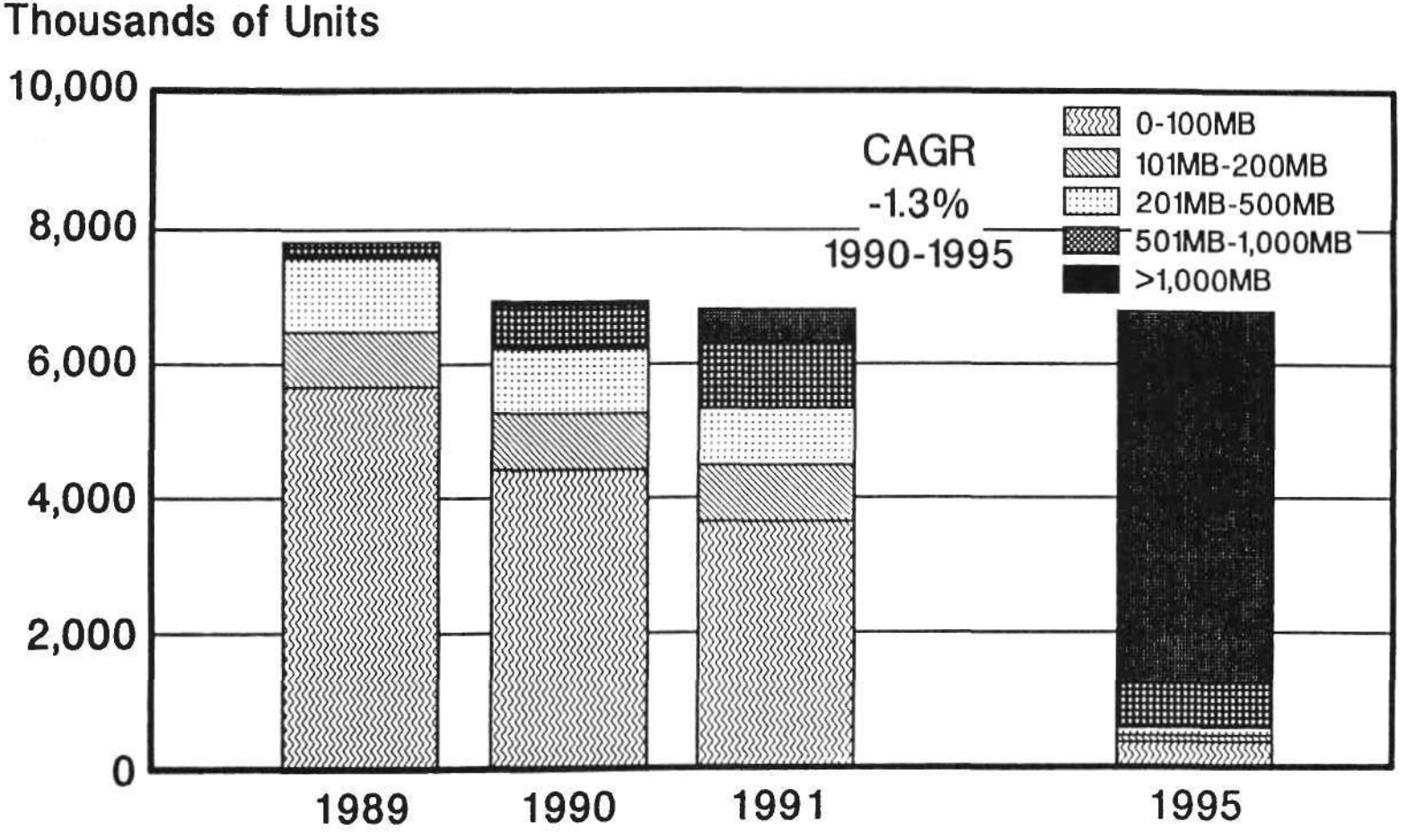
Source: Dataquest

8- TO 14-INCH SALES BY CAPACITY



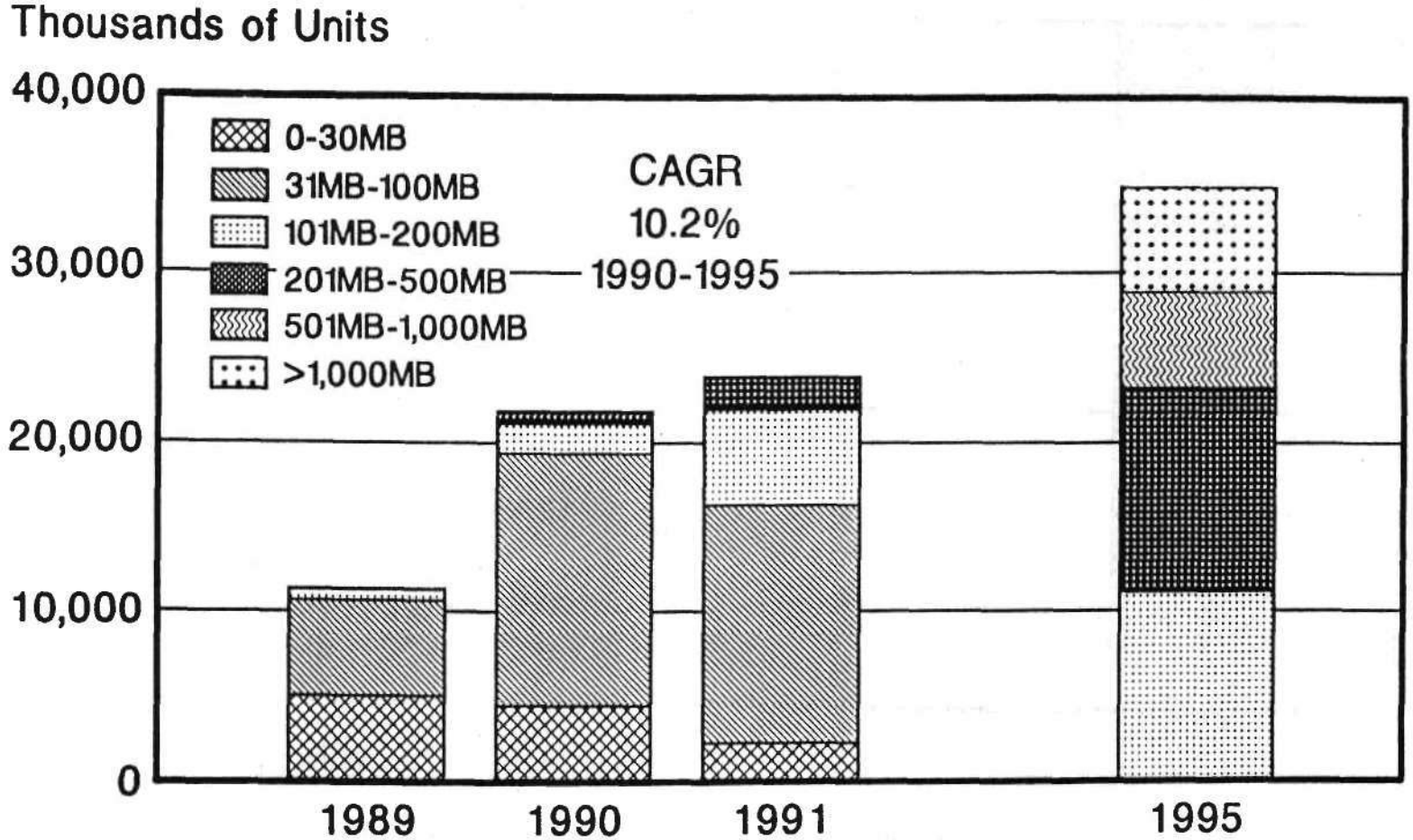
Source: Dataquest

5.25-INCH SALES BY CAPACITY



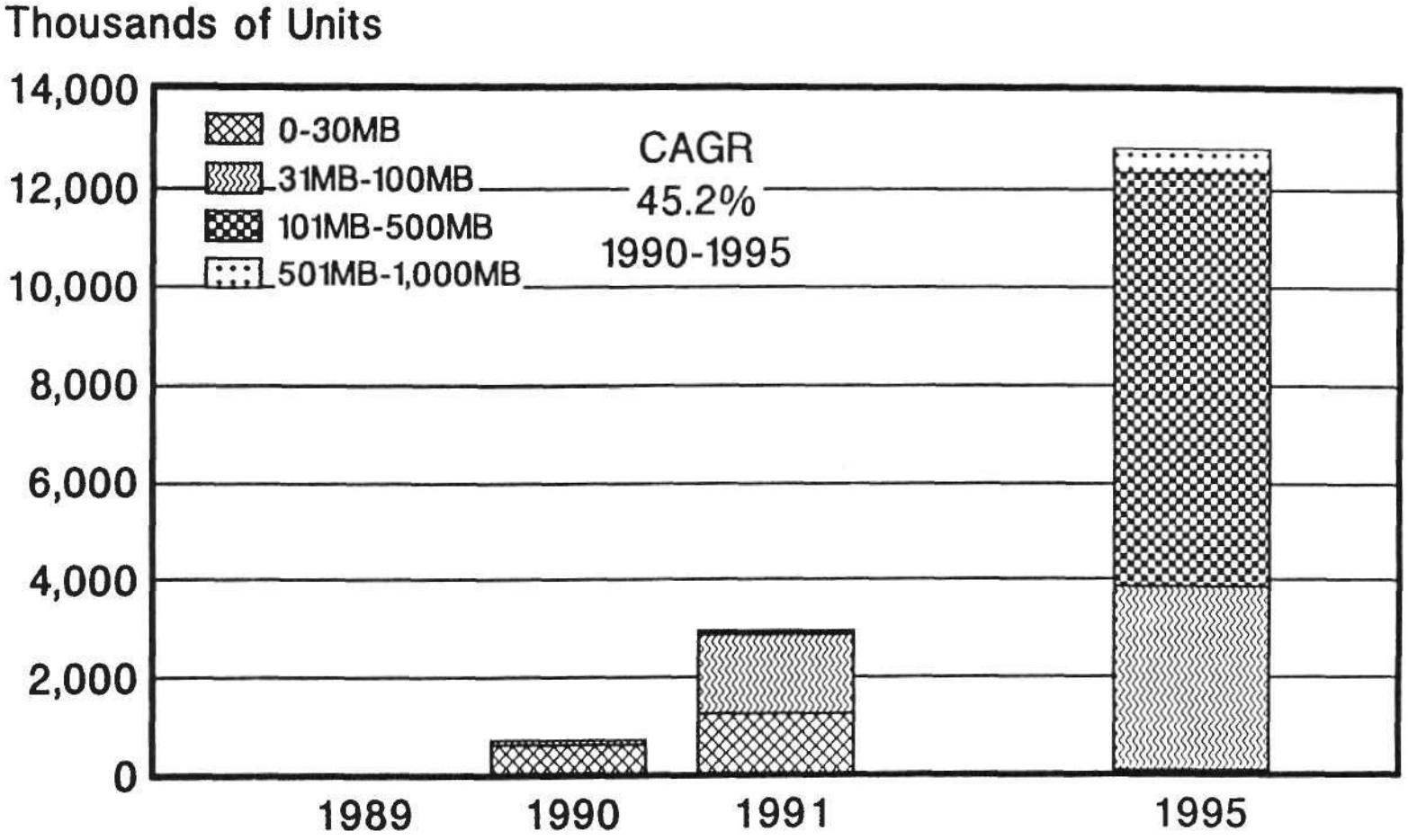
Source: Dataquest

3.5-INCH SALES BY CAPACITY



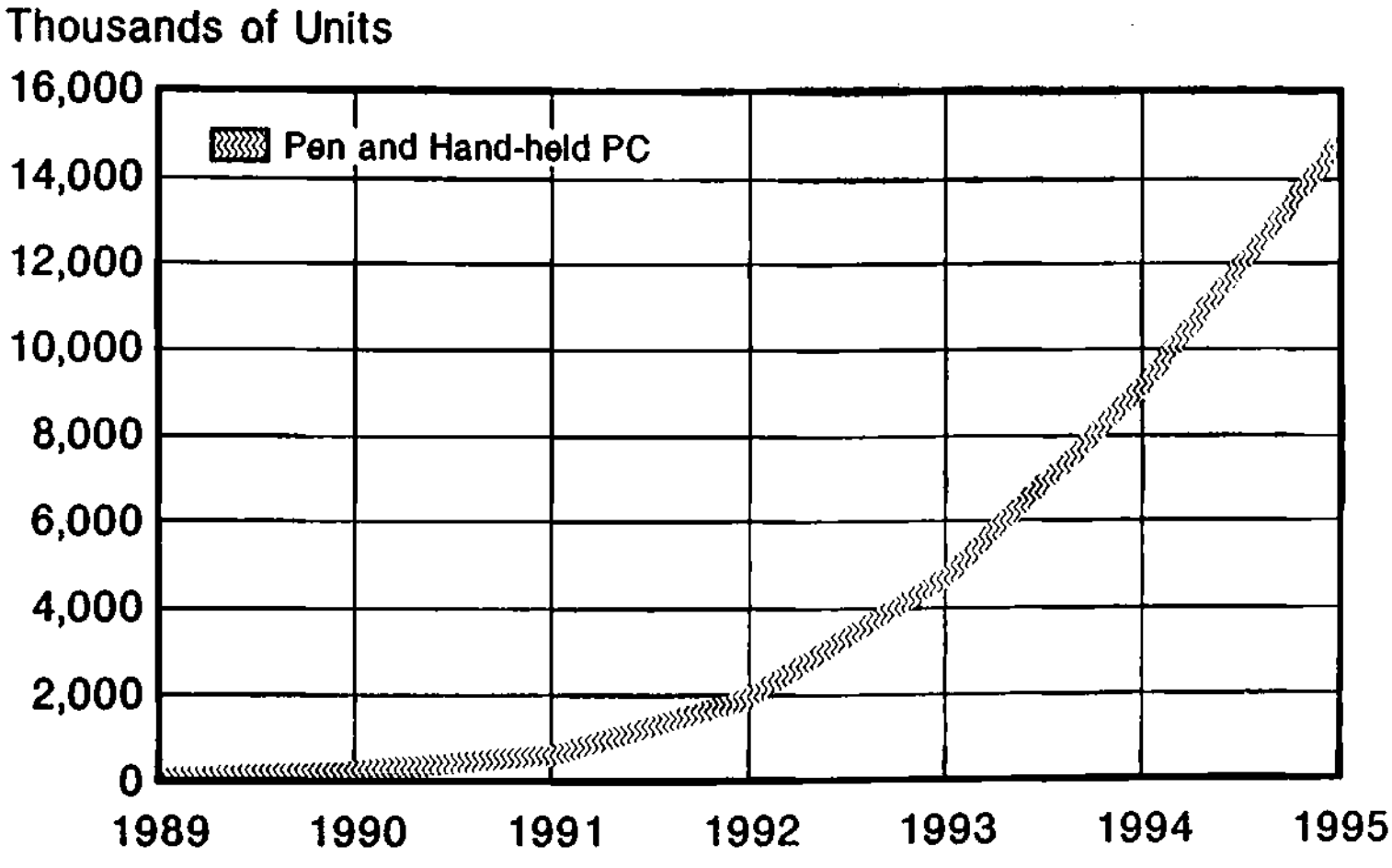
Source: Dataquest

2.5-INCH SALES BY CAPACITY



Source: Dataquest

TOTAL MARKET FOR 1.8-INCH

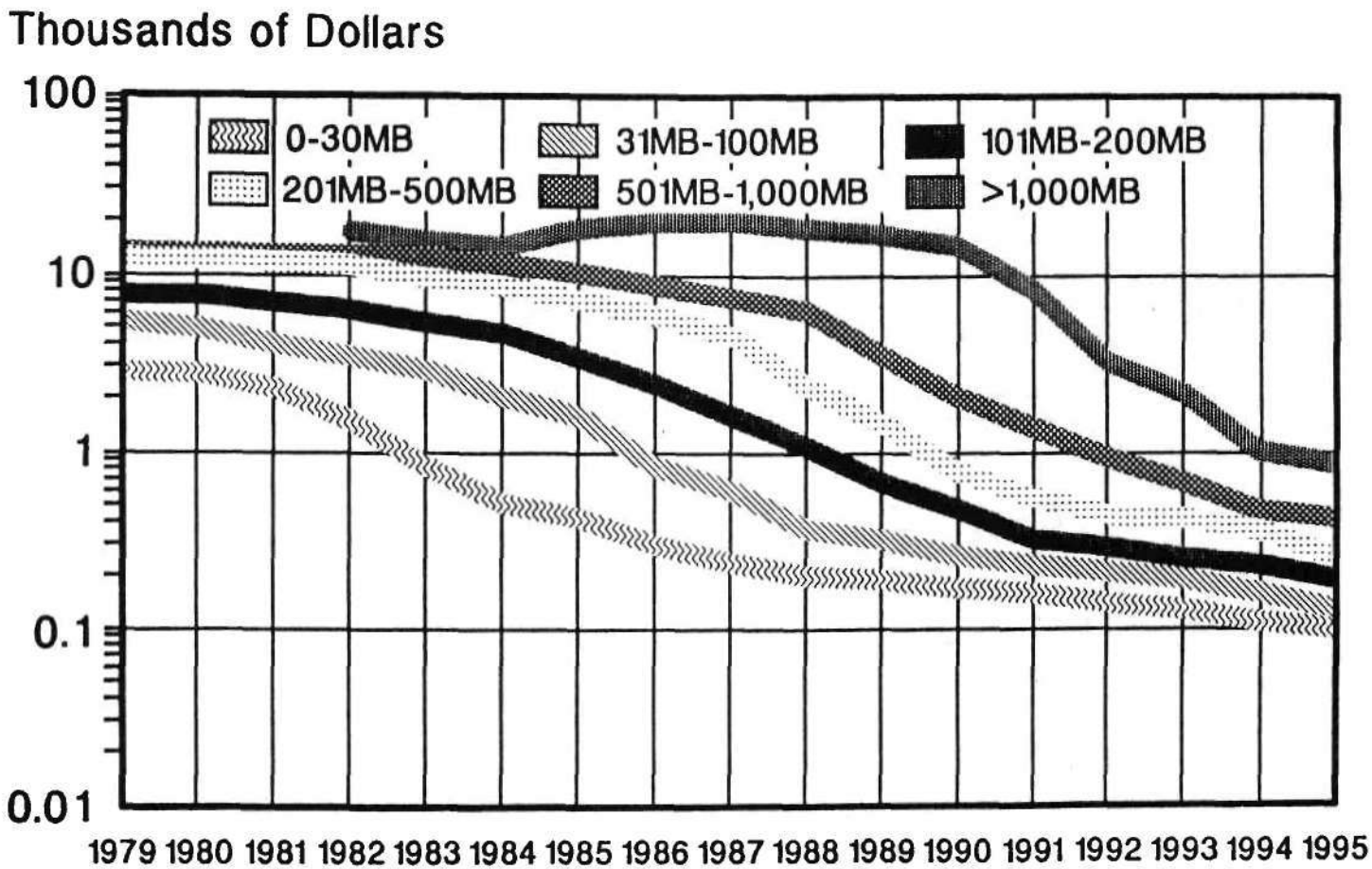


Source: Dataquest

FORECAST ASSUMPTIONS

- Prices tend to fall at 22% annually
- Form-factor penetration rates repeat
- Most popular price point is $240 (factory)
- Storage revenue follows system growth rates
- 1991 and 1995 recessions

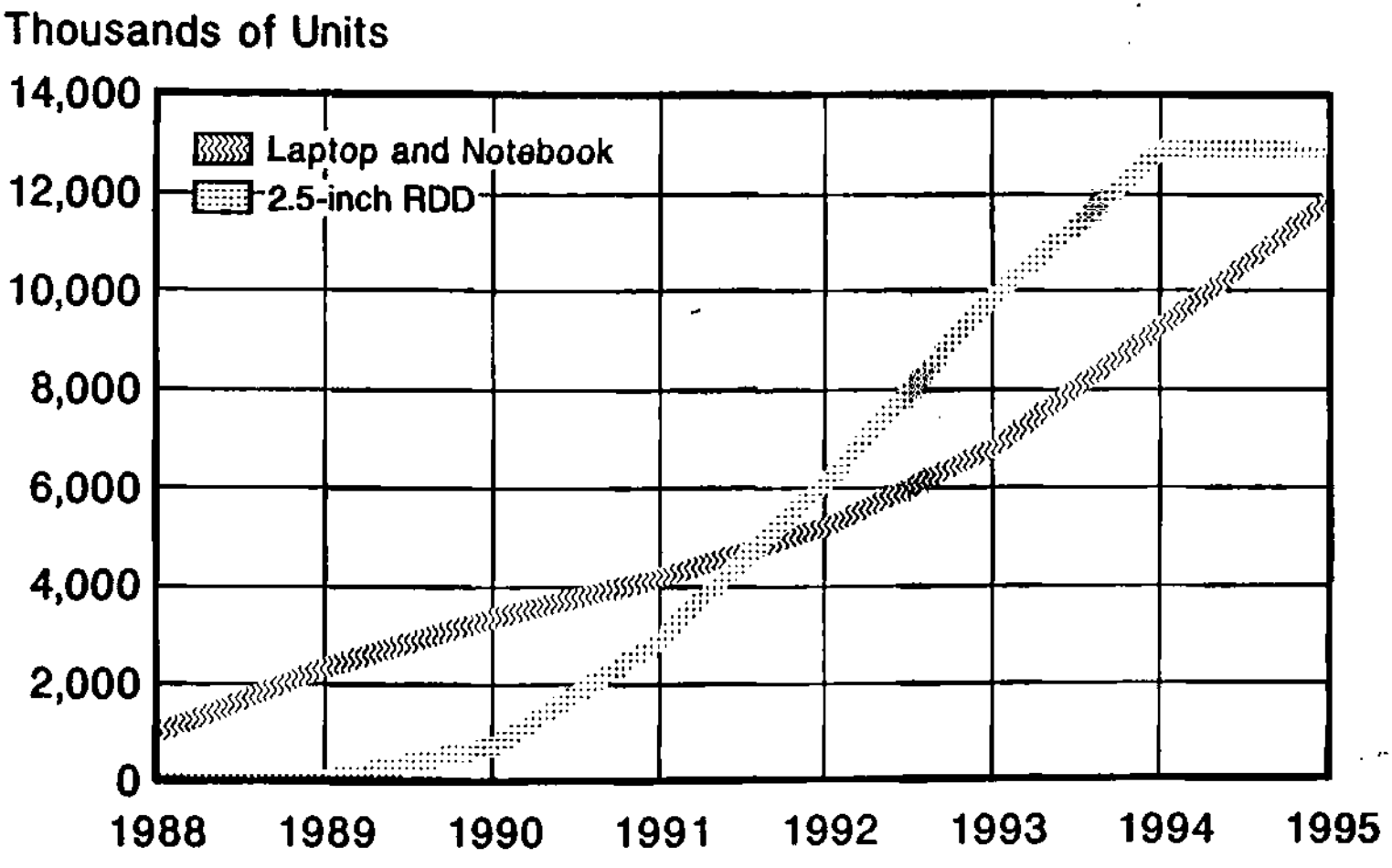
RIGID DISK FACTORY PRICES BY CAPACITY



Source: Dataquest

Controversy of the Year

CAN 2.5-INCH DEMAND CONTINUE?



Source: Dataquest

SUMMARY

- Large-diameter disk sales are doomed
- 5.25-inch will replace them
- 3.5-inch future is assured
- Industry dynamics understandable
- Money is still scarce for storage companies

CONCLUSIONS

- 100MB-500MB 3.5-inch market is best growth
- Gigabyte market is bigger than expected
- 2.5-inch overproduction likely
- 1.8-inch market grows as price approaches $100
- Good business expected through forecast period

Science and Technology in Korea "Today and Tomorrow"

Jung Uck Seo
Vice Minister
Ministry of Science and Technology

Jung Uck Seo is Vice Minister at the Ministry of Science and Technology. He has held this position since December 1990. Prior to this, from January 1984, he was Vice President at the Korea Telecommunication Authority. He managed the business division of TDX, the electronic switching system developed by the authority, business development division, quality assurance division, and main computer development division. Previously, Dr. Seo was with the Agency for Defense Development where he served first as Manager, then Vice President and finally, President. He was also a Professor at the Korean Air Force Academy from August 1957 till August 1970. Dr. Seo received a B.S. degree in Electrical Engineering from Seoul National University, Seoul, Korea; and both his M.S. and Ph.D. degrees in Electrical Engineering from Texas A&M University, United States.

1991 High-Tech Electronics
Industry Conference

Portable Computer Market Update

Andrew M. Seybold
Associate Director
Microcomputer Systems Group
Dataquest Incorporated

Mr. Seybold is the Associate Director of Dataquest's Microcomputer Systems Group. His responsibilities Include In-depth analysis, evaluation, forecasting, and research of personal computer hardware and software products. He is also responsible for customized consulting that focuses on the microcomputer industry.

Mr. Seybold has over 21 years of experience in both the computer and communications Industries and has authored many articles on microcomputers for industry-related publications. He is the author of a number of books about computers and communication. He is recognized as one of the top industry analysts within the microcomputer field and is called upon frequently to provide information about microcomputers to the press. His particular areas of expertise include systems planning, Implementation and applications, and software development and evaluation. Mr. Seybold is considered by many to be the industry's leading authority on the portable personal computer market.

Mr. Seybold was the co-founder of The Computer School in Los Angeles in 1982 and is noted for his work in the laptop and desktop productivity areas of the microcomputer industry. Mr. Seybold has a B.S.E.E degree from Northwestern University.

1991

PORTABLE COMPUTING IN THE 90s

A BLUEPRINT FOR SUCCESS

Steve J. Lair
Vice President and Director
Microcomputer Systems Group
Dataquest Incorporated

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AGENDA

- Portable issues for the 1990s
- Worldwide market projections
- Notebook PC issues
- A look ahead to 1996

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Introduction

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In the next four years, the market for PCs will grow to over 250 million installed units.

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PORTABLE ISSUES FOR THE '90s

- Color LCDs
- Notebook vs. pocket
- Notebook vs. pen-based
- Communications
  - Cellular
  - Networking (slots vs. docking station)
  - Connectivity

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PORTABLE ISSUES FOR THE '90s

- Power management
  - Batteries
- UNIX and RISC
- Modularity (LegoLap)
- Shift from second to only computer

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PROCESSING POWER

Mainframe and Workstation			Microprocessor		
Year	Model	MIPS	Model	MIPS	Ratio
1982–1984	3080	6–7	8086	0.4	30:1
1985–1988	3090	15	80286	1.0	15:1
1988–1990	3090S	20	i386	2.5–3.5	7:1
1990–1991	Summit	40–45?	i486	9–11	3.8:1
1991–	Risc	50–75?	i486/i586	19–28?	2.6:1

Source: Dataquest

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WHAT WAS

- Technology as the driving force
- High margin, high volume
- PC market considered homogeneous
  - PC
  - MAC
  - Other

91WAS.gel

WHAT IS

- No longer a homogeneous market
- Market is dividing into multiple distinct product segments
- Technology no longer the primary driving force
- Marketing skill and channel management effectiveness will determine the winner
- Margin protection is crucial for both manufacturers and resellers

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WHAT'S HOT

- Portable computing
  - Notebooks
  - Hand-held systems
  - Pen-based systems
  - Communications
- High-end computing
  - Local area networks and servers
  - High-performance systems
  - PC crossover into workstations area

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WHAT'S HOT

- High-end computing
  - Add-in and add-on devices
  - Home computing
  - Multimedia
- Communications
  - Marriage of computing to transmission methods
  - Cellular phones, wireless LANs,
  - worldwide access

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INDUSTRY UPDATE

- Manufacturers scrambling to make profit
  - Unit shipments up, profits down
- New issues are clouding the future and making decisions difficult
  - Operating systems
  - Pen-based computers
  - Communications interfaces
  - Local area networks
  - Distribution of products
  - Customer service/support
  - Company/product differentiation

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INDUSTRY UPDATE

- Cost of entry for new companies is now very high
  - Start-ups need to have synergy with large players
  - Large players are combining into consortiums and partnerships
- Risks
  - Cost of development/time-to-market issues can be critical
    - Example: 80386SX-based protable computers

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INDUSTRY UPDATE

- Risks
  - End users are hanging back, waiting to see which direction to take
    - New operating systems wars have slowed implementation by many major buyers
    - Industry committees and standards groups are slowing progress
    - Return on investment for products is not guaranteed

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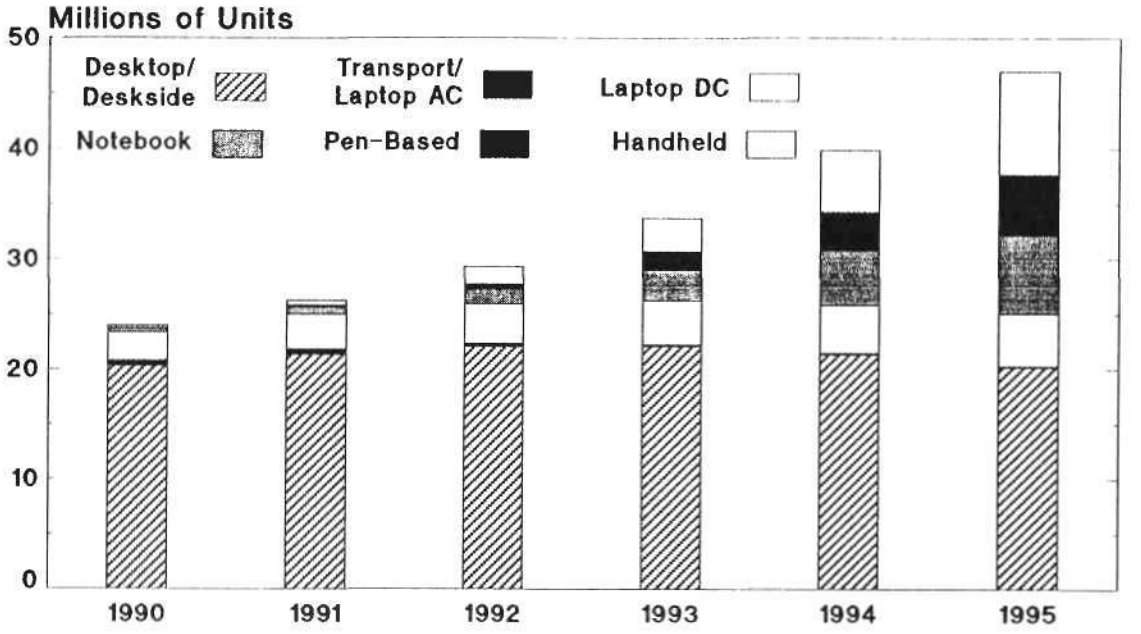
PC SHIPMENT PROJECTIONS BY PACKAGING TYPE

WORLDWIDE MARKET



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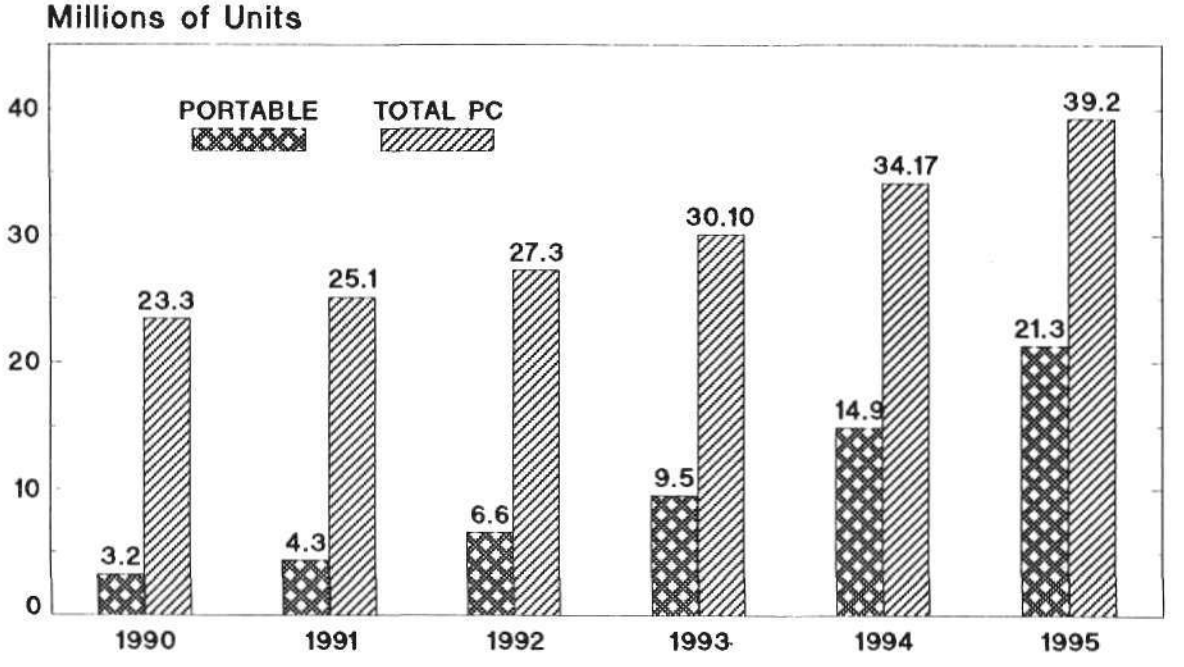
Source: Dataquest

PROJECTED PORTABLE PC GROWTH AS A FUNCTION OF TOTAL WORLDWIDE PCs



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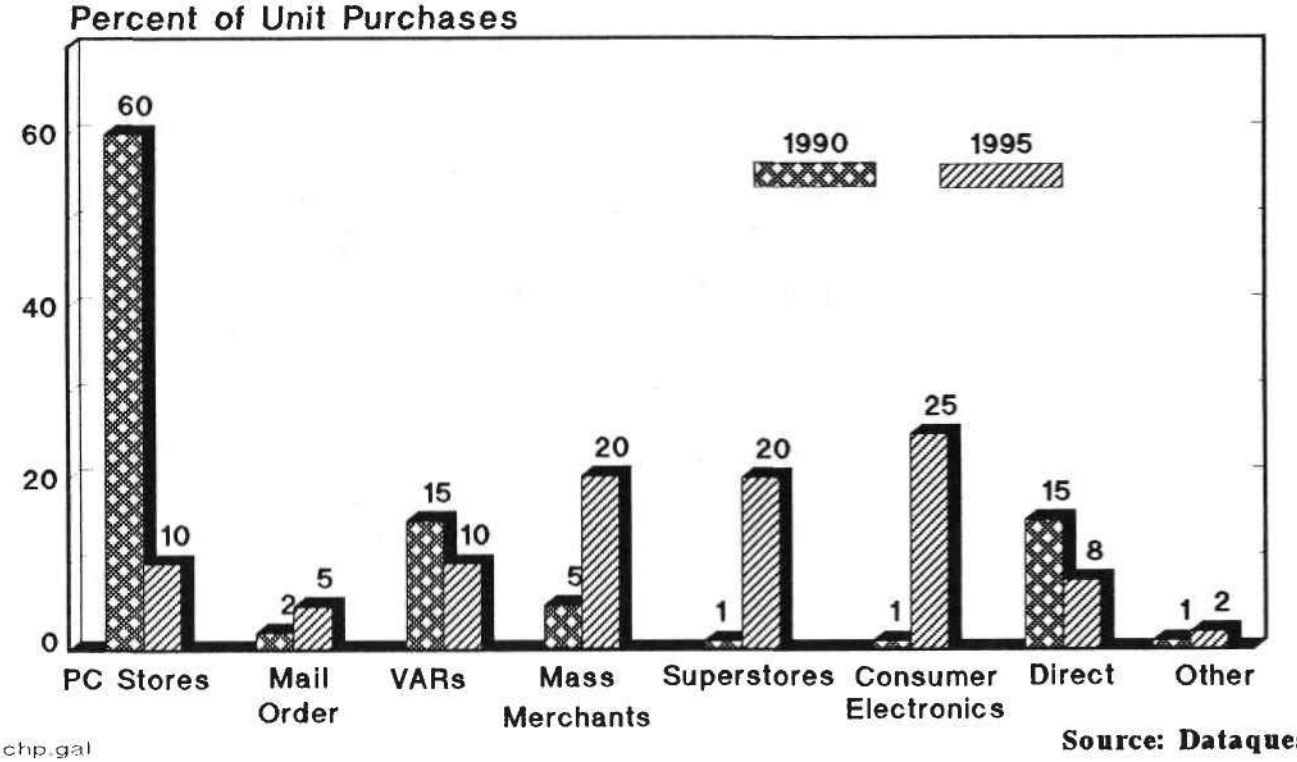
Source: Dataquest

ESTIMATED PC HARDWARE BUSINESS PURCHASES BY CHANNEL FOR PORTABLE SYSTEMS



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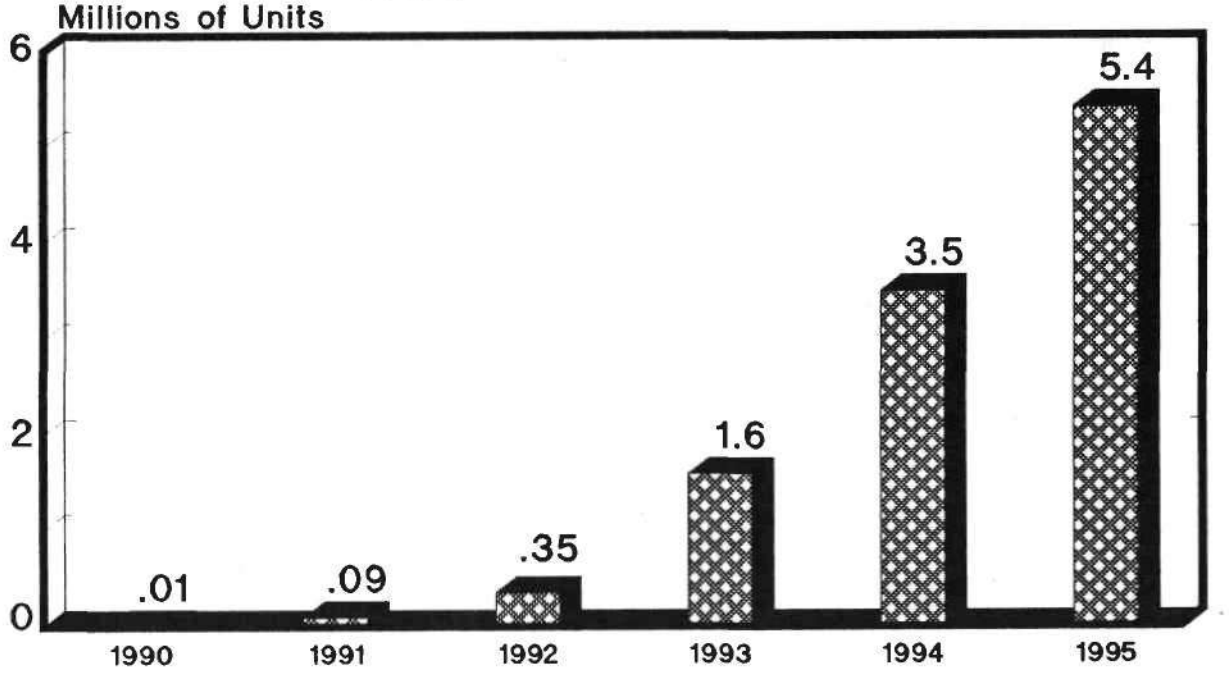
Source: Dataquest

WORLDWIDE PEN-BASED PCs UNIT PROJECTIONS



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Source: Dataquest

NOTEBOOK ISSUES

- Hardware requirements:
  - Form, fit, and function
    - Storage
    - Dimensions
    - Weight
    - Display
    - Power management
    - Communications

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NOTEBOOK ISSUES

- Software requirements:
  - ROM based operating systems
  - ROM based applications
  - PCICMA/JEIDA card portable specific applications:
    - PIMs
    - Downsized software
    - Communications applications
    - Desktop to portable products

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NOTEBOOK ISSUES

- Primary PC vs. secondary PC
- Move toward only PC
  - What drives this move?
- Docking stations
- Wired connectivity
- Wireless connections
- Price/performance

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NOTEBOOK ISSUES

- Notebooks vs. hand-held
  - Hand-held systems
  - Who will use them?
  - Will they steal sales from notebooks?
  - Handheld performance vs. notebook performance

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NOTEBOOK ISSUES

- Notebooks vs. pen-based systems
  - Will pen-based units impact notebook sales?
  - Will hardware vendors build both keyboard and pen input?
  - Market impact by GO! and Microsoft products

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NOTEBOOK ISSUES

- Communications
  - Key to size and weight
  - Key to making portables the primary personal computer
  - Wired and wireless

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NOTEBOOK ISSUES

- Communications
  - Wireless
    - Licensed vs. unlicensed
    - Frequency coordination
    - 902 to 928 MHz spectrum issues
  - Cellular
    - Systems today
    - Future satellite use
    - Specialized wireless service providers

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NOTEBOOK ISSUES

- A look ahead to 1996
  - Applications
    - Fully interactive with desktops
    - Optimized for portables
    - Notebooks become the companion PC
  - Storage requirements
    - Increased due to graphics, but decreased due to datacomm

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NOTEBOOK ISSUES

- A look ahead to 1996
  - Storage
    - CD technologies
    - Chip based
    - Card based
    - Hard disk based

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NOTEBOOK ISSUES

- A look ahead to 1996
  - Costs
    - Average selling price: $2,500
      includes:
      - Fully integrated PC and communications
      - Battery life: about 12 hours
      - Weight: 2 to 3 lbs
      - Pen or key entry
      - Full color
      - Fulltime use

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NOTEBOOK ISSUES

- A look ahead to 1996
  - Channels
    - Commodity product
      - Systems will be shrink wrapped, but systems companies and VARs will provide corporate solutions

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1991 High-Tech Electronics
Industry Conference

Asian PC Market and Industry

Nagayoshi Nakano
Senior Industry Analyst
Microcomputer Systems Group
Dataquest Japan Limited

Mr. Nakano is a Senior Industry Analyst for Dataquest's Microcomputer Systems Service and is based in Tokyo. He is responsible for researching and analyzing Japanese and Asian personal computer industry. He is a co-editor of reports: Emerging Personal Computer Opportunities in Japan and Japan's Personal Computer Market: Hardware/Software Strategies and Trends.

Prior to joining Dataquest, Mr. Nakano worked for six years as a journalist for the foreign correspondent department of The Daily Electronics Industry Newspaper and most recently as associate editor for The Journal of Electronics and Engineering. For four years before coming to Dataquest's Information Systems Group, he worked for the Semiconductor Industry Group to develop a database product of the Japanese Semiconductor Application Market.

Mr. Nakano received a B.A. degree in English Linguistics from Doshisha University, Kyoto. He served as a vice president of Doshisha University Committee of International Association of Students in Economics and Commerce (AISEC).

Predictions for the 1990s

In the 1980s they were big players only in portable PCs and as suppliers of components. Soon they will stake out whole new markets with novel devices that bridge the gap between computers and inexpensive electronic gadget.

Steve Jobs and Bill Gates Talk about Tomorrow
The Future of The PC
Fortune August 26, 1991

Agenda

- Asia Triangle
- Personal Computer Market and Production
  - Japan
  - Korea
  - Taiwan
- New International Tactics

Emerging Powers of Asia PC Vendors

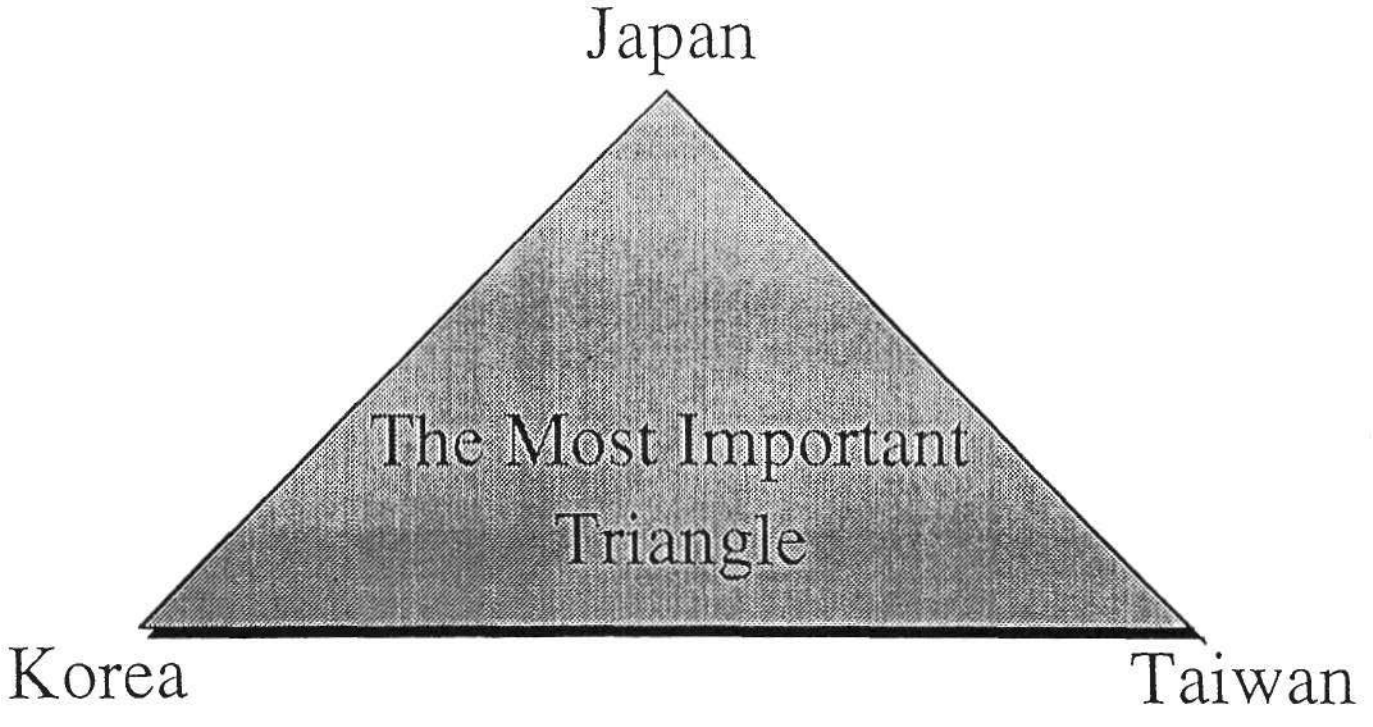
U.S. Market Share of Unit Shipments by Vendor

Game/Hobby ⟶ Business

	1982	1983	1984	1985	1986	1987	1988	1989	1990
1	Commodore	Commodore	Commodore	IBM	IBM	IBM	Apple	IBM	IBM
2	TI	TI	IBM	Apple	Apple	Apple	IBM	Apple	Apple
3	Apple	Apple	Apple	Commodore	Tandy	Commodore	Commodore	Commodore	Tandy
4	Tandy	IBM	Tandy	Tandy	Commodore	Tandy	Tandy	Tandy	Compaq
5	Timex	Atari	Atari	Compaq	Atari	Zenith	Atari	Compaq	Packard Bell
6	Osborne	Tandy	Compaq	AT&T	Compaq	Atari	Compaq	Packard Bell	Commodore
7	Atari	Timex	Coleco	Atari	AT&T	Compaq	Zenith	Zenith	Epson
8	HP	Coleco	HP	HP	Zenith	Leading Edge	Epson	Atari	Toshiba
9	Xerox	Kaypro	Franklin	Zenith	Leading Edge	Epson	HP	Epson	Samsung
10	Zenith	Digital	Zenith	Kaypro	Epson	AT&T	Toshiba	NEC	ZDS-GB

Source: Dataquest

New International Tactics

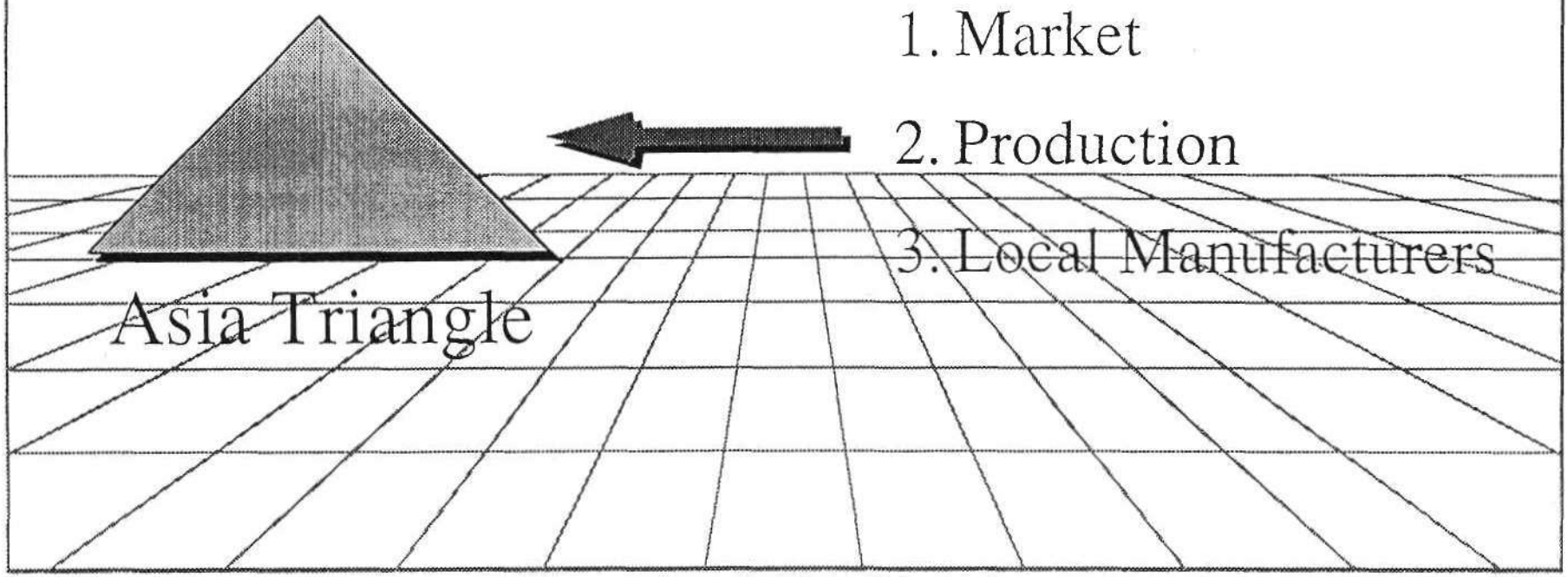


Changes

Market	Region	U.S.A.	→	Eastern Europe, Asia
Model	Microprocessor	80286	→	386SX/SL
	Packaging	Desktops	→	Notebooks
Vendor	Nationality	Japan	→	Korea
		U.S.A		Taiwan

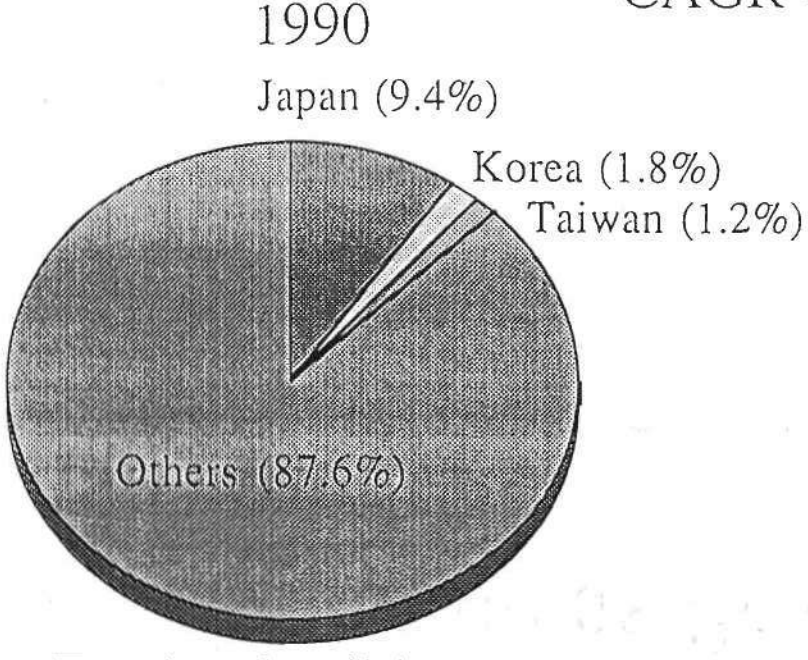
Source: Dataquest

Asia: Japan, Korea and Taiwan

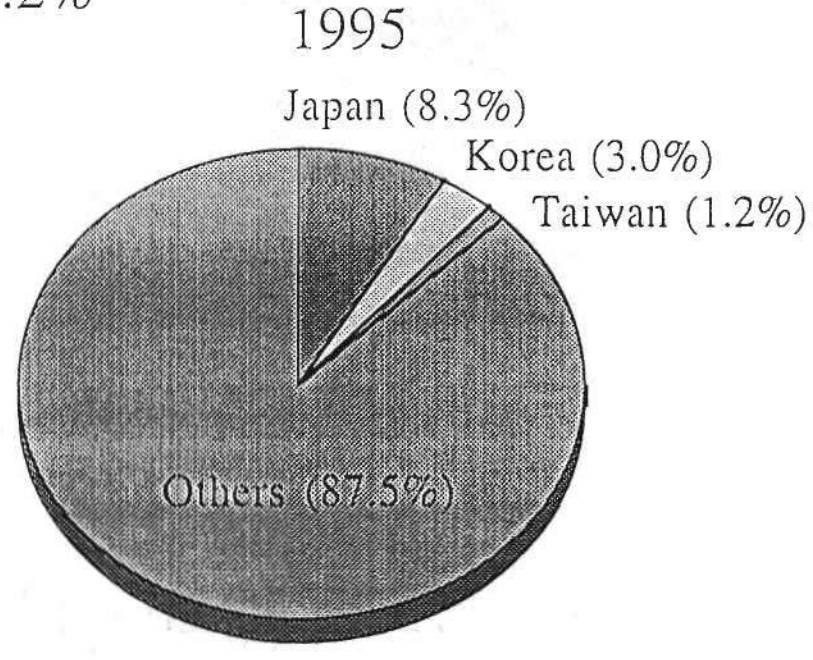


Asia Triangle as Market: 1990 – 1995

CAGR = 13.2%



Total: 2.9 million units

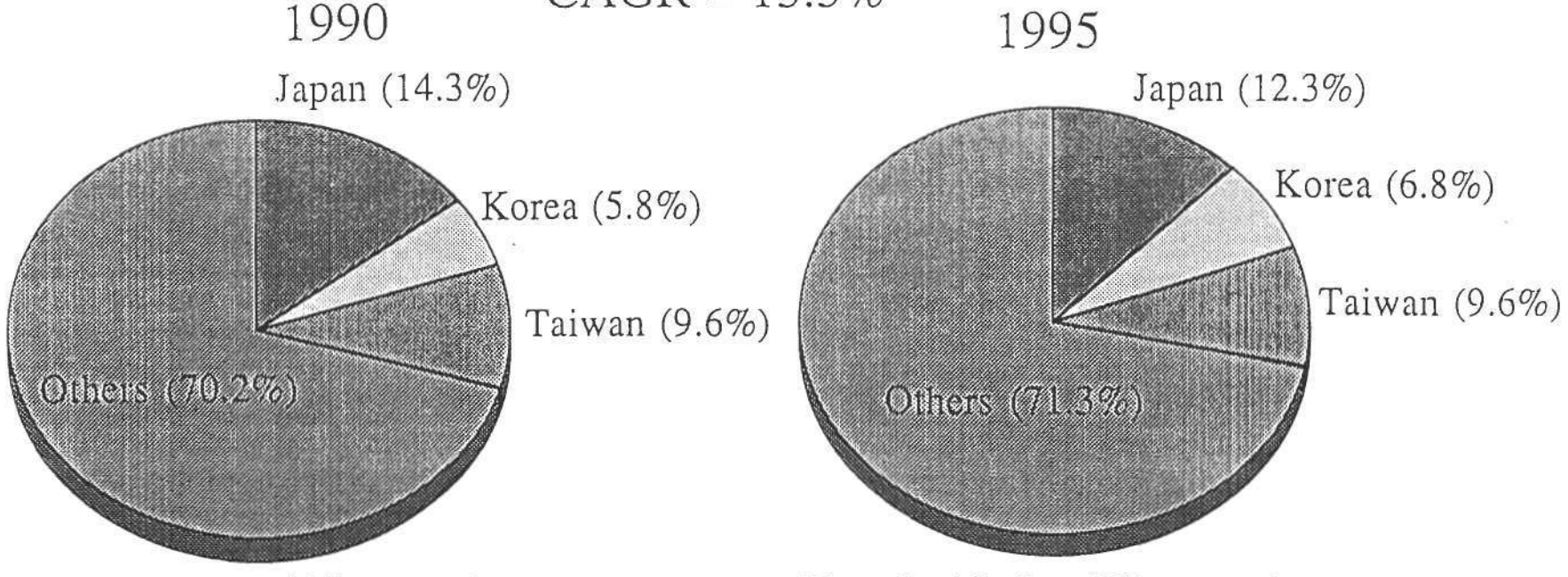


Total: 5.9 million units

Source: Dataquest

Asia Triangle as Production Sites: 1990 – 1995

CAGR = 13.5%



Total: 7.1 million units

Total: 13.5 million units

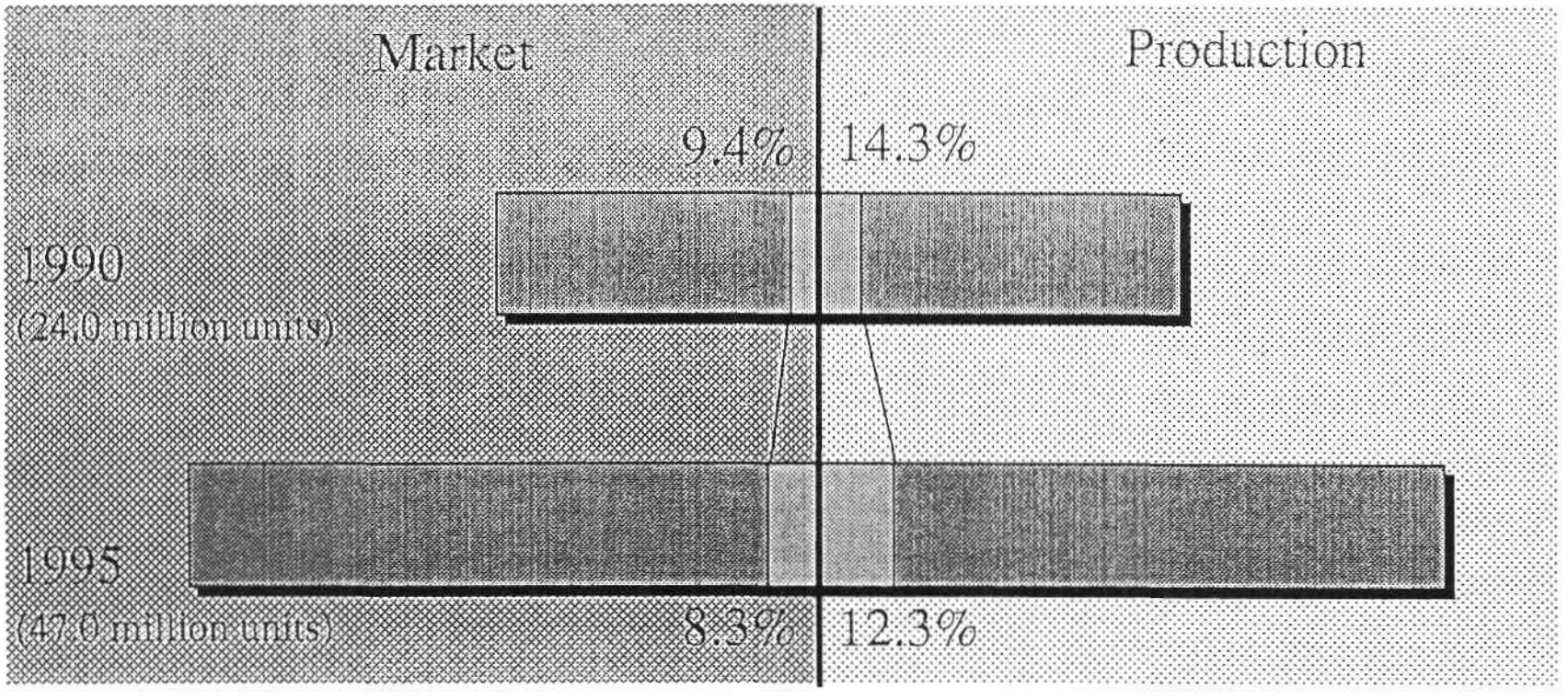
Source: Dataquest

Asia Triangle as Local Manufacturers

1984	1990		
	Japan	Korea	Taiwan
NEC	Epson	Daewoo	Acer
	NEC	Hyundai	Copam
	Panasonic	Samsung	LEO
	Sanyo	GoldStar	Mitac
	Sharp	TriGem	Tatung
	Toshiba	Koryo	Twinhead

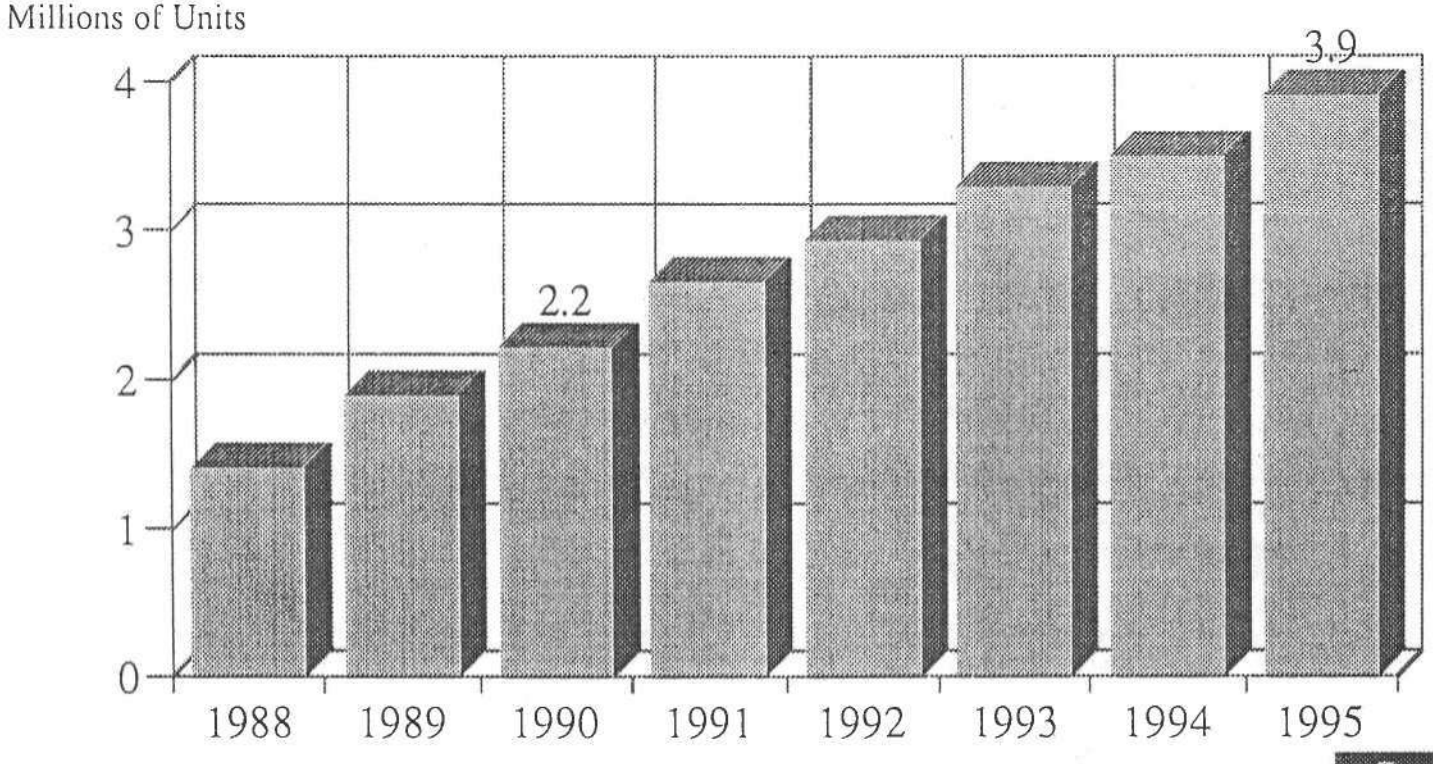
Source: Dataquest

Japanese Personal Computer Market and Production: 1990 – 1995



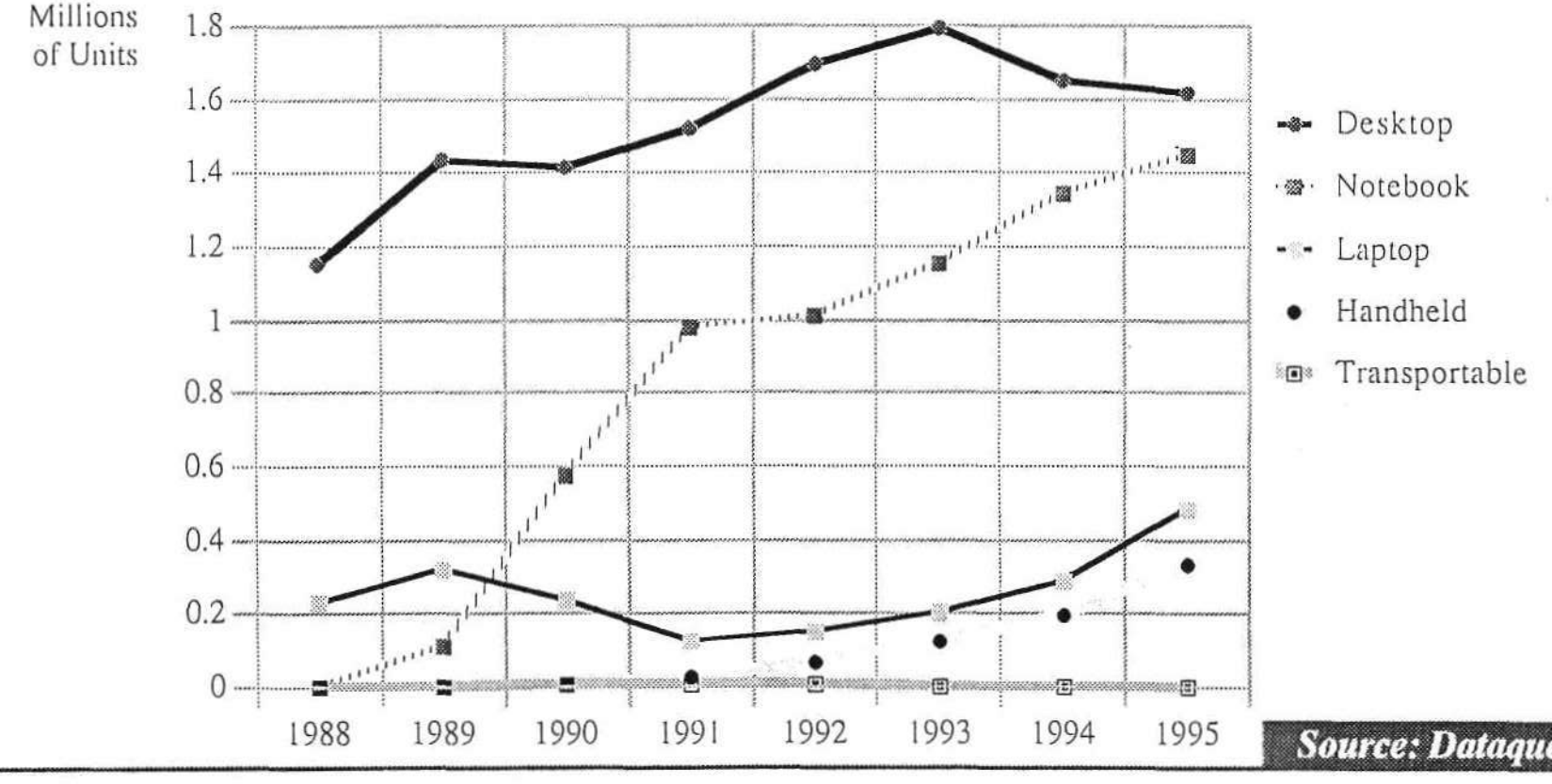
Source: Dataquest

Japanese PC Market Projection: 1988 – 1995



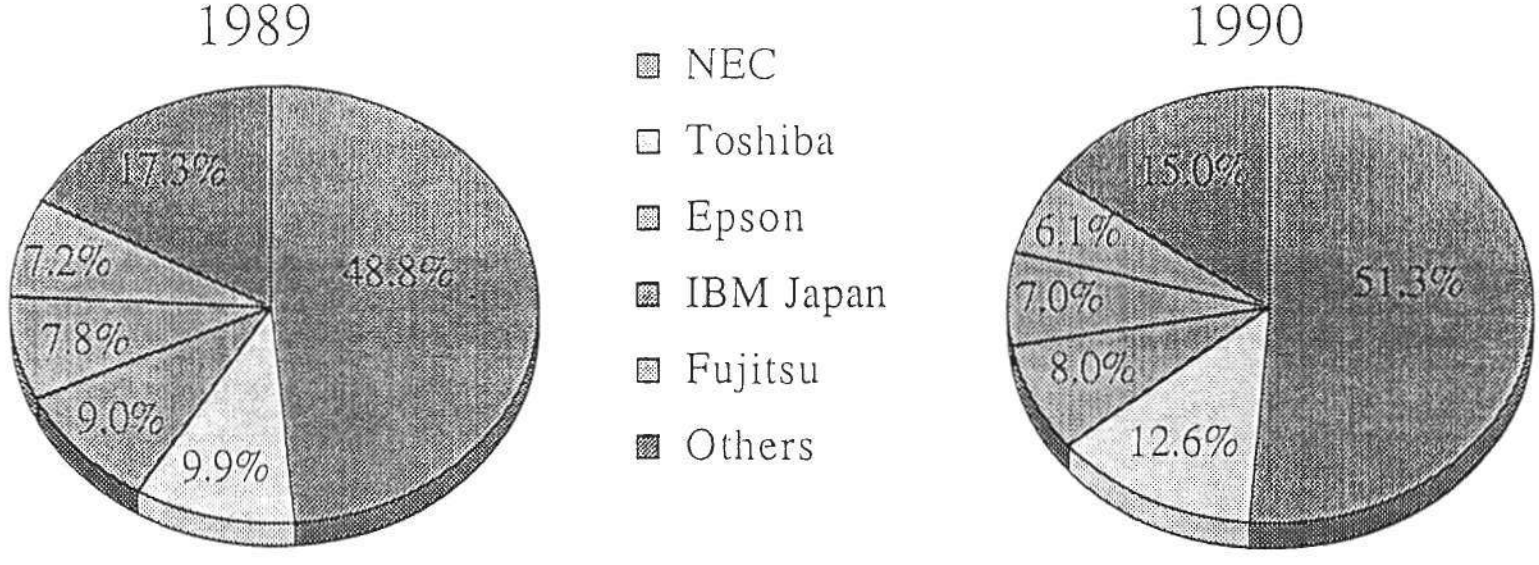
Source: Dataquest

Japanese PC Market Projection by Packaging Type: 1988 – 1995



Source: Dataquest

Japanese PC Market Share Changes: 1989 – 1990

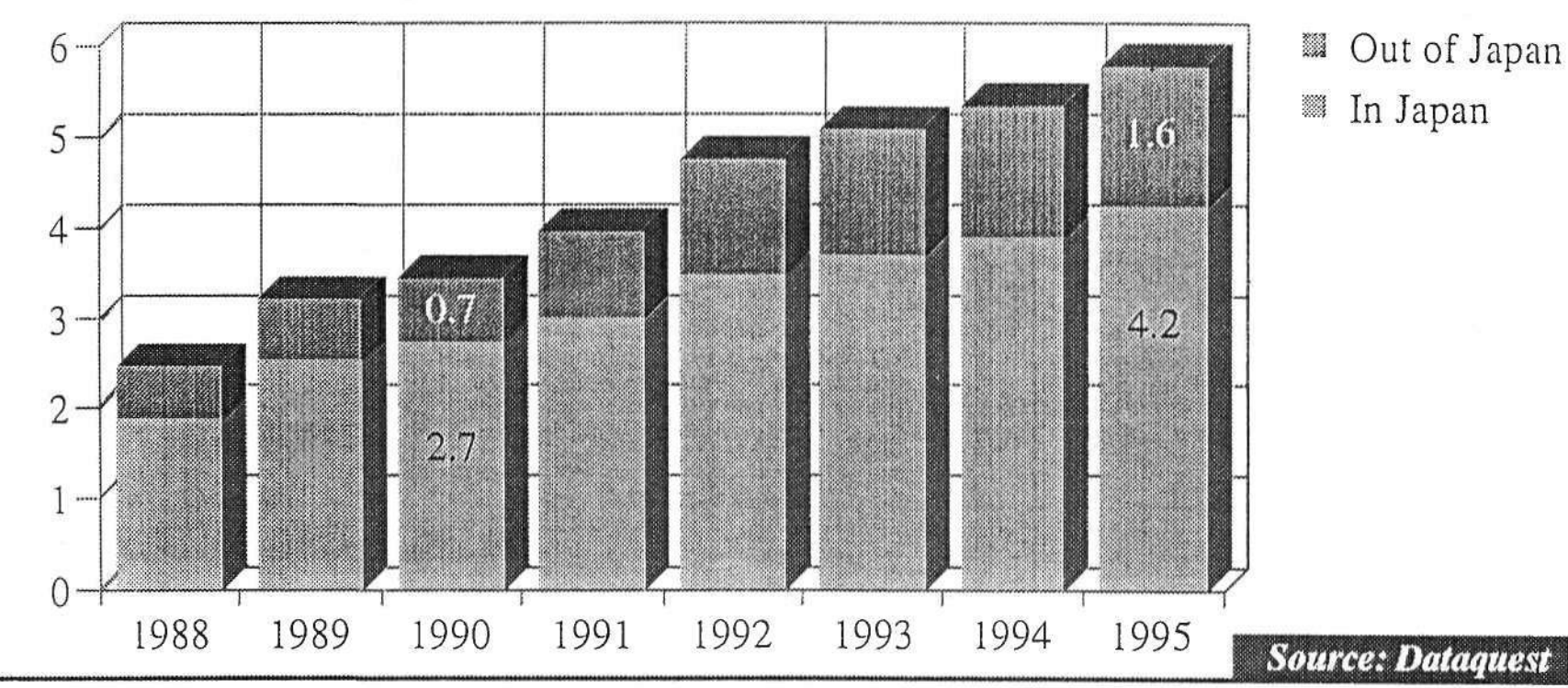


Total: 1.865 million units

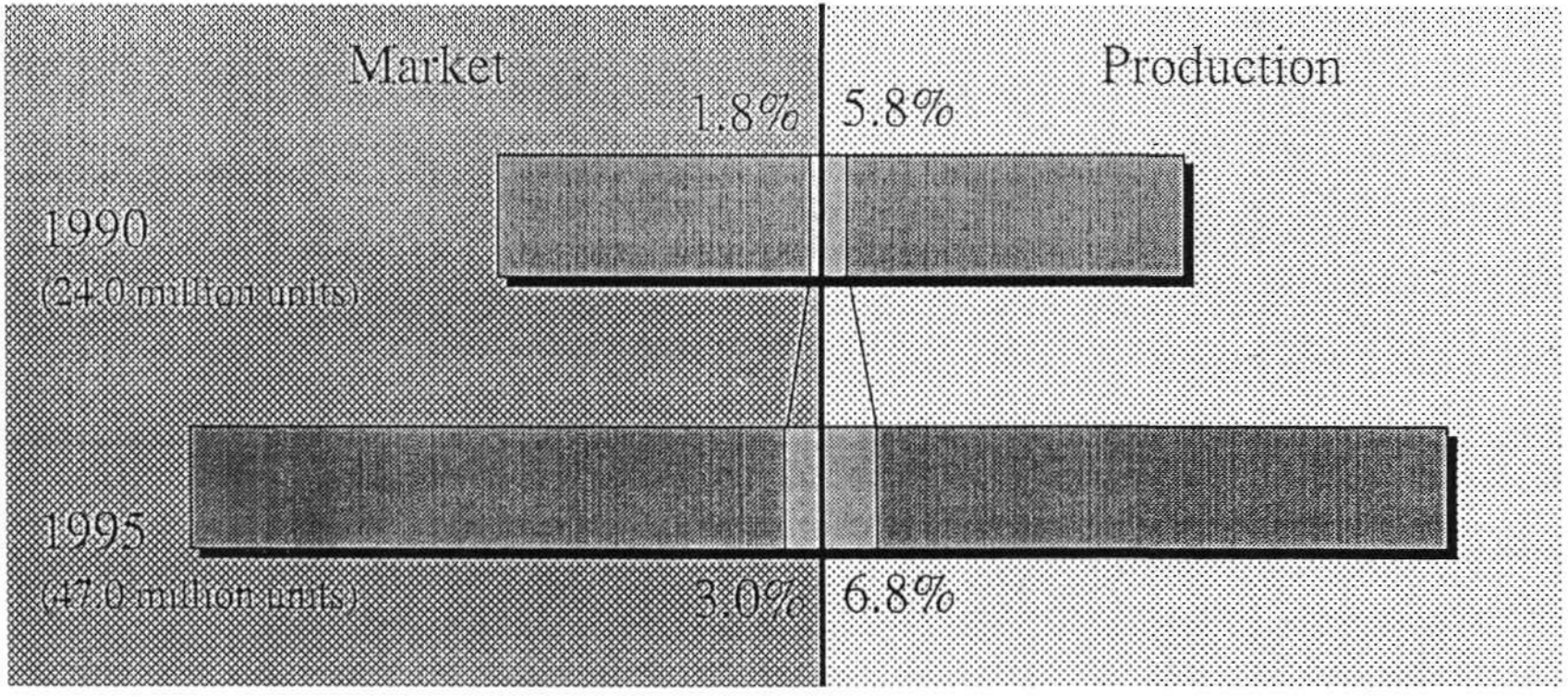
Total: 2.245 million units

Source: Dataquest

Japanese PC Production Forecast: 1988 – 1995

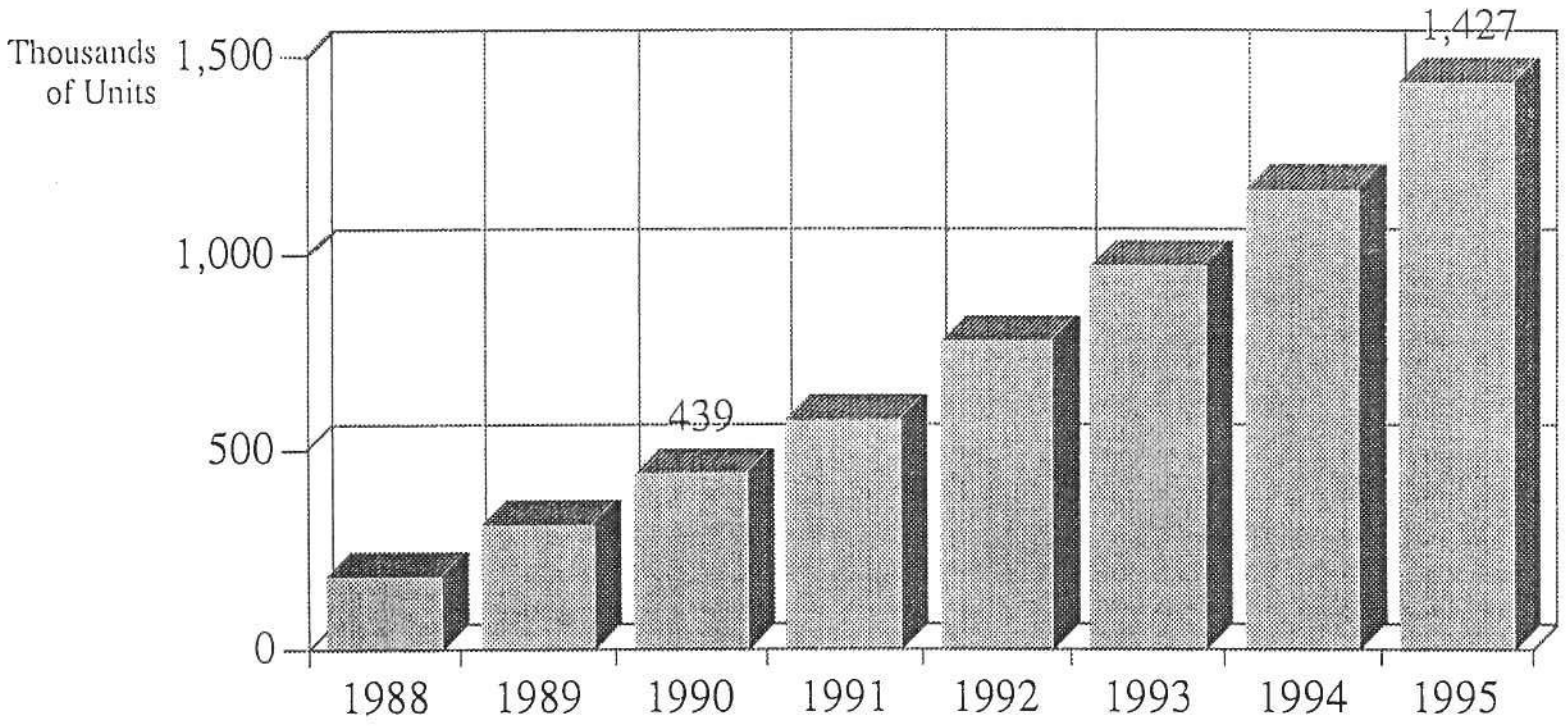


Korean Personal Computer Market and Production: 1990 – 1995



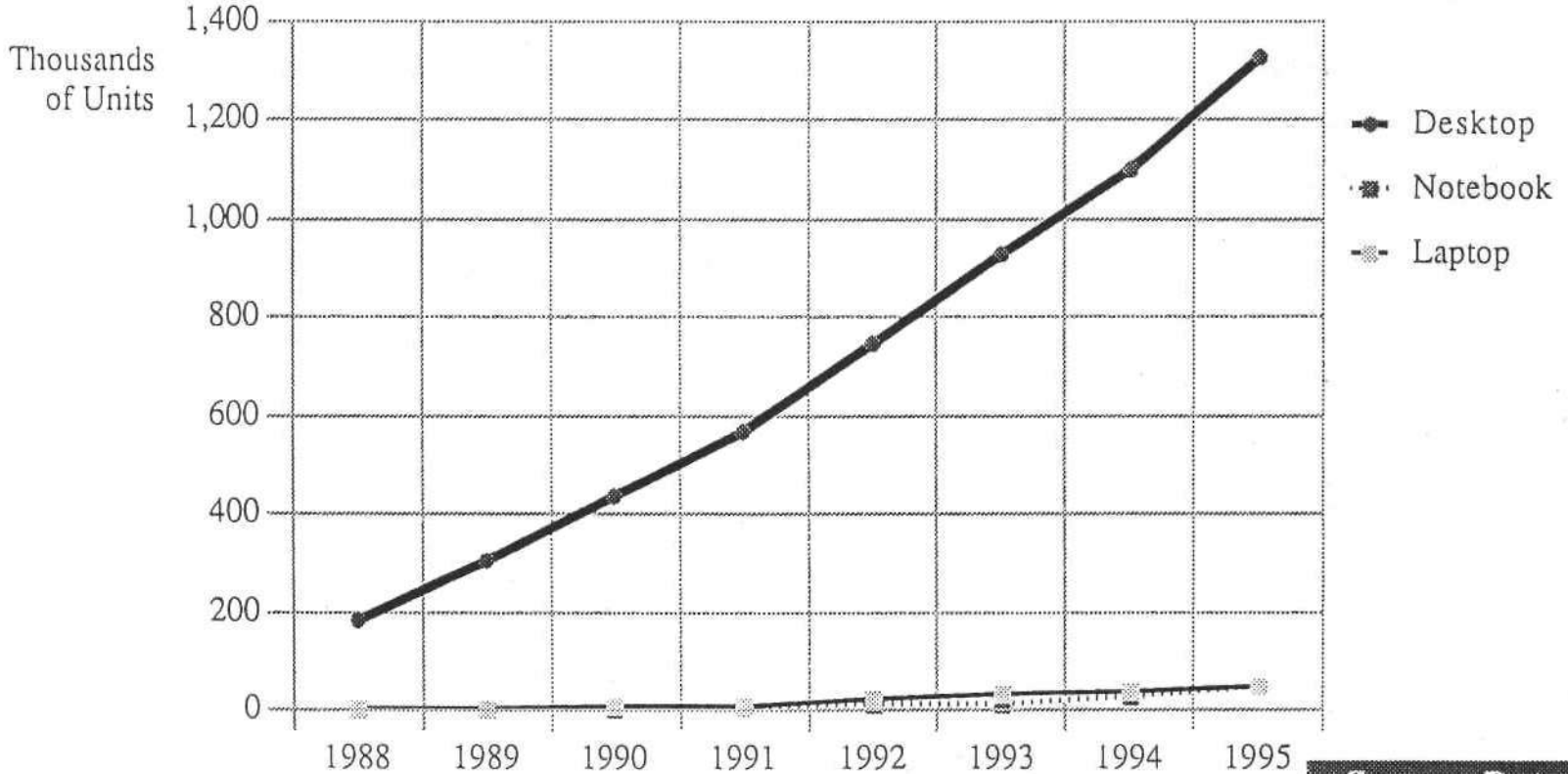
Source: Dataquest

Korean PC Market Projection: 1988 – 1995



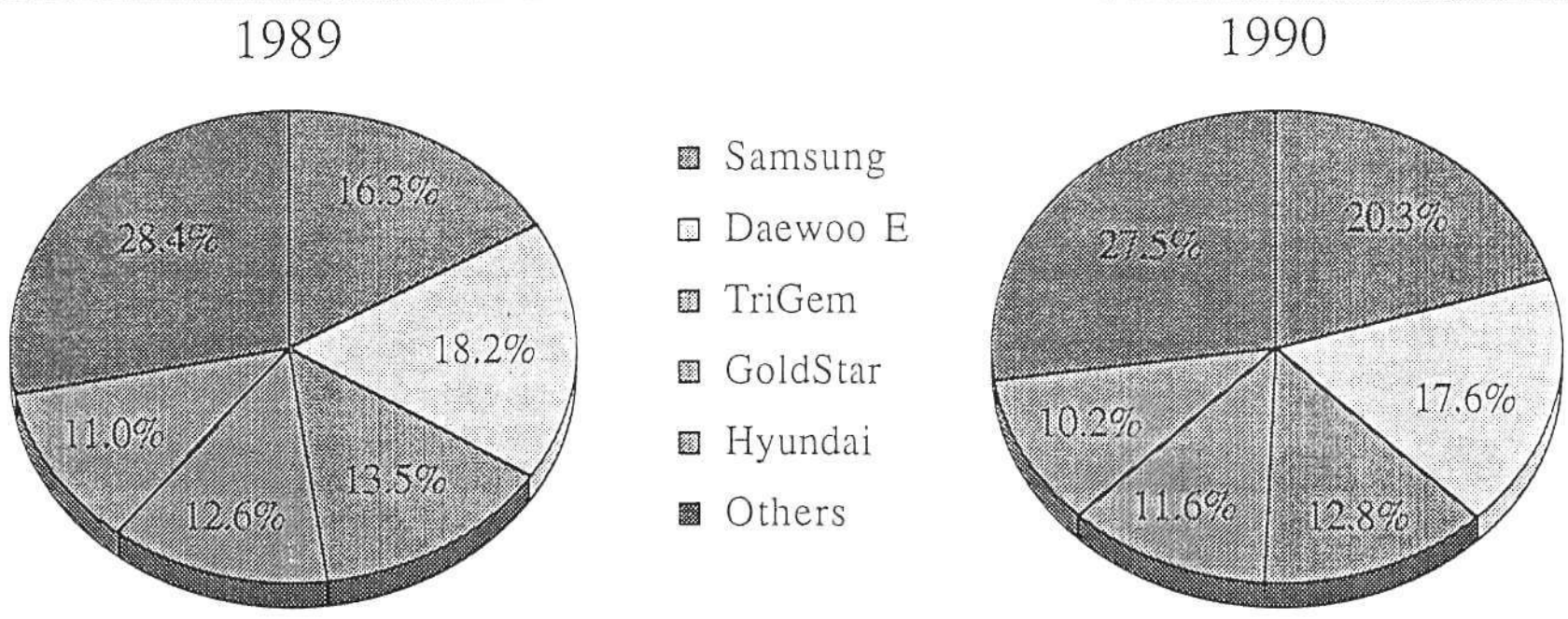
Source: Dataquest

Korean PC Market Projection by Packaging Type: 1988 – 1995



Source: Dataquest

Estimated Korean PC Market Share Changes: 1989 – 1990

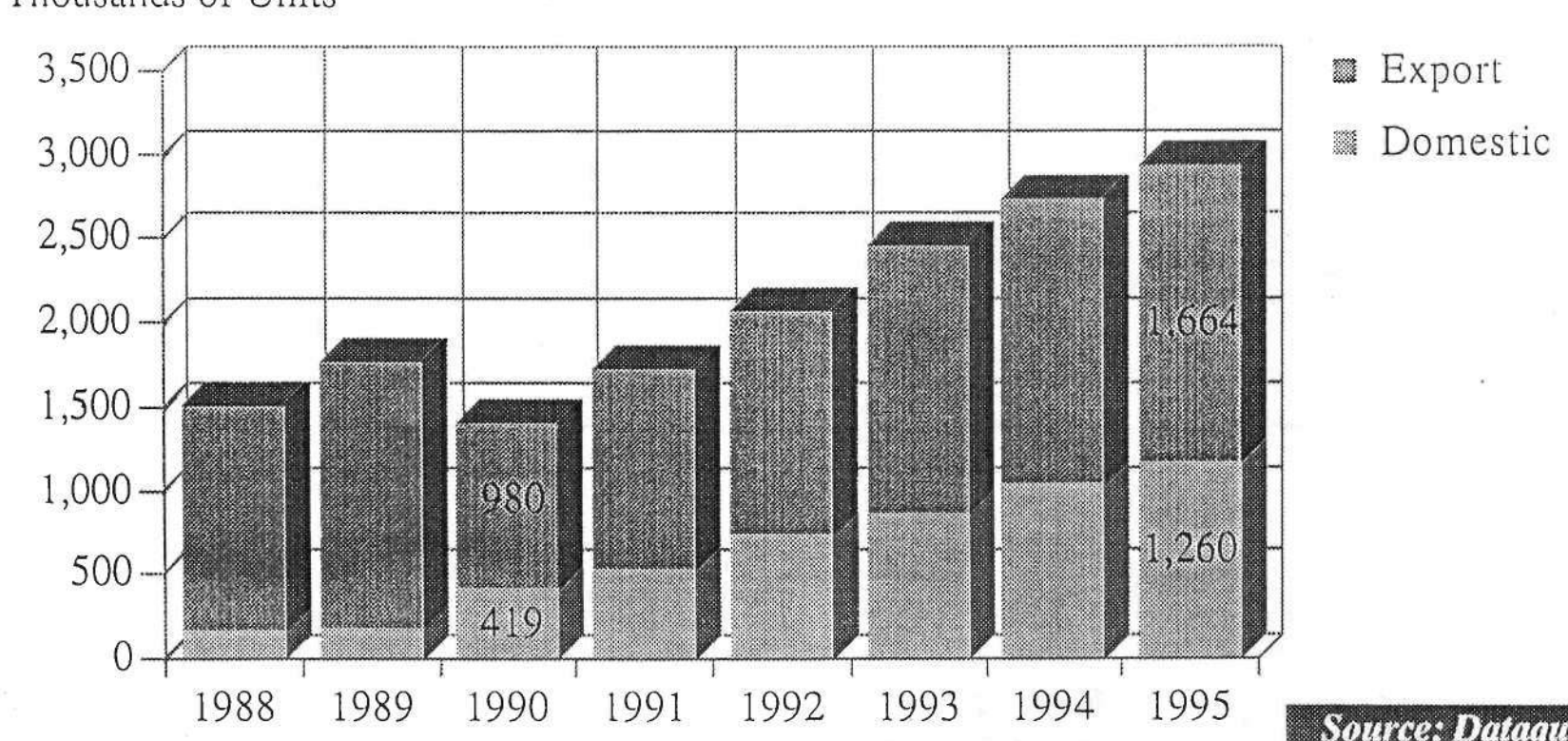


Total: 306 thousand units

Total: 439 thousand units

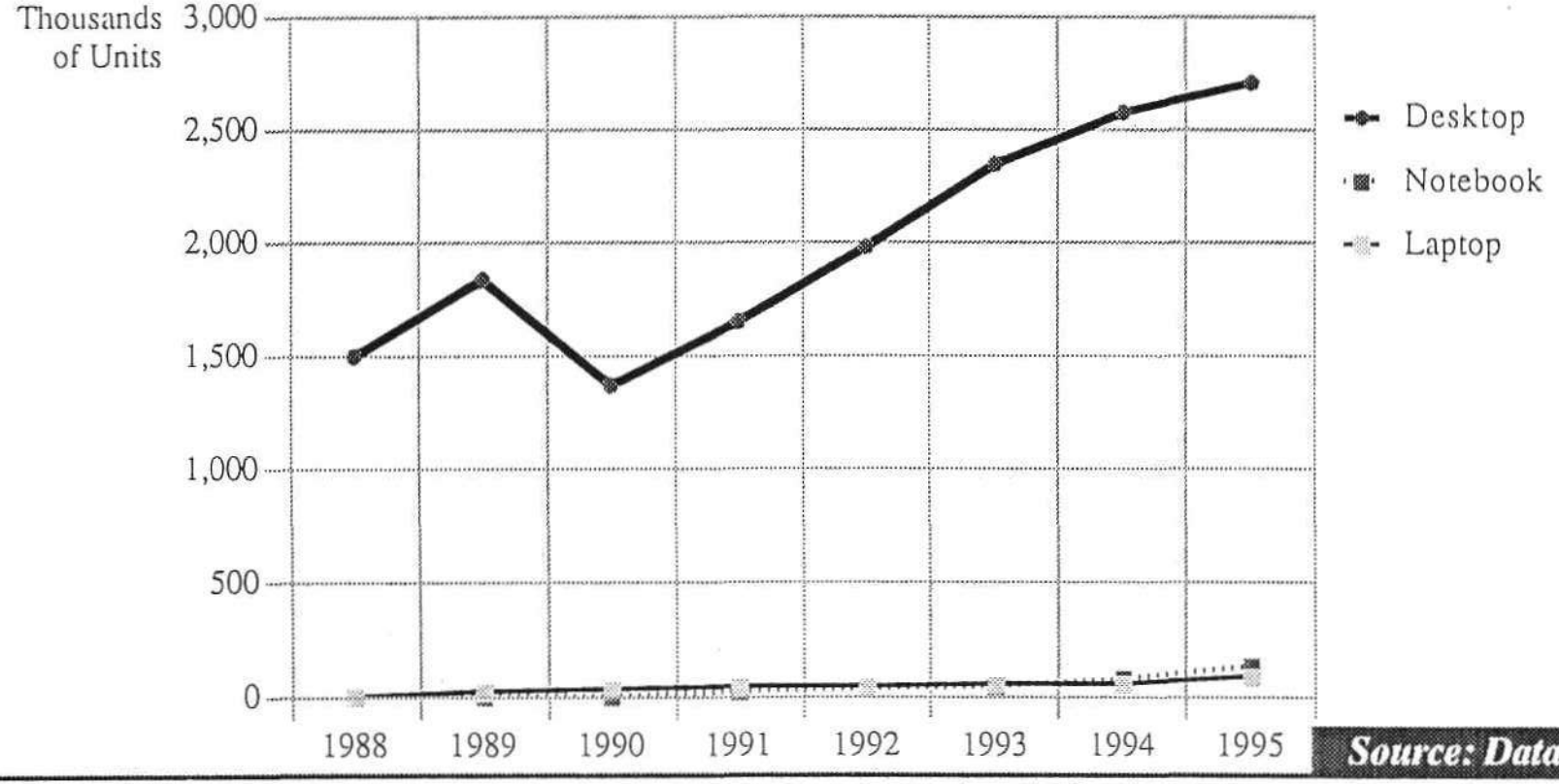
Source: Dataquest

Korean PC Production Forecast: 1988 – 1995



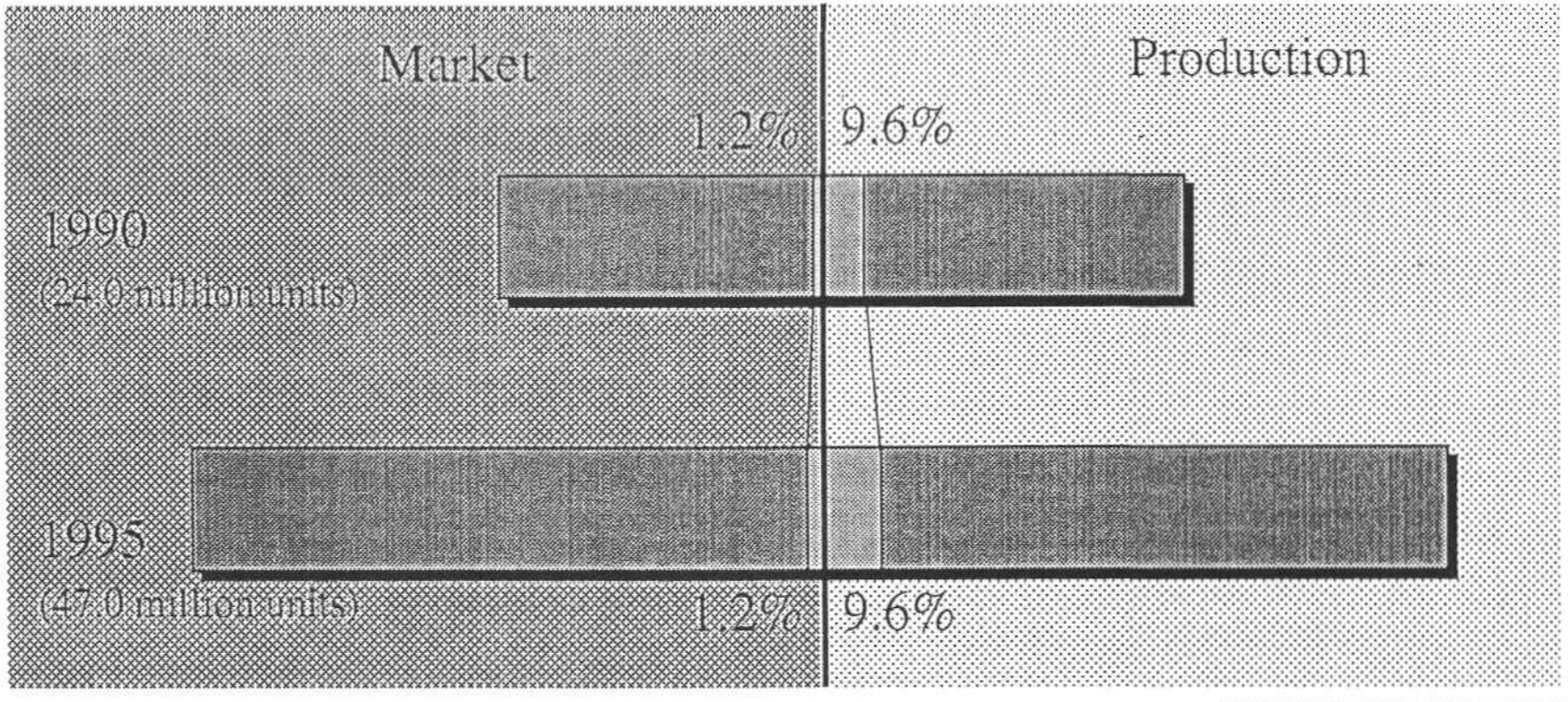
Source: Dataquest

Korean PC Production Forecast by Packaging Type: 1988 – 1995



Source: Dataquest

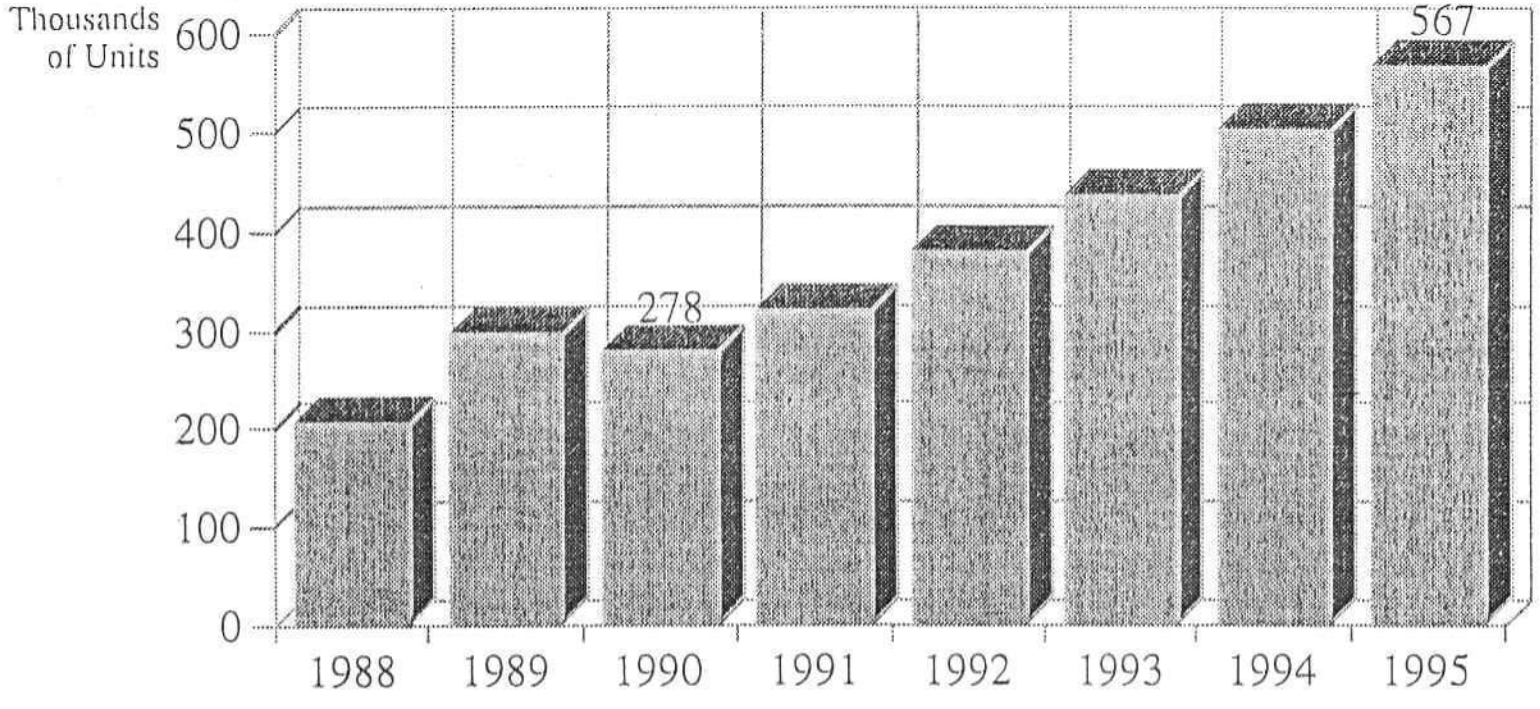
Taiwan Personal Computer Market and Production: 1990 – 1995



Source: Dataquest

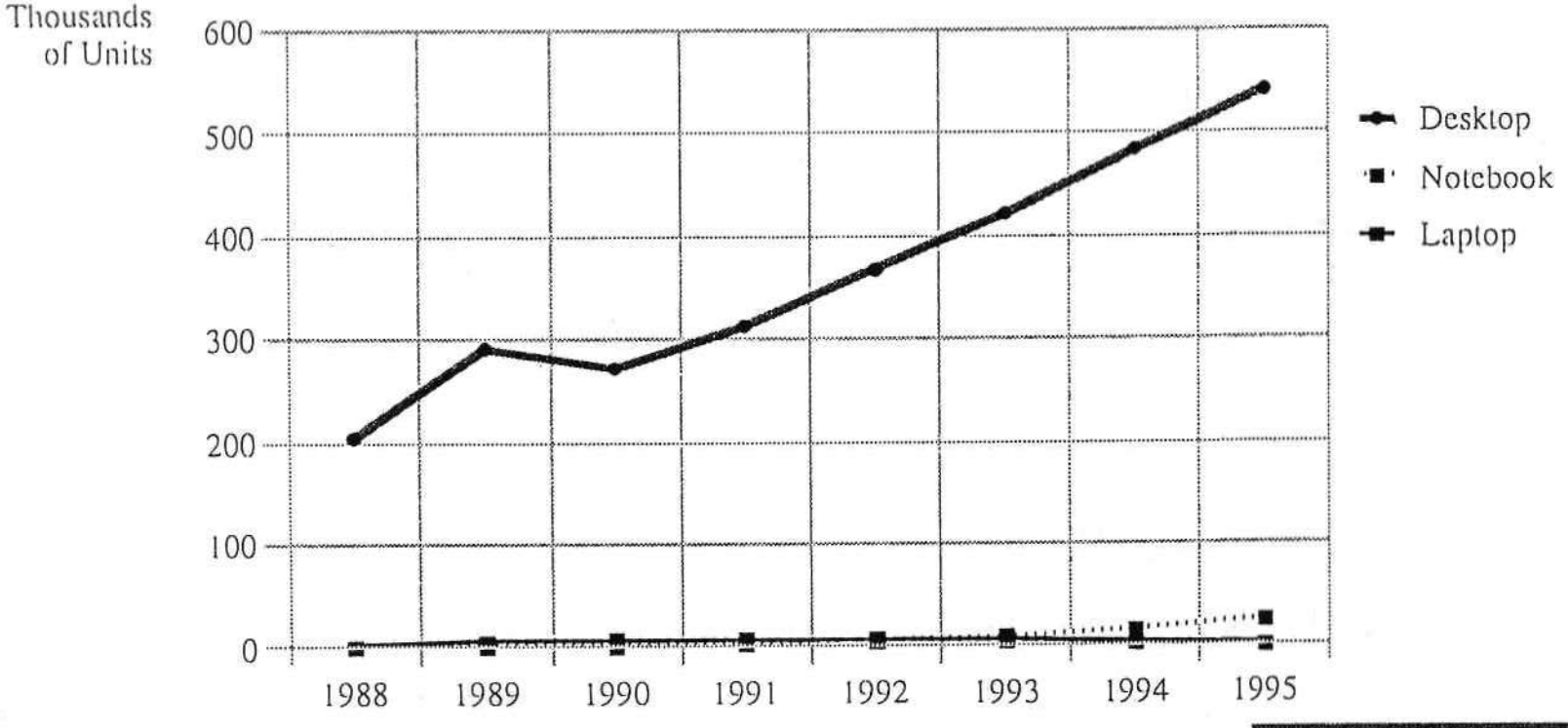
Asian & Japanese Personal Computer Market

Taiwan PC Market Projection: 1988 – 1995



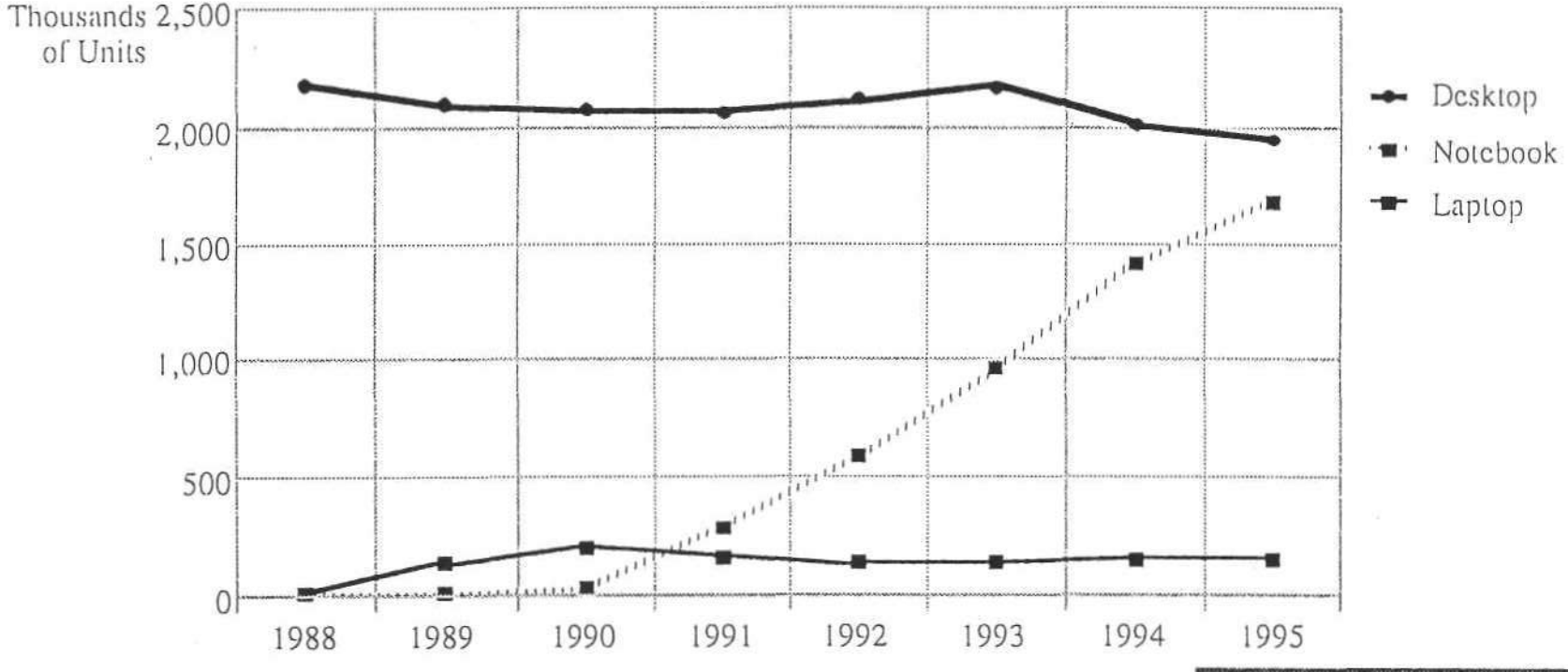
Source: Dataquest, MIC

Taiwan PC Market Projection by Packaging Type: 1988 – 1995



Source: Dataquest, MIC

Taiwan PC Production Forecast by Packaging Type: 1988 - 1995



Source: Dataquest, MIC

Dataquest View: Japan

- Today
  - The Second Largest Single Market in the World
  - Major Vendors for Portable Machines
  - Own Brands
  - OEM ➡ JanaNIEs
  - Advanced Technology Development
    - Display, Battery and IC Cards
- Tomorrow
  - Strategies for Severe Competitions from Asian NIEs PC Vendors
  - NEC De-facto Standard
  - Trade Frictions
  - Too Much Rely on Portable Machines
    - The Revenge of Desktop PC Arena
  - Concept Creator
    - Personal Computers from Tools for Dataprocessing to Tools for Creative Works

Source: Dataquest

Dataquest View: Korea

- **Today**
  - The Second Largest Single Market in Asia
  - Government-led Demands for PCs
  - Integrated Manufacturers
  - Major Vendors for OEM
  - OEM ➡ Own Brands
- **Tomorrow**
  - Strategies against Taiwan PC Vendors
  - Lower Awareness of Brands
  - Too Much Rely on Export (OEM) Business
  - Weak Relationships with Local Personal Computer Industry

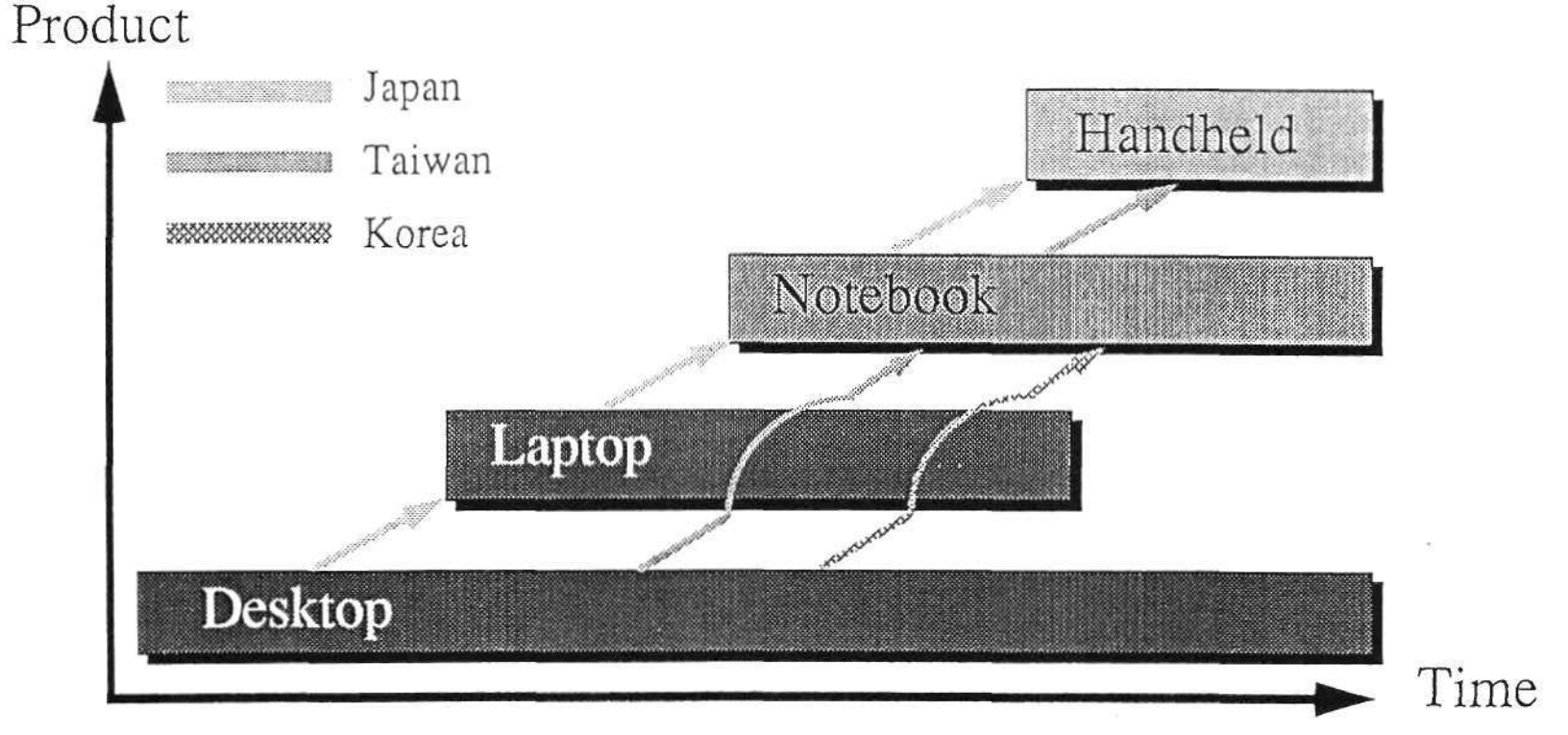
Source: Dataquest

Dataquest View: Taiwan

- **Today**
  - Major Vendors for OEM
  - Own Brands
  - OEM
  - Government-led Technology Developments for PCs
  - Established PC Speciality Manufacturers
  - Acceptances as PC Speciality Manufacturers with Technology
- **Tomorrow**
  - Strategies for Price Competitions
  - Product Differentiations
  - Too Much Rely on Export (OEM) Business
  - Emerging Superstores as Major Retail Channels

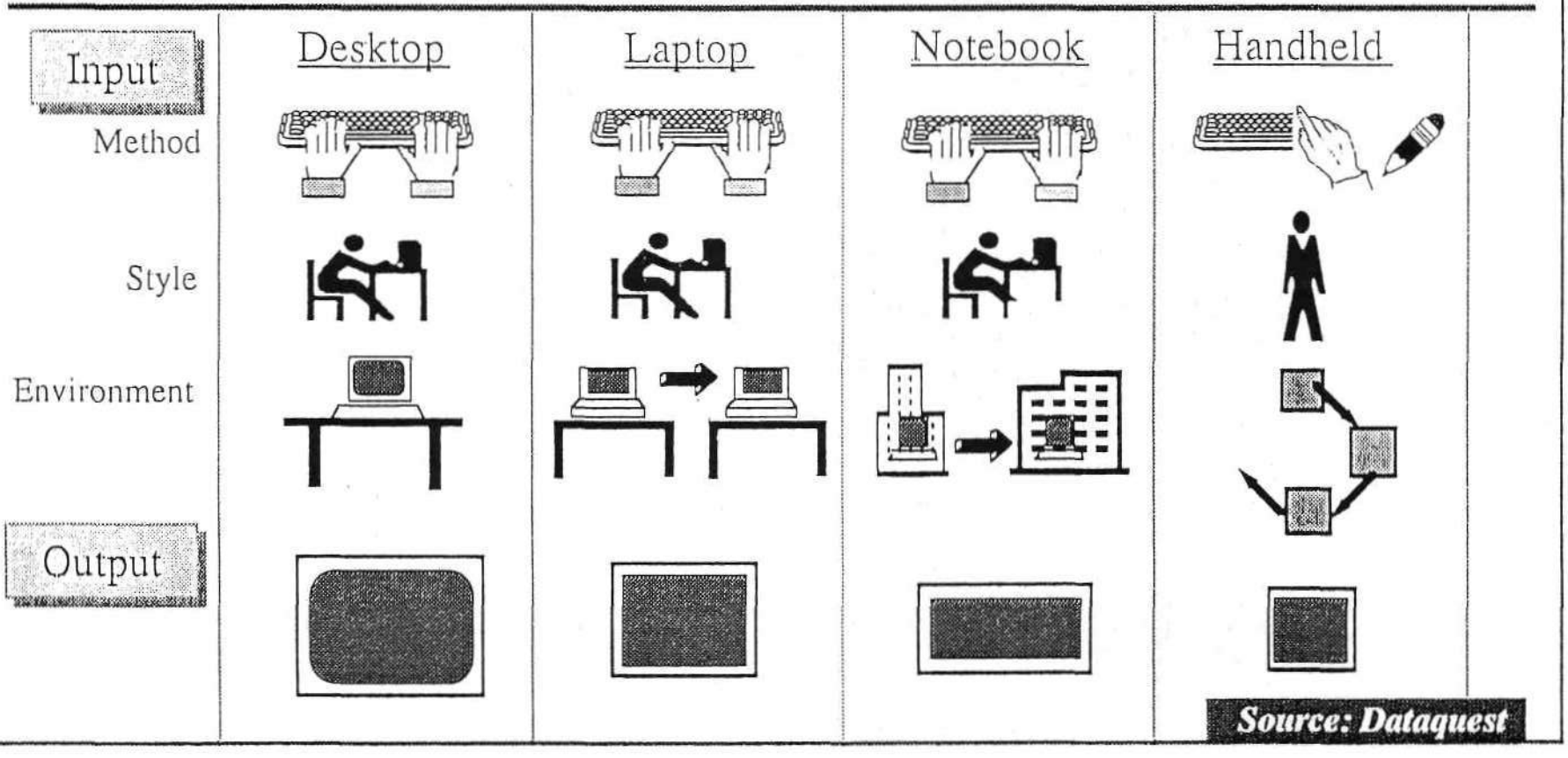
Source: Dataquest

International Tactics: Product Approach



Source: Dataquest

Dataquest View: Future Handheld PC



Strategies to bring up the Korean Electronics Industry

Ki Sung Lee
Director General
Bureau of Electronics and Electric Appliances Industry
Ministry of Trade and Industry

Ki Sung Lee is currently the Director General of the Bureau of Electronics and Electric Appliances Industry at the Ministry of Trade and Industry. He has held this position since January 1991. Dr. Lee has been with the Ministry of Trade and Industry since 1965 and he has held several managerial positions namely, Officer for Trade Cooperation, April 1990 to January 1991; Director General at the Office of Patents Administration, June 1987 to March 1990; and Officer for Trade Promotion, February 1986 to May 1987. From 1965 to 1986 he has held positions of Director at the Office of Patents Administration, Manager at the Ministry and Officer at the Ministry. Dr. Lee received a B.S. degree in Law from Koryo University, Seoul, Korea; a M.S. degree in Economics from Kukmin University, Seoul, a M.S. degree in Economics from Canberra University, Australia; a M.S. degree in Economics from Vanderbilt University, United States; and a Ph.D. degree in Economics from Kukmin University, Seoul, Korea.

Data Quest 강연자료

'91. 9. 30 (월) 14:45~15:15

전자정보산업의 육성 방향

'91. 9. 30

상 공 부 전자전기공업국장

이 기 성

1. 전자산업의 최근 동향

수출동향

o 전자산업은 '89년 이후 국내의 고임금화 추세에 따라 주종품목인 가전제품의 가격경쟁력이 약화되고 국내기술수준의 저위로 인한 고부가가치 신제품 개발도 지연되어 수출부진 추세가 지속

o 금년들어 1~7월간 수출은 15.8% 증가하여 '89년 이후의 수출부진 에서는 벗어났으나 이는 EC 및 동구권 특수로 인한 일시적 요인에 힘입은 바 크며, 주시장인 미국.일본시장의 수출부진이 지속되고 있고 하반기 들어 대EC 수출도 급격히 둔화되고 있어 금년 수출은 13~14% 증가한 2,029불선으로 전망됨.

[수출동향 및 전망]

(단위 : 백만불, %)

구 분	'89	'90	'91.1~7	'91 전망
금 액	17,087	17,815	11,289	20,220
증가율	5.1	4.3	15.8	13.5

투자동향

o '89년 이후의 수출부진으로 '90년에는 '89년대비 16%가 감소하였으나 금년에는 17.8% 증가한 25,365억원에 달할 전망임

o 투자내용에 있어서는 최근 수출수요의 부진을 반영하여 설비능력 증가 투자는 10.6% 증가에 그치고 있으며 그중 신제품 생산 투자는 23.8% 증가할 전망이나 설비확장은 오히려 10.2% 감소할 전망임. 반면에 최근의 임금상승에 따른 경쟁력 약화를 자동화와 기술개발로 극복하기 위해 합리화 투자는 26.6%, 연구개발 투자는 45%가 증가할 전망임

[설비투자 동향 및 전망]

(단위 : 억원, %)

구 분	설비투자액			증 감 율	
	'89	'90	'91	'90/'89	'91/'90
합 계	25,653 (100.0)	21,541 (100.0)	25,365 (100.0)	-16.0	17.8
o 설비능력 증가	17,429 (67.9)	12,318 (57.2)	13,622 (53.7)	-29.3	10.6
- 신제품 생산	6,141 (23.9)	7,535 (35.0)	9,328 (36.8)	22.7	23.8
- 설비 확장	11,288 (44.0)	4,783 (22.2)	4,294 (16.9)	-57.6	-10.2
o 합 리 화	4,364 (17.0)	4,325 (20.1)	5,476 (21.6)	-0.9	26.6
- 자동화.성력화	2,738 (10.7)	2,003 (9.3)	2,623 (10.3)	-26.8	31.0
o 연구개발	1,775 (6.9)	2,807 (13.0)	4,093 (16.1)	58.1	45.8
o 기 타	2,085 (8.1)	2,091 (9.7)	2,174 (8.6)	0.3	4.0

※ 주 : ( )는 구성비(%), ※ 자료 : 한국산업은행

2. 전자산업의 당면과제와 정책 방향

가. 당면 과제

- ㅇ 전자산업은 기술력이 그 성패를 좌우하는 반면 우리의 자체 기술개발 기반의 취약으로 선진국과의 기술격차가 상존하고 있으며 이를 극복하기 위한 기술 개발 투자의 확대와 산.학.관을 연계하는 효율적인 기술개발체제 구축이 시급

- ㅇ 산업구조를 고부가가치.기술집약형 으로 더욱 고도화 하기 위하여 산업용 전자기기의 생산.수출비중을 높이고 그 중요성이 증대되고 있는 소프트웨어 및 데이타베이스 등의 정보처리산업을 포함한 정보산업을 본격적으로 육성 하여야 함

- ㅇ 조립가공형 생산.수출 구조의 탈피를 위한 핵심부품.소재 국산화의 조기추진과 수출산업화를 촉진

- ㅇ 국내 전자제품은 수출시장에서 아직도 가격에 큰 영향을 받으므로 원가절감, 불량율저하, 자동화 등을 통한 생산성향상으로 가격경쟁력을 향상

- ㅇ 소수국가에 편중된 무역구조로 인한 무역마찰을 해소하고 지속적인 수출증대를 위하여 시장구조를 다양화하고, 개방경쟁체제에 대응한 우리 전자산업의 국제화도 적극 추진해야 함

- ㅇ 우리나라 전자제품의 수출은 아직도 OEM 수출비중이 총수출액의 70% 정도를 차지하고 있으므로 국가상표수출로의 전환에 적극 노력

나. 정책 방향

o 첨단 대형기술과제의 공동 개발

- 향후 세계시장 규모가 크고 전자산업의 성장을 주도할 품목으로서 산업 전반에 미치는 기술적 파급효과가 큰 반면
- 개발에 소요되는 자금과 인력의 과다로 개별기업 차원에서 개발.추진이 곤란한 품목을 대상
- 국가적 차원에서 상공부를 비롯한 과기처, 체신부 등 관계부처에서 공동으로 개발을 지원하고 산업계와 대학, 연구기관 등을 연계하여 공동개발을 추진
- 현재 HDTV, 16/64M DRAM, 첨단중형컴퓨터(주전산기 Ⅲ), G4 FAX 등의 개발을 추진중

o 핵심부품 개발 추진

- 기술 및 자본집약적이고 선진국이 기술이전을 기피하는 LCD, Microprocessor등 18개 핵심부품 개발을 추진
- 제조업경쟁력 강화대책중 생산기술발전 5개년계획의 일환으로서 공업기반 기술 개발사업 등을 통하여 지원 ('91년중 232억원 지원)
- 핵심부품개발 지원을 위하여 생산기술연구원 산하 전자부품종합기술연구소 설립 ('91.8월)

o 전자부품.소재의 국산화 추진

- 전자산업의 수입의존적 생산구조의 개선을 위하여 '86년 이후 전자부품. 소재 국산화 5개년 계획을 수립하여 추진중
- '86년 부터 '91.6월 까지 공업발전기금 등에서 1,669억원을 지원하여 500개 품목을 개발완료하고 735개 품목의 개발을 추진중임.
- 내년부터 '96년까지 제2차 5개년 계획을 수립하여 국산화 시책을 계속 추진 예정임.

o 정보산업의 육성을 통한 구조고도화 촉진

- 첨단중형컴퓨터의 국산개발과 PC의 고기능화.소형화를 통해 수출주도 산업으로 육성
- PC 및 주변기기의 핵심부품 개발
- S/W산업, DB산업 등 정보처리산업의 육성을 위해 세제.금융.기술자금 지원 등에 있어서 제조업 차원에서 지원육성하고 전문인력 양성 확대

o 자동화.정보화를 통한 산업의 경쟁력 강화

- 기술 및 기능인력 부족, 고임금화 추세에 대처하여 자동화.정보화 5개년 계획을 수립하여 추진중
- 중소기업의 정보화 추진을 위하여 중소기업 구조조정기금 등을 통하여 지원 추진
- 무역, 유통, 철강, 기계, 전자등 각 산업별 정보화 사업 추진

o 국제화 촉진

- 선진국과의 통상마찰에 대응하여 전자진흥회 등을 중심으로 선진국 관련 단체와의 협의체제를 구축하여 통상마찰을 사전 예방하고 산업협력 강화를 모색
- 컴퓨터, 반도체등 첨단제품을 둘러싼 지적재산권 분쟁에 대처하기 위한 전문 컴퓨터침 보호법의 제정 등 국내제도 정비를 추진
- 전자산업의 해외현지생산 확대, 선진국 기업과의 전략적 제휴, 해외마케팅 능력의 강화등 전자산업의 국제화를 촉진

3. 부문별 육성방향

정보산업

○ 중대형 컴퓨터의 국산개발 추진

- '90년대 중반 국가기간 전산망 사업에 효율적으로 사용할 수 있는 주전산기Ⅲ를 개발하여 수입대체 및 수출산업화
  - 1단계 ('91 ~ '93) : 첨단중형 컴퓨터
  - 2단계 ('94 ~ '96) : 중대형 컴퓨터
  - 3단계 ('97 ~ '99) : 대형컴퓨터
- 상공부, 체신부, 과기처 공동개발 추진
- 소요자금(1단계) : 300억원 (정부지원 110억원, 민간 190억원)

○ PC 핵심부품의 국산화

- 필요성
  - PC 핵심부품은 제품의 경쟁력을 결정하는 주요인으로서 국산개발을 통한 선진국 수입의존탈피 및 수출산업화 이룩
  - 부품의 자체공급을 통한 휴대용 PC의 국제경쟁력 확보
- 대상품목
  - LCD, 마이크로프로세서, 소형, 대용량 HDD와 FDD, 스테핑 및 서보모타, 소형.고충전 밧데리 등
- 추진방법
  - 제조업 경쟁력 강화대책의 일환으로 추진
  - 민간업계의 공동개발을 유도하고 공업기반기술개발자금 지원

o 정보처리산업을 제조업 차원에서 지원 · 육성

- S/W 및 DB산업을 세제 · 금융 · 기술자금 지원 등 정부의 각종 지원시책에 있어서 첨단산업 업종으로 지정하여 지원

- 소프트웨어산업의 육성
  · 소프트웨어업체의 기술정보유통과 전문화 유도를 위하여 협동화단지 및 첨단정보빌딩 건설을 지원
  · 한국컴퓨터기술원, 포항공대부설 정보산업대학원등을 통한 소프트웨어 인력양성 확대

- 데이타베이스산업의 육성
  · 산업기술정보원을 중심으로 데이타베이스 구축 중장기계획을 수립 · 추진하여 공공 데이타베이스를 확충
  · 데이타베이스 관련 기술개발지원 및 표준화 연구등을 위한 지원자금 확보 전담조직의 설치
  · 데이타베이스 기술자 시험제도의 신설 추진등 데이타베이스 인력양성을 확대

반도체 산업

o DRAM 분야의 세계 최고수준 유지

- 16M/64M DRAM 공동개발의 차질없는 추진
- 256M/1G DRAM 공동개발 분위기 조성

o 생산제품의 다양화를 통한 선진국형 수급구조 조기 실현

- ASIC 전문설계회사 및 전용 생산라인 설치 지원

- 연세대 ASIC 설계공동연구소 운영의 내실화를 통한 설계전문인력 양성
- 화합물반도체 발전기반 조성

o 반도체장비 국산화 5개년 계획 추진

- '94년 까지 핵심장비 국산화 기반 조성 및 국산장비 사용비율 50% 달성
- 반도체장비 업체 입지확보 지원 : 천안 2공단, 송탄공단
- 핵심장비 생산을 위한 전문 제조회사 설립
- 반도체 장비 교육센타 설립 추진

o 선진국의 지적재산권 보호주의 강화에 대한 대처

- 반도체칩 보호법 제정
- 민간차원의 협력관계 확대
  . 미국 반도체산업협회(SIA)와 반도체 업계간의 정례모임 개최
  . WSTS(세계 반도체 통계)에 가입 추진 : '91년중
  . 미.일 등의 선진기업과 협력 확대 : 합작투자, 기술제휴, OEM 공급, 특허 Cross Licening 등

전자부품

o 핵심부품 개발에 대한 지원 강화

- '91.3 청와대에 보고된 제조업 경쟁력 강화 방안의 일환으로 추진되고 있는 919개 생산기반 기술개발 과제중 전자부품은 220여개 포함
  . 이를 공업기반기술사업 대상 과제는 66개

- 이중에서 특히 기술자본집약적이고 선진국이 기술이전을 기피하고 있는 액정소자, 소형정밀모터 등 18개 핵심부품에 대해 중점 지원

o 생산기계, 장비의 국산화 및 자동화 촉진

- 시설재에 대해 관세감면 대상 업종 및 시설재의 확대, 시설재 도입에 대한 외화대출 확대 등 세제 금융상의 지원 확대

o 전자재료.소재의 국산개발 촉진

- KIET와 협조하에 종합육성대책 수립 추진중
- 생산기술연구원과 협의하여 전자재료에 대한 표준화 및 품질평가 기능 강화
- 국산개발된 전자재료, 소재의 수요확보 지원

o 전자부품종합기술연구소를 통한 중소기업의 기술개발 지원

- 중소기업의 공통애로기술 및 핵심부품 개발 등 전자부품 기술개발의 종합 구심체 역할 수행

o 전자부품 산업의 국제화 추진

- 외국 관련기관, 단체와의 협력 증진으로 통상마찰 사전 예방
  . 한국 반도체산업협회(SIAK) — 미국 반도체산업협의회(SIA)
  . 전자공업진흥회(EIAK) — 유럽 전자부품협의회(EECA)

- PCB 등 내수형 품목의 수출산업화 유도

- 전자부품의 해외투자 지원
  . 투자정보 제공 등

- 개발부품 소재의 해외 홍보활동 지원 등

o 생산품목의 고도화 및 다양화 추진

- 중저급품 위주의 생산구조에서 고부가가치, 신제품 생산체제로 전환
  . TV : 중소형 CTV → 액정TV, Projection TV
  . VCR : 2Head Mono → 4Head, VHS, 8mm Camcorder, Video Walkman
  . Audio : 보급형 CDP, Car CDP → HI-FI CDP, DAT, 초박형 Walkman
- 대량수출 주종품목, 대기업 중심품목에서 중소기업제품 으로 다양화
- 가정용 의료, 정보가전, 가정용 통신기기를 포함한 System화 추진

o 전문부품업체의 육성

- 다품종 소량생산에 적합한 시스템구축 및 원가절감을 위한 생산공정의 합리화와 자동화 추진
- 현지 부품조달비율을 요구하고 있는 지역을 중심으로 전문부품업체를 동반한 해외진출 적극 추진
- 선진국이 기술이전을 기피하고 있는 첨단산업은 산업계 공동개발로 선진국과의 격차 해소
  . S-VHS VTR, 8mm Camcorder, 대형 브라운관, 비디오워크맨 등
- 선진국이 개발을 추진하고 있거나 차세대 제품으로 실용화가 예상되는 제품은 도입초기 단계에서 상품화를 목표로 정부, 민간 공동개발
- 소형 Motor, PCB, 표면처리기술, 실장기술, 정밀가공기술 등 기반기술 확보

o 국제산업구조의 재편에 부응한 국제화의 추진

- 현지국 기업과의 경쟁우위 확보를 위해 독자브랜드, 마케팅능력, 규모의 경제 등 기업특유의 독점적 우위 확보
  . 가격 및 비가격 경쟁요소 뿐만 아니라 기술경쟁력 확보에도 주력

- 국내기업 상호간 또는 기술력이 앞선 선진국기업과의 전략적 제휴 확대
  . 경쟁력 보완 및 기술력, 고객서비스, 마케팅능력 강화

- 현지 시장특성에 맞는 제품의 개발.생산.판매, 현지 자율경영 등 현지화의 추진

- 경쟁력 상실품목의 생산기지 해외 이전
  . 국내생산은 고부가가치제품 및 핵심부품 생산에 특화
  . 저부가가치 제품 및 단순부품은 해외 현지생산 조달

o 하부구조의 정비

- 국내수요 확대 및 창출
  . 생필품화된 서민용 가전제품(소형 C-TV, 소형냉장고 등)의 특소세 개선 추진
  . 기술개발 선도품목에 대한 특소세 잠정세율 적용 (캠코더, LDP, DAT등)

- 국산품질 우위제품의 홍보 및 서비스 유통망 강화

- HA System, HDTV, DAT 등의 국제규격 통일 및 표준화 사업에 적극 참여

1991 High-Tech Electronics
Industry Conference

Lithography Technology Trends

Shoichiro Yoshida
Senior Managing Director
Nikon Corporation

Shoichiro Yoshida is Senior Managing Director at Nikon Corporation. Prior to this he was Managing Director. Mr. Yoshida joined Nippon Kogaku K.K. (Nikon Corporation after April 1988) in 1956 and has held several managerial positions including, President, Nikon Precision, Inc.; Member of the Board and Director of their Industrial Supplies & Equipment Division; General Manager, Designing Department, Industrial Supplies & Equipment Division; Mr. Yoshida was elected Director of the Semiconductor Equipment Association of Japan in May 1989. He was appointed Project Director, YOSHIDA Nano-Mechanism Project Research Development Corporation of Japan in October 1985. Mr. Yoshida graduated in Precision Engineering from the Department of Technology at Tokyo University.

1991 High-Tech Electronics
Industry Conference

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TIME OF CONFERENCE

1991 High-Tech Electronics
Industry Conference

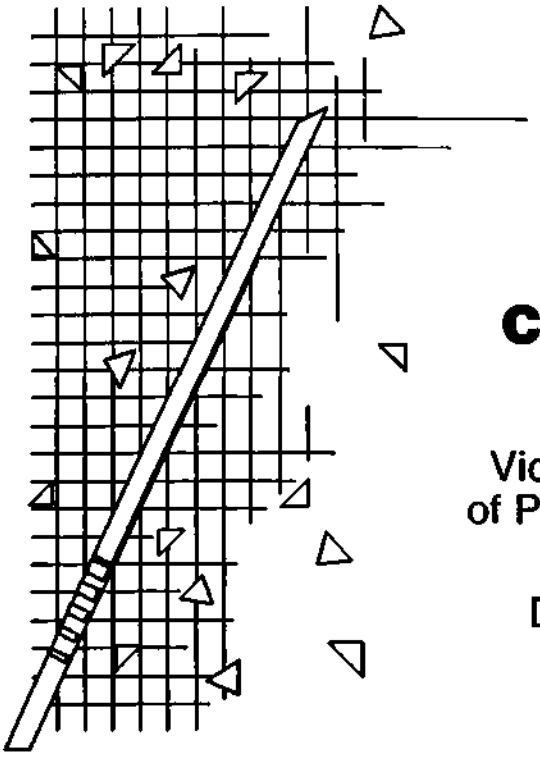
Personal Communications

Victor Krueger
Vice President and Director
Telecommunications Group
Dataquest Incorporated

Mr. Krueger directs Dataquest's research activities in markets for public telecommunications equipment and services, image communications, and in personal communications. Mr. Krueger's group is responsible for analyzing markets, competitive issues, and technology in public transmission and switching equipment, long distance and local telecommunication services, ISDN, video teleconferencing, cellular telephone equipment and services, and the emerging markets in personal communications services. Mr. Krueger is the lead spokesman for personal communications and ISDN.

Mr. Krueger was founder and President of ComQuest Corporation, a leading market research firm specializing in the communications field, prior to the company's acquisition by Dataquest. Previously, he was Vice President of Marketing and cofounder of Stanford Telecommunications. His earlier experience includes senior market research, product planning, and engineering positions with Quantum Science Corporation, Ford Aerospace and Communications Corporation, and Bell Telephone Laboratories.

Mr. Krueger studied physics and mathematics at the University of Gottingen, West Germany, and received B.S. and M.S. degrees in Electrical Engineering from the New Jersey Institute of Technology.



Personal Communications

Victor Krueger

Vice President and Director
of Public Telecommunications
Telecommunications
Dataquest Incorporated

AGENDA

Personal Communications

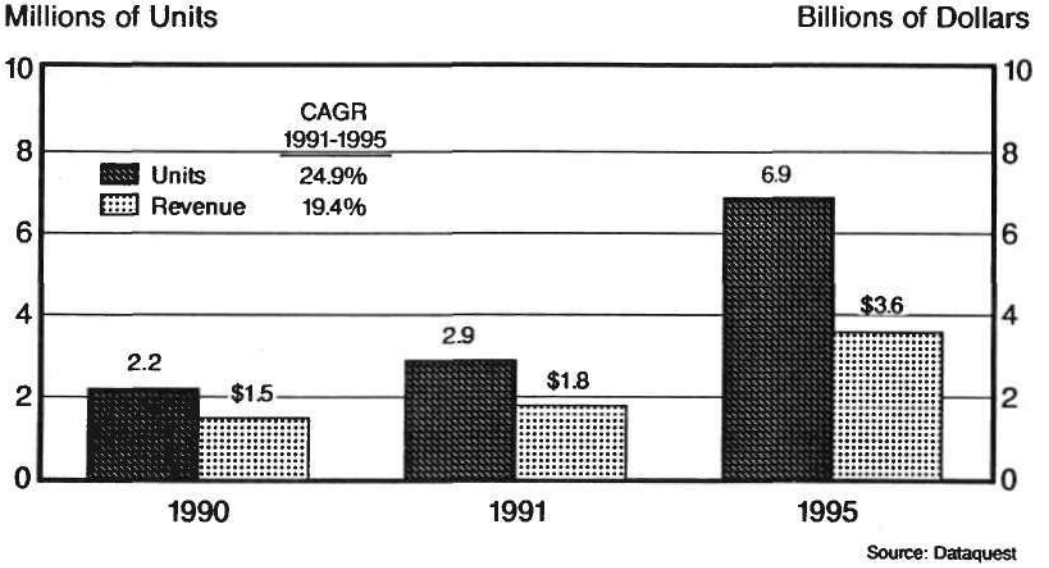
- Cellular telephone
- Paging
- Personal Communications Network (PCN)
- Gating factors
- Market opportunities
- Conclusion

Cellular Telephone

CELLULAR TELEPHONE

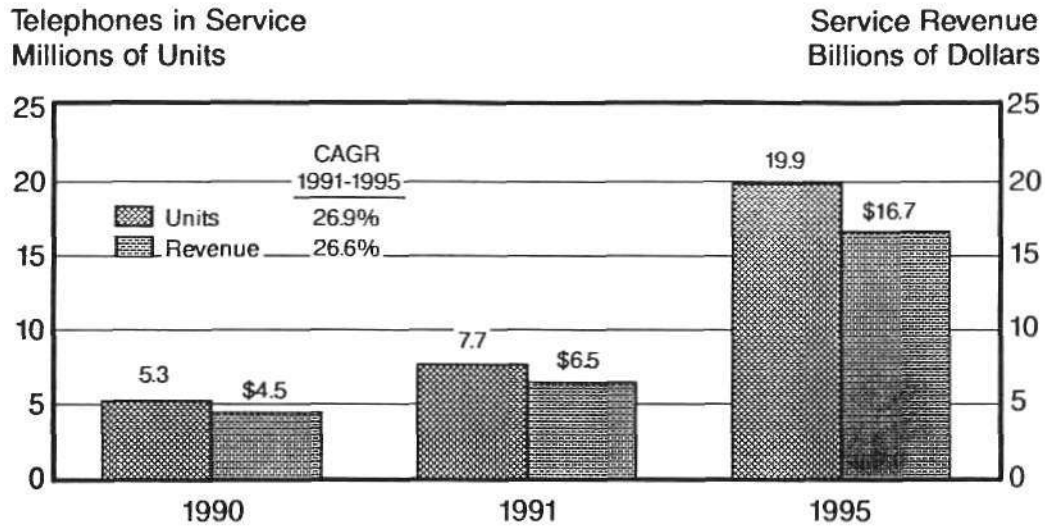
- Service inaugurated in 1983
- More than 300 urban areas on-line
- Rural Service Area franchises being awarded by FCC
- More than 5 million telephones in service
- Broadening market penetration
  - Softening service prices
  - Declining telephone prices
- Growing popularity of portable telephones

ESTIMATED U.S. MARKET FOR CELLULAR TELEPHONES



Source: Dataquest

ESTIMATED GROWTH OF THE U.S. CELLULAR SERVICES MARKET



Source: Dataquest

DIGITAL CELLULAR RADIO

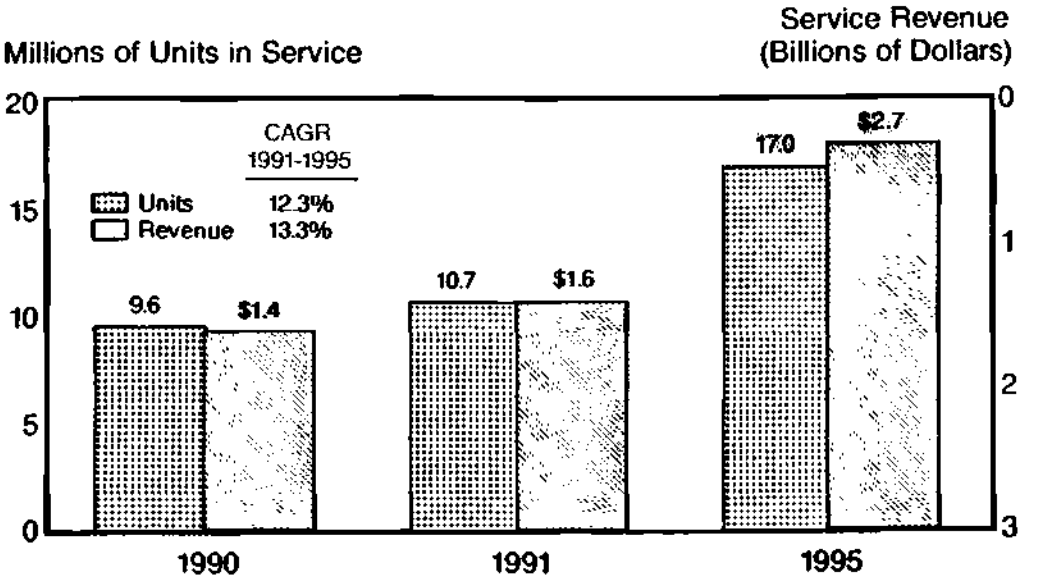
- Cellular radio will evolve
  - Analog ➡ dual mode ➡ digital
- Significant increase in system capacity
- TDMA is now standard; CDMA a future contender
- Comparable or better voice quality
- New ISDN-like service possible
- Security

Paging

PAGING

- Evolution from "paging" to messaging market
- Supplement to, not substitute for, alternative forms of wireless communication
- Deployment of new technologies
  - FM sideband
  - Wristwatch pager
- Nationwide paging services
- Integration with other functions such as voice mail

ESTIMATED U.S. PAGING MARKET



Source: Dataquest

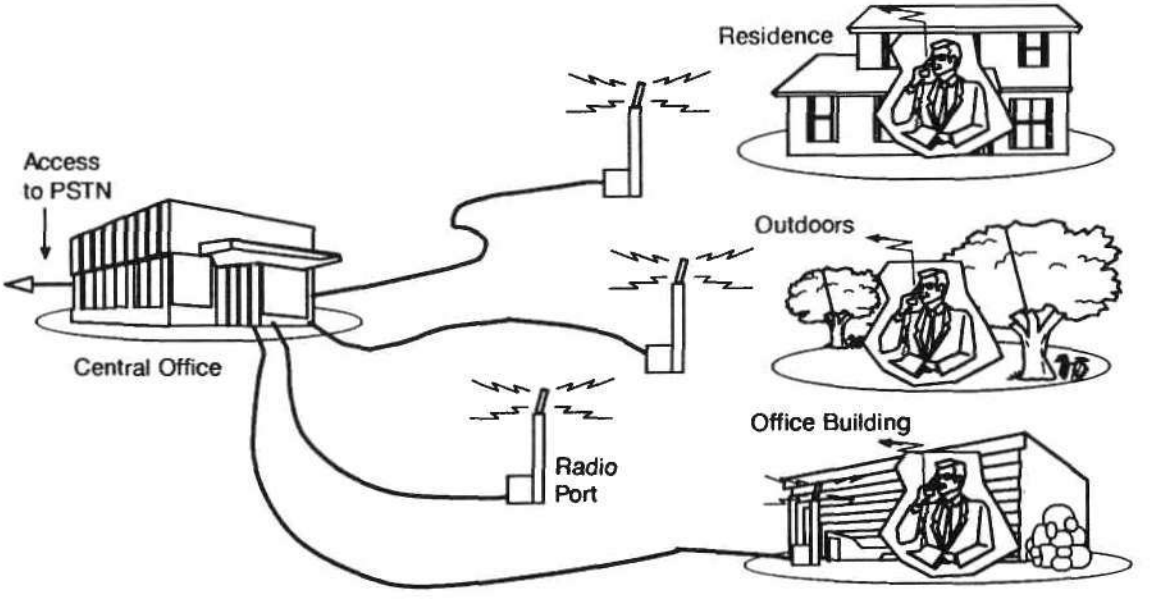
Personal Communications Network

PERSONAL COMMUNICATIONS

Definition

- Anywhere
- Anyone
- Anytime

POSSIBLE CT2 AND PCN INTEGRATION WITH PSTN



PERSONAL COMMUNICATIONS INNOVATIONS

- Cordless telephone systems
  - CT2, Telepoint
  - DECT (CT3)
- PCN
  - Satellite systems

CT2

- Concept developed in the United Kingdom
- Attractive substitute for public pay phone
- Four licenses issued in United Kingdom
- DECT standards nearing completion
  - Improvement over CT2
- Window of opportunity in the United States

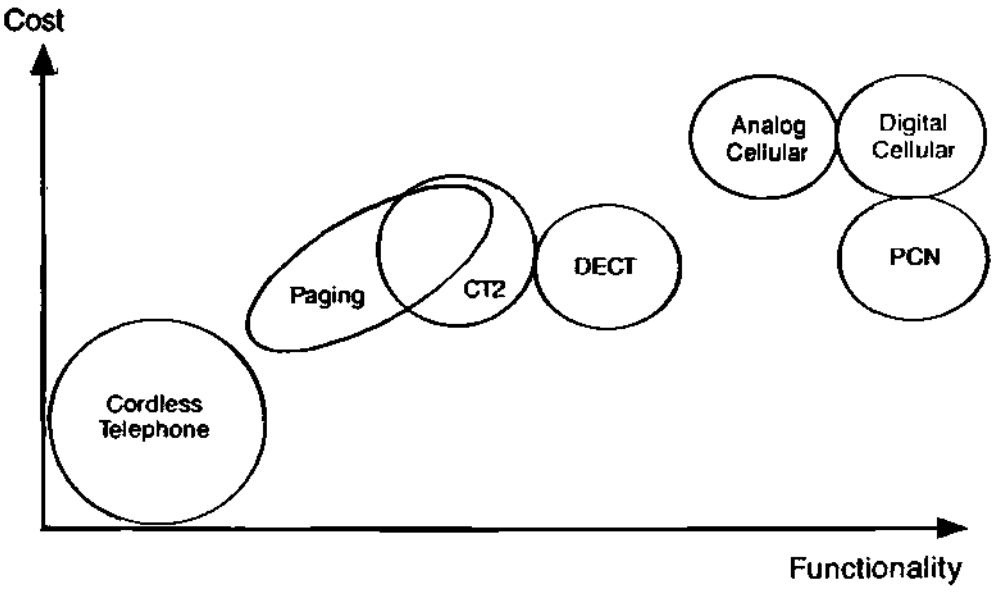
PCN

- Extension of cellular concept
  - Microcells
- PCN being implemented in United Kingdom
- Digital Cellular System 1800 (DCS 1800) standard in Europe
  - Based on GSM
  - Under consideration by ETSI
- U.S. standards under consideration
  - CDMA the likely technology

PCN IN THE UNITED STATES

- Experimental PCN licenses granted by the FCC
  - PCN America (Millicom subsidiary)
    - Houston, Texas
    - Orlando, Florida
  - Graphic Scanning
    - Detroit, Michigan
    - Chicago, Illinois
    - White Plains, New York
  - Motorola
  - NYNEX
  - BellSouth
- License applications pending for:
  - American Personal Communications, Inc.
  - Ameritech
  - McCaw
  - GTE
  - Others

MOBILE COMMUNICATIONS SYSTEMS



Source: Dataquest

FUNCTIONAL COMPARISON OF PERSONAL COMMUNICATIONS DEVICES

	CT2	Paging	Cellular	PCN
Function	Originate	Receive	Originate/receive	Originate/receive
Communications Range	200m	Metro area	>2 Miles	200m
Mobility	Limited; no handoff	High	Automobile	Pedestrian
Terminal Cost	Low ($100)	Low ($100)	High ($400-$700)	Low ($100)
Terminal Size	Small	Small	Medium/Large	Small
Battery Life	High	High	Low	High
Base Station Cost	Low	Medium	Very high	Low

Source: Dataquest

PCN TRIALS

- Test feasibility of technology
  - CDMA, spread spectrum
  - Microcell structure
- Explore 2-GHz operational issues
- Test user acceptance
  - Demand
  - Price
  - Functionality

Gating Factors

PERSONAL COMMUNICATIONS

Regulatory Gating Factors

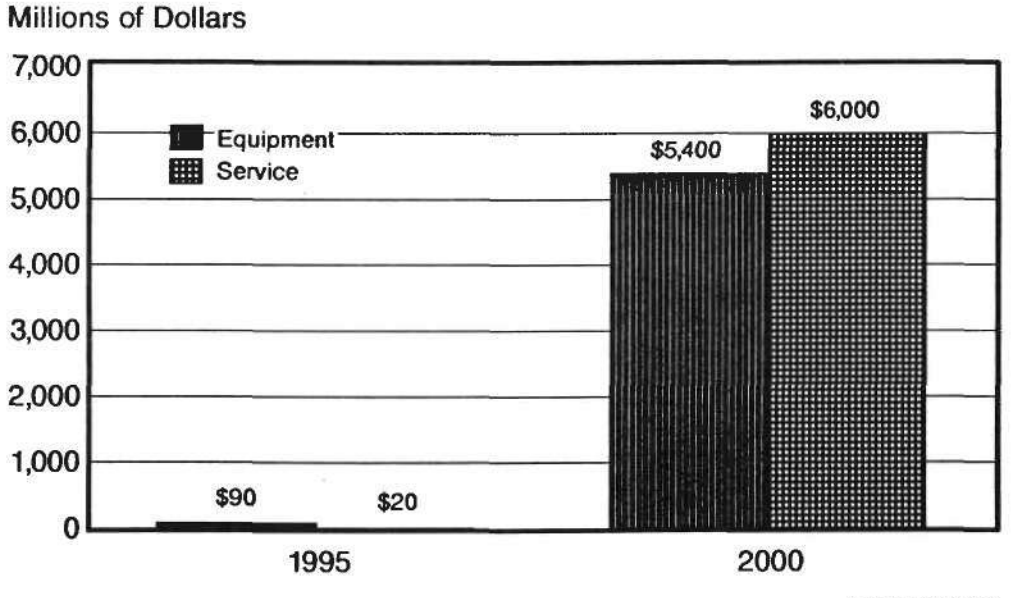
- Frequency allocation
- Industry structure
  - PCN entry
  - Telepoint entry
  - Licensing
  - Service regulation
- Standards and equipment licensing
- Resolution not expected before 1992/1993

PERSONAL COMMUNICATIONS TECHNOLOGY GATING FACTORS

- Choice of transmission technology
  - CDMA -- apparent front-runner
- Standards
  - Common Air Interface
  - Network interface

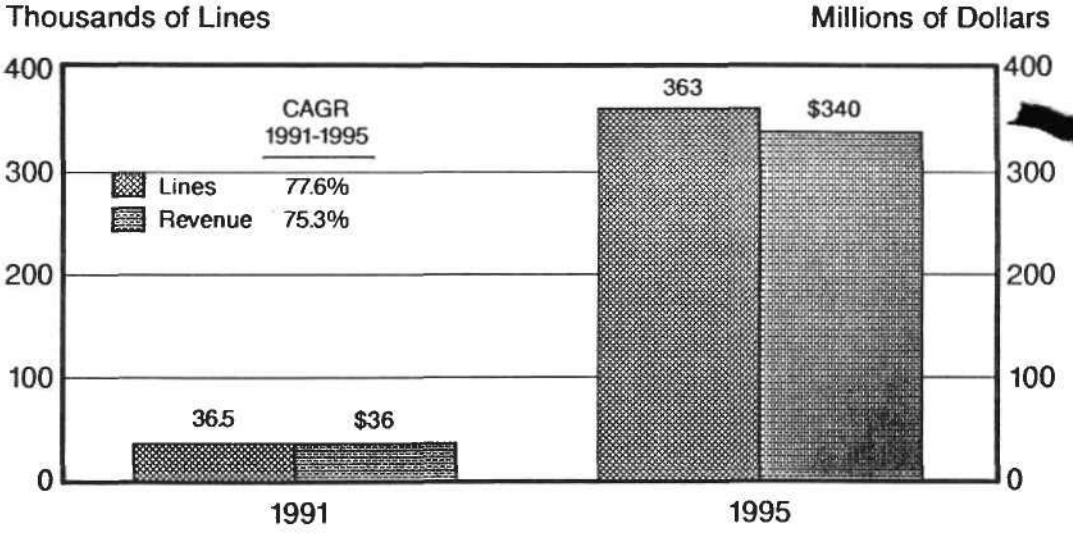
Market Opportunities

ESTIMATED U.S. PCN MARKET



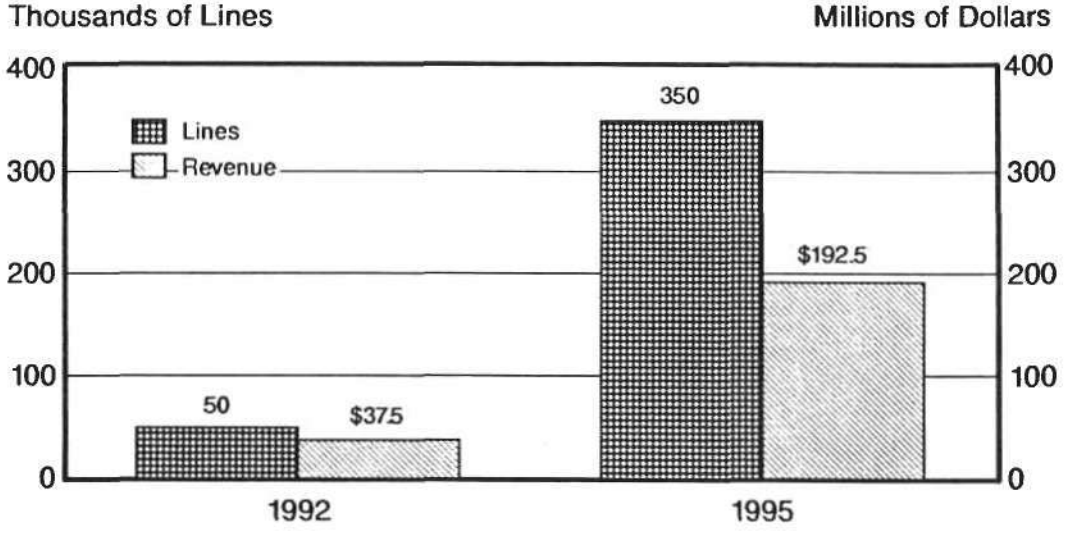
Source: Dataquest

ESTIMATED U.S. WIRELESS PBX SHIPMENTS



Source: Dataquest

ESTIMATED U.S. WIRELESS KTS MARKET



Source: Dataquest

CONCLUSION

Personal communications is opening up new vistas -- and new opportunities

1991 High-Tech Electronics
Industry Conference

Growth Opportunities in European Telecommunications

Robin Duke-Woolley
Director
European Telecommunications Group
Dataquest Europe Limited

Robin Duke-Woolley is Director of Dataquest's European Telecommunications Group and is located in the Company's UK office based in Denham. He is responsible for providing a complete service in the European telecommunications arena, from analyzing market and technology trends to conducting multi-client and client-specific research and consulting.

Before joining Dataquest, Mr. Duke-Woolley spent over 15 years in various senior management positions in the telecommunications industry, most recently as Director and General Manager of the Business Systems Division of STC Telecommunications. Originally graduating with a B.Sc Honours degree in Electronics, he went on to become an internal MIS consultant at GEC before taking an M.Sc in Management and Business Studies and becoming Marketing Manager for PABXs. Moving to STC as Sales Manager for telephones, telex terminals and radio pagers, he developed the business into the UK's largest supplier of telephones and established a new business in personal mobile communications before being promoted to Sales and Marketing Director. From both this and his most recent position, he managed the substantial growth in the company's business through a network of independent dealers and distributors operating in Europe and the United States.

EUROPEAN TELECOMMUNICATIONS

Growth Opportunities in European Telecommunications

Robin Duke-Woolley
Director, European Telecom Group
Dataquest Europe

EUROPEAN TELECOMMUNICATIONS

AGENDA

- Dataquest European Market Segmentation
- European Telecom Overview
- Key Growth Sectors
- Eastern Europe
- Conclusions

DATAQUEST ETCIS COVERAGE

ETCIS GEOGRAPHICAL COVERAGE

- France
- Italy
- Netherlands
- Spain
- Sweden
- United Kingdom
- West Germany
- Rest of Europe

DATAQUEST ETCIS COVERAGE

ETCIS GEOGRAPHICAL COVERAGE

Rest of Europe (CEPT)

Austria	Norway
Belgium	Portugal
Denmark	Switzerland
Finland	Turkey
Greece	Yugoslavia
Ireland	Others

EUROPEAN TELECOMMUNICATIONS

MARKET SEGMENTATION

- Image Communications & Terminals
  - Facsimile
  - Videoconferencing
  - Telex / Teletex / Videotex

- Voice Communications
  - PBX/KTS
  - Automatic Call Distribution
  - Voice Mail
  - Telephones (incl. Cordless)

EUROPEAN TELECOMMUNICATIONS

MARKET SEGMENTATION

- Networking Communications
  - Modems
  - Statistical multiplexers
  - Time Division Multiplexers
  - Data Network Control Systems
  - Packet Switching Equipment
  - LANs

EUROPEAN TELECOMMUNICATIONS

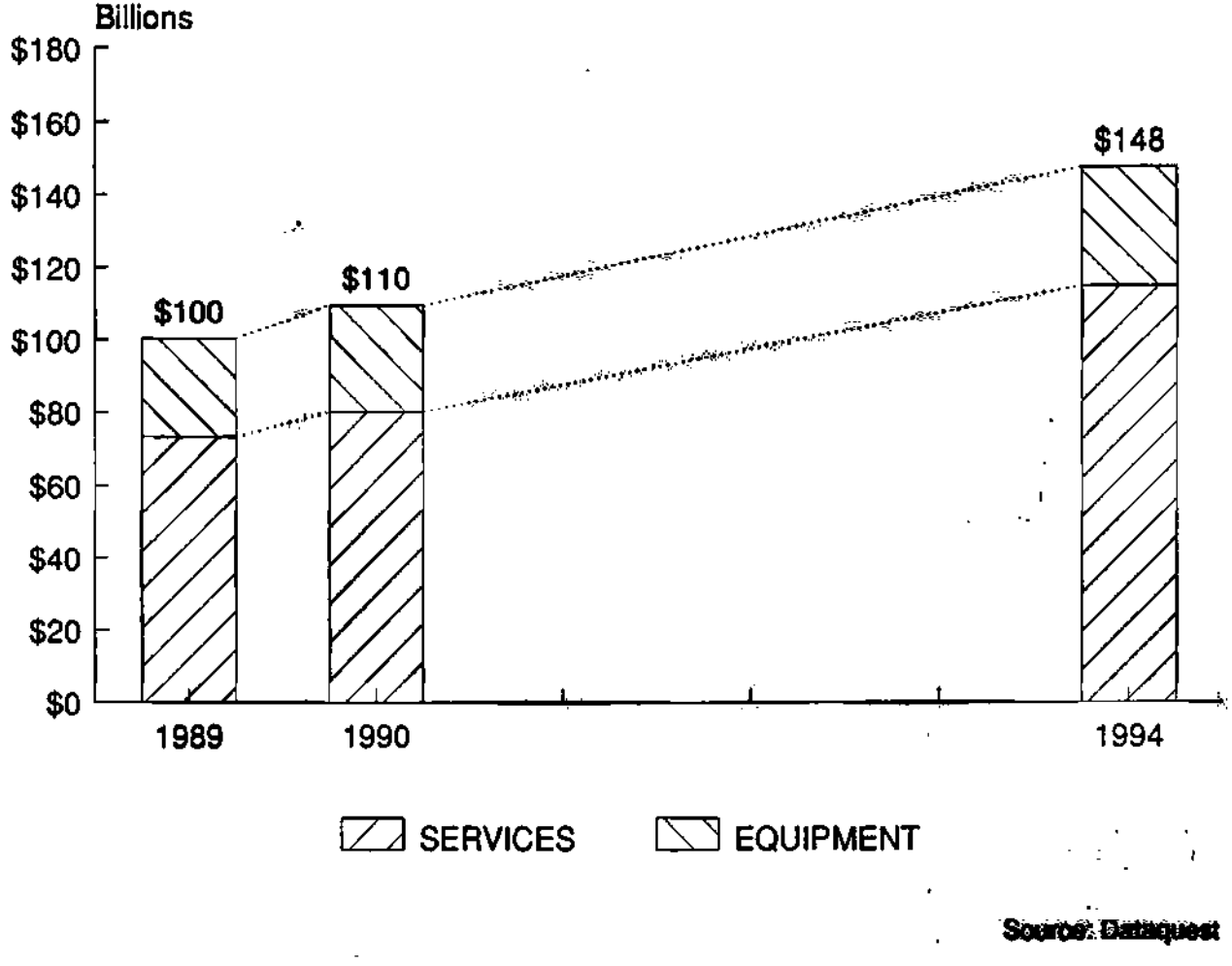
MARKET SEGMENTATION

- Public Network Equipment & Services
  - Transmission Equipment
  - Central Office Equipment
  - Telephone Services
  - Public Data Network Services
- Personal Communications
  - Cellular Telephones
  - Cordless Technology
  - Personal Communications Networks

EUROPEAN TELECOMS OVERVIEW

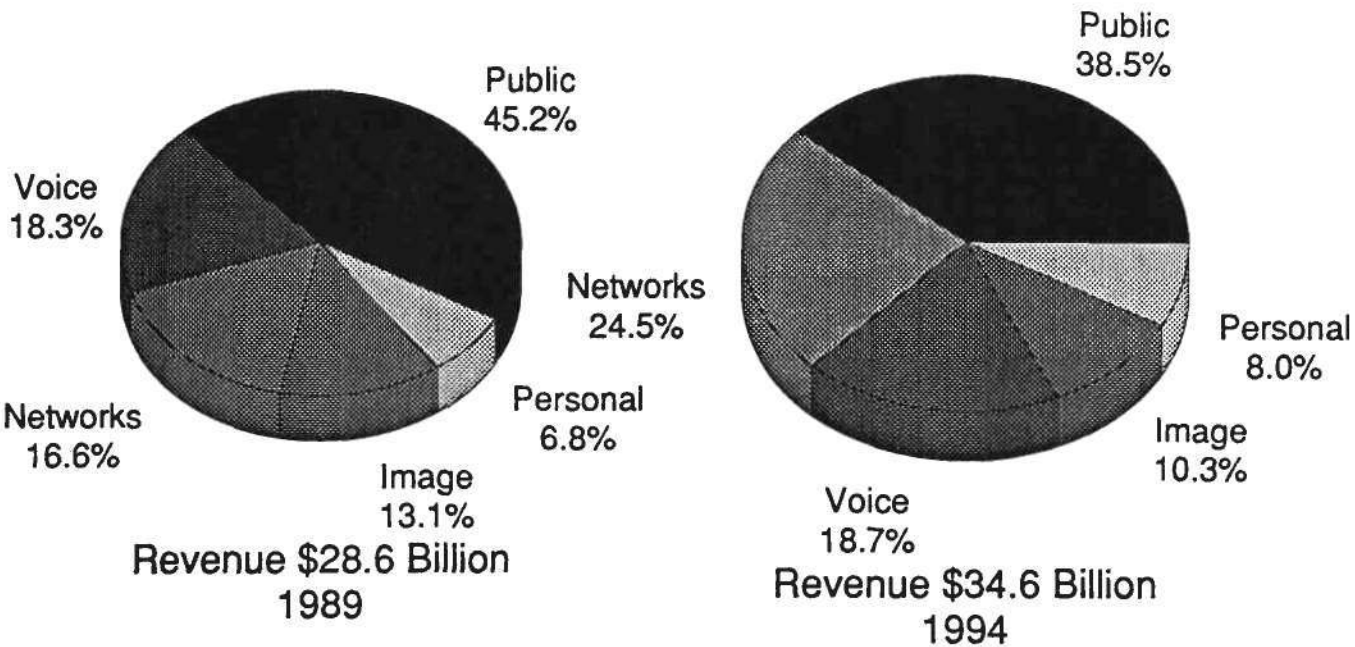
- EUROPEAN TELECOM OVERVIEW

EUROPEAN TELECOMMUNICATIONS MARKET



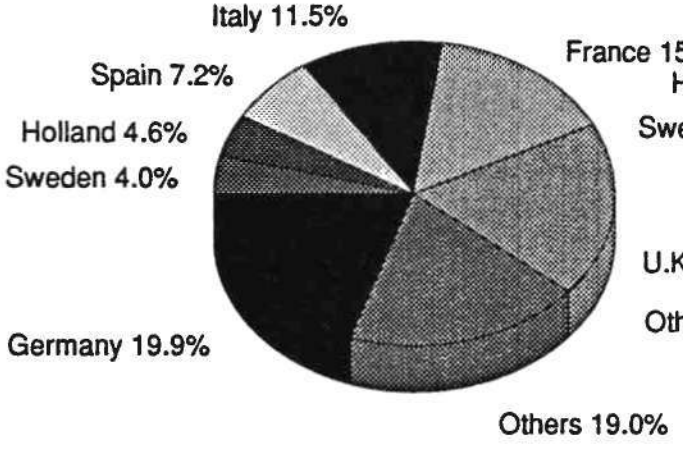
Source: Dataquest

EUROPEAN EQUIPMENT BY SEGMENT

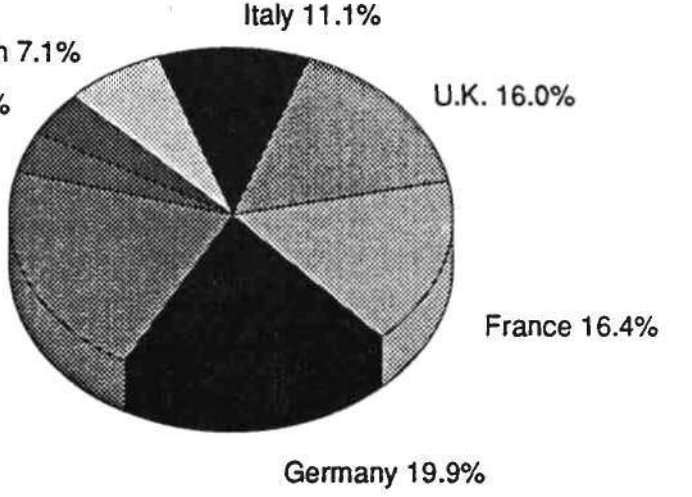


Source: Dataquest

EUROPEAN EQUIPMENT BY COUNTRY



Revenue $28.6 Billion
1989



Revenue $34.6 Billion
1994

Source: Dataquest

EUROPEAN TELECOMMUNICATIONS

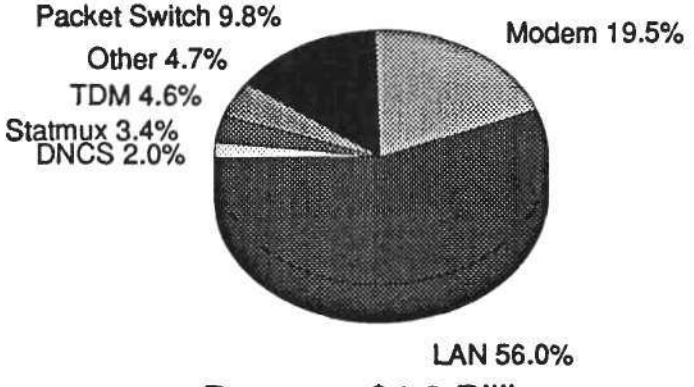
KEY GROWTH SECTORS

- Networks / Datacoms
- Voice Communications
- Personal Communications

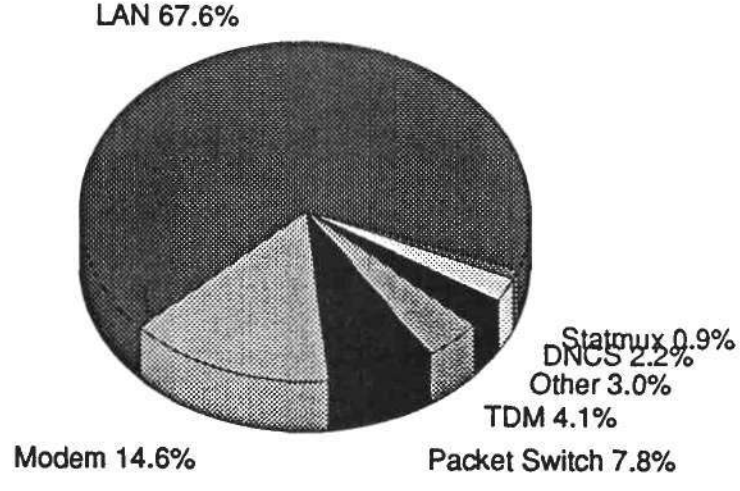
EUROPEAN TELECOMMUNICATIONS

- NETWORKS / DATACOMS

EUROPEAN DATACOMS BY SEGMENT



Revenue $4.8 Billion
1989



Revenue $8.5 Billion
1994

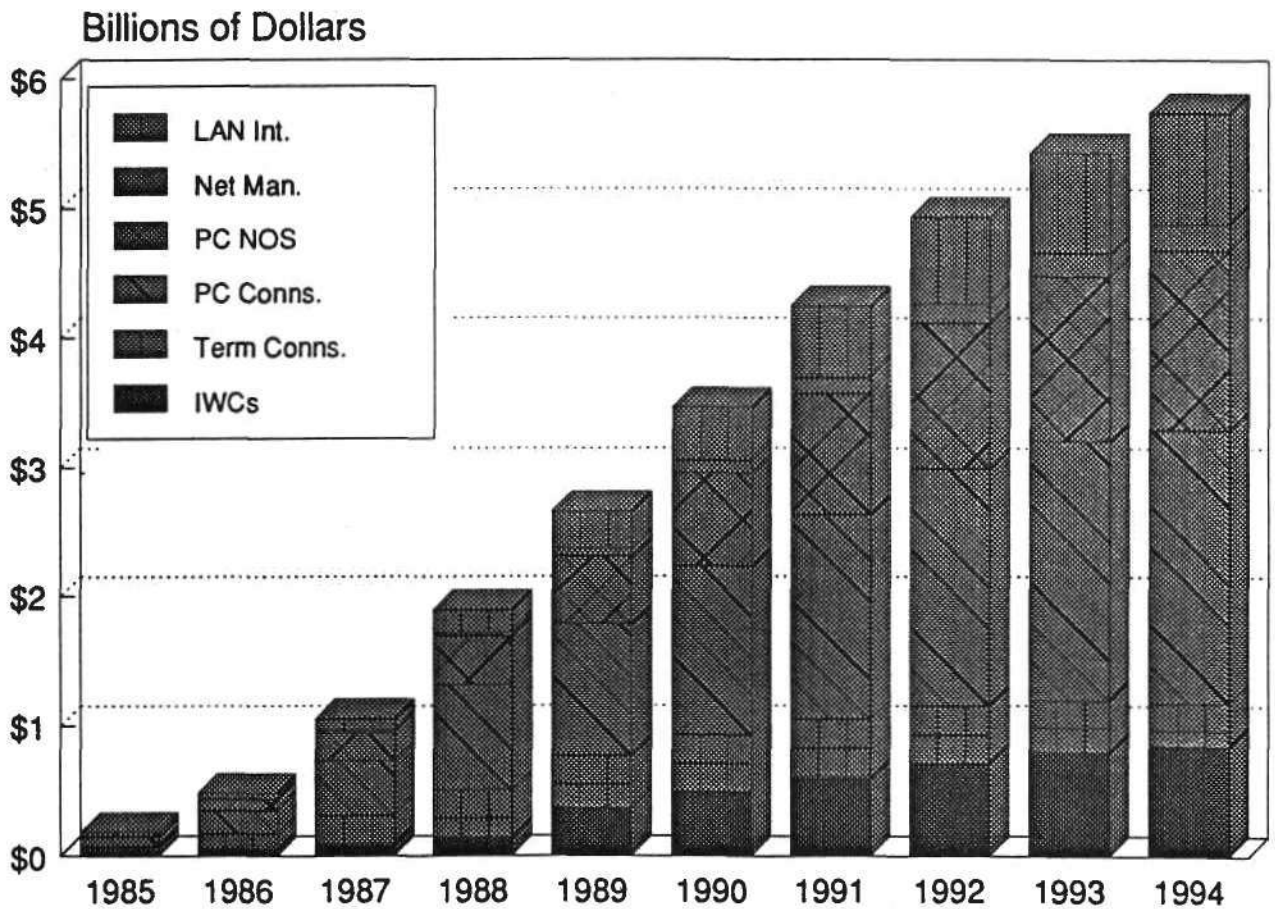
Source: Dataquest

LOCAL AREA NETWORKS

DATAQUEST LAN SEGMENTATION

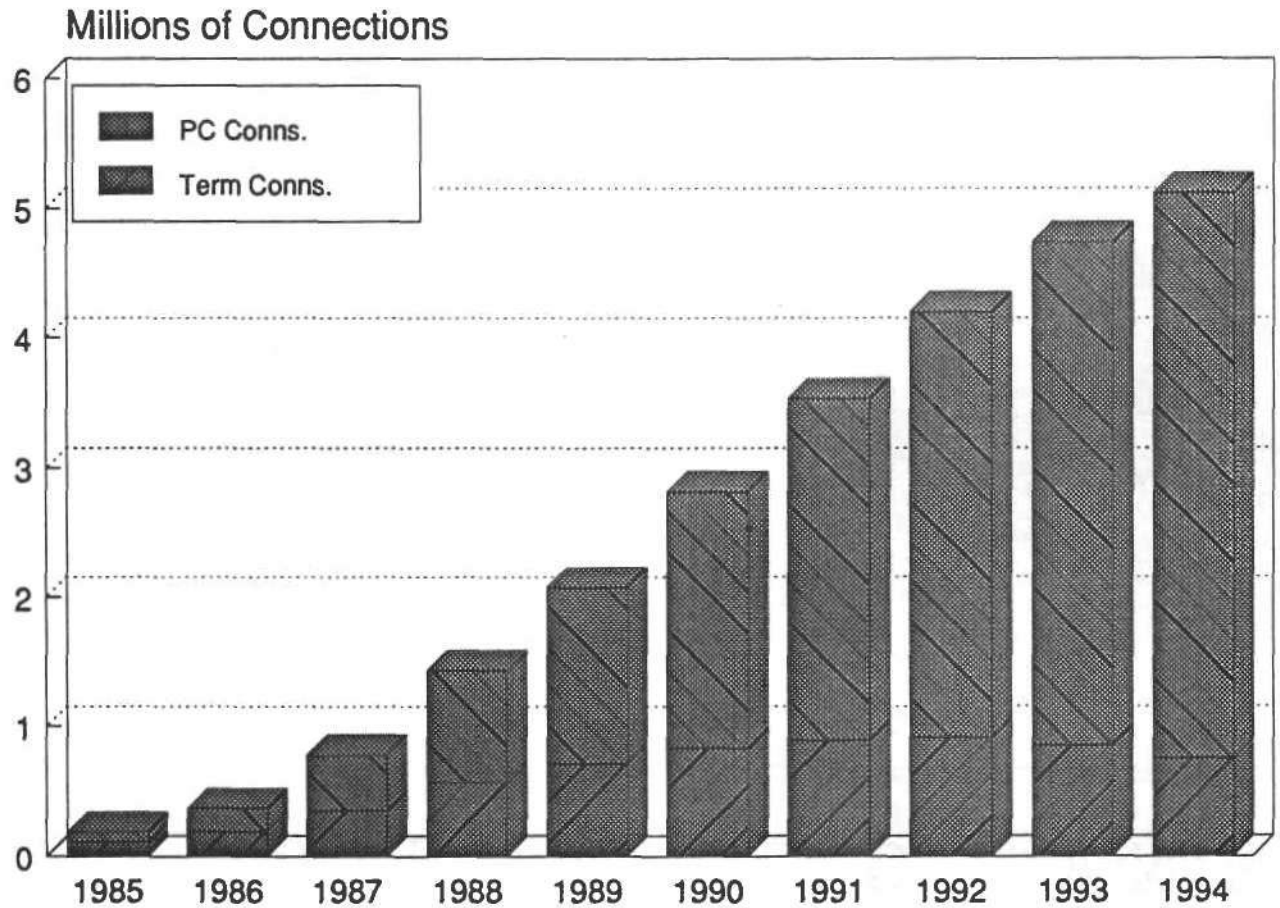
- Terminal Server connections
- PC connections
- Network Operating Software (NOS)
- Network Management products
- LAN Interconnect products
- Intelligent Wiring Centres (IWCs)

EUROPEAN LAN MARKET



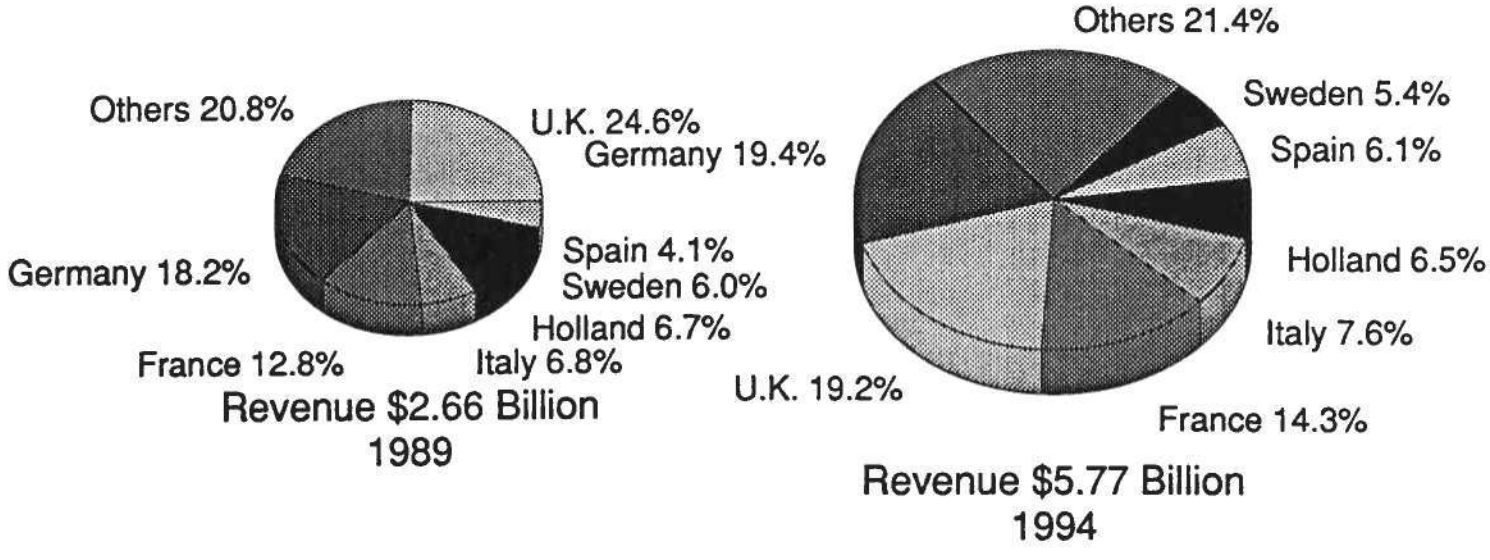
Source: Dataquest

EUROPEAN LAN MARKET



Source: Dataquest

EUROPEAN LAN MARKET BY COUNTRY



Source: Dataquest

LOCAL AREA NETWORKS

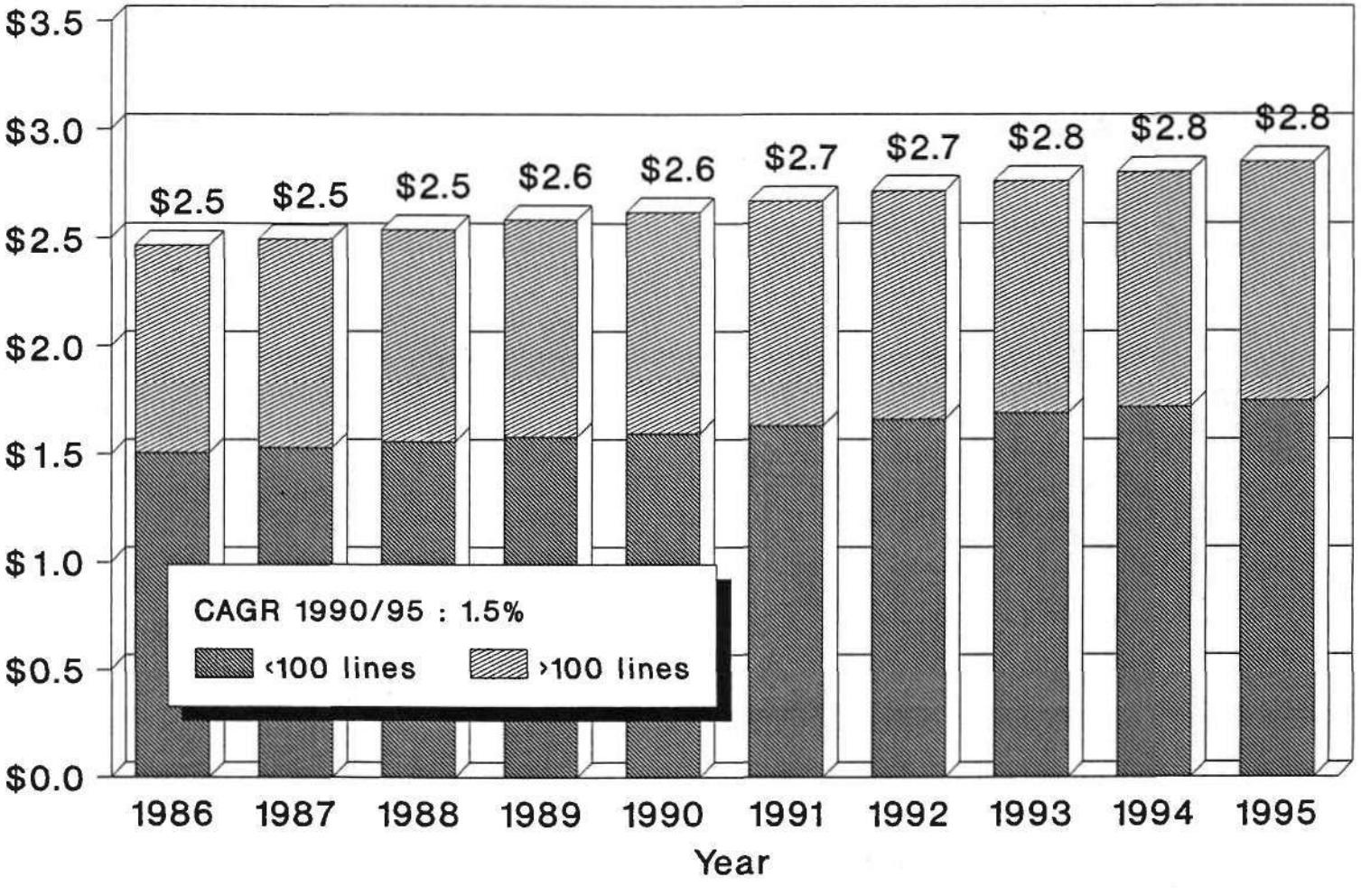
WHAT ARE THE TRENDS?

- Increasing use of dedicated file and application servers
- Increasingly sophisticated applications: distributed databases, CAD/CAM, etc.
- Increasing demand for TCP/IP products
- First shipments of OSI application products
- Increasing use of gateways and LAN interconnect products
- Emergence of sophisticated network management tools

EUROPEAN TELECOMMUNICATIONS

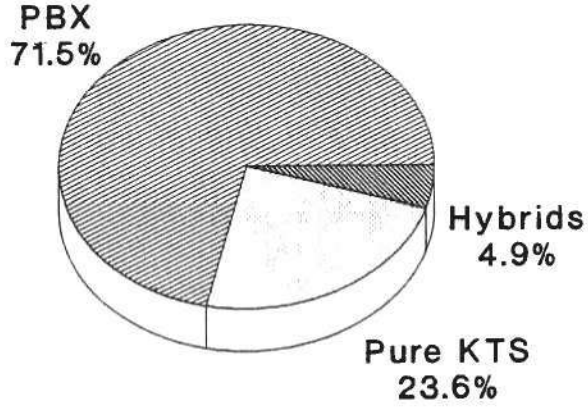
- VOICE COMMUNICATIONS

Europe : PBX/KTS Sales Revenue 1986-1995
(Excludes VAT, Terminals, Inst & Cable)

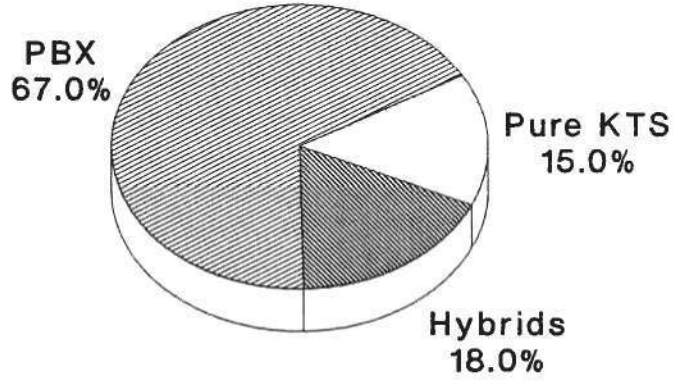


Source : Dataquest 1991

Europe : Premise Switching Equipment
(Analysis by Product Type)



Total 1990
8.47 Million Lines



Total 1995
9.96 Million Lines

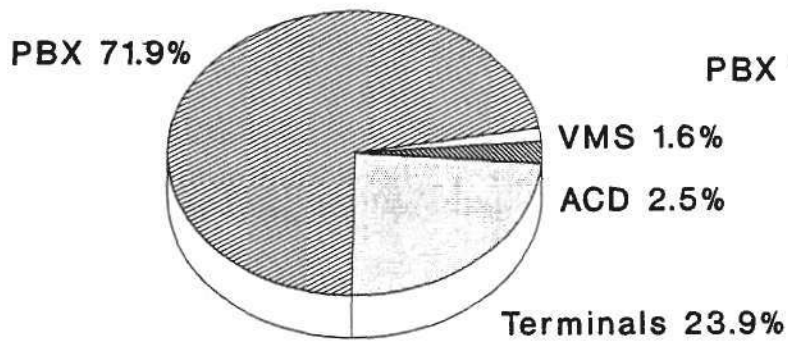
Source : Dataquest 1991

EUROPEAN PREMISE EQUIPMENT - OPPORTUNITIES

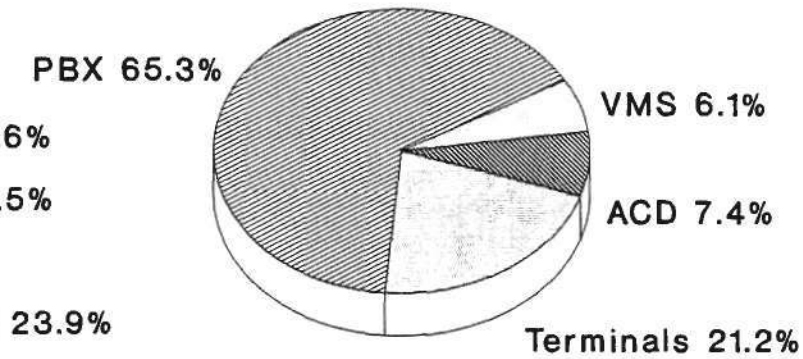
Value Added System Sales

- Automatic Call Distribution
- Voice Messaging & Voice Response
- Call Management

Europe : Voice Premise Equipment Sales
(Excludes VAT, Installation & Cabling)



Total 1990
$3.55 Billion



Total 1995
$4.36 Billion

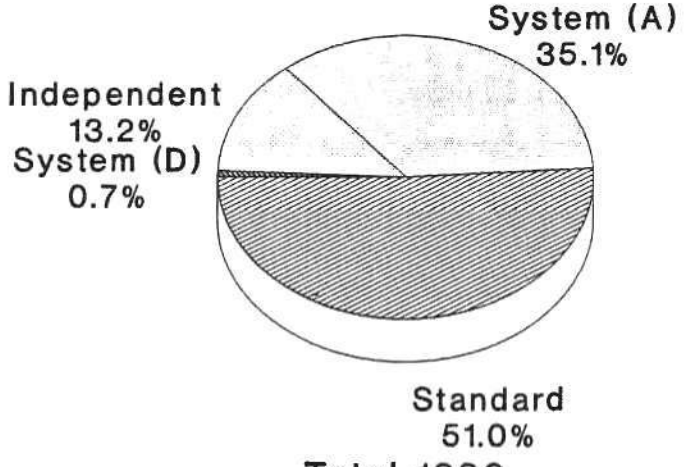
Source : Dataquest 1991

EUROPEAN PREMISE EQUIPMENT - OPPORTUNITIES

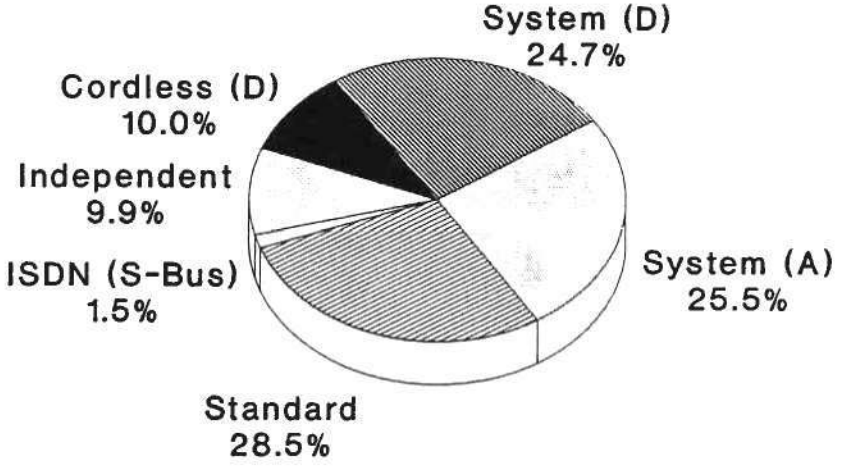
Value Added Terminals & Interfaces

- Proprietary Digital Featurephones
- Digital Cordless Telephones
- Videophones
- ISDN (S-Bus) Terminals

Europe : PBX/KTS Based Terminal Devices
(Segmentation by Product Type)



Total 1990
8.5 Million Units



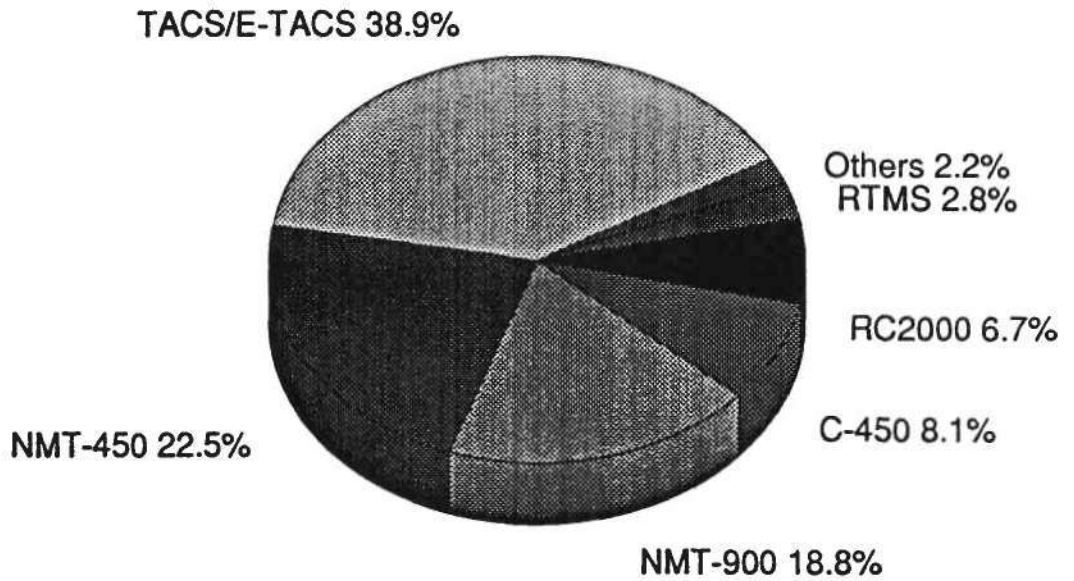
Total 1995
11.2 Million Units

Source : Dataquest 1991

EUROPEAN TELECOMMUNICATIONS

- PERSONAL COMMUNICATIONS

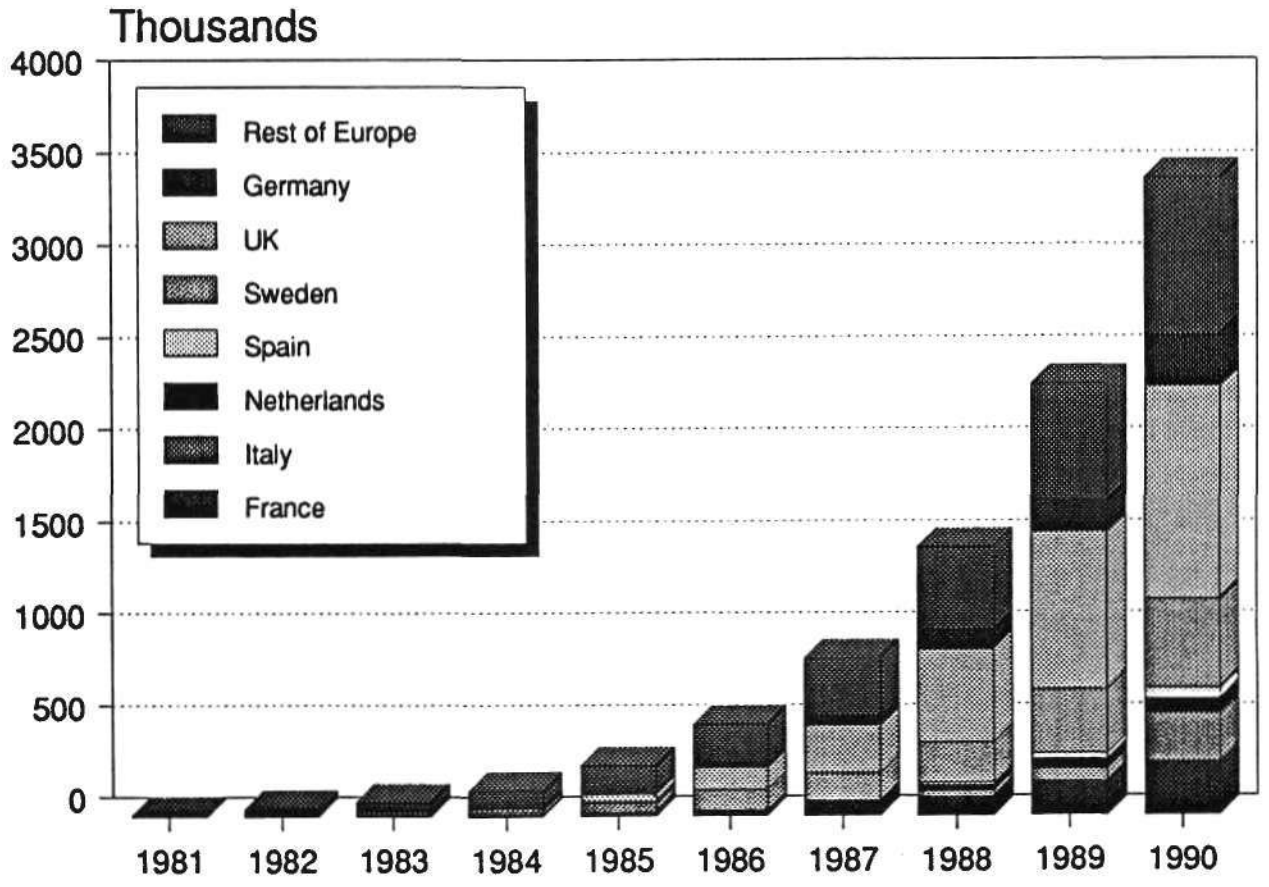
EUROPEAN CELLULAR SUBSCRIBERS



Total 3.46 Million Users
End 1990

Source: Dataquest

EUROPEAN CELLULAR SUBSCRIBERS - 1981-1990



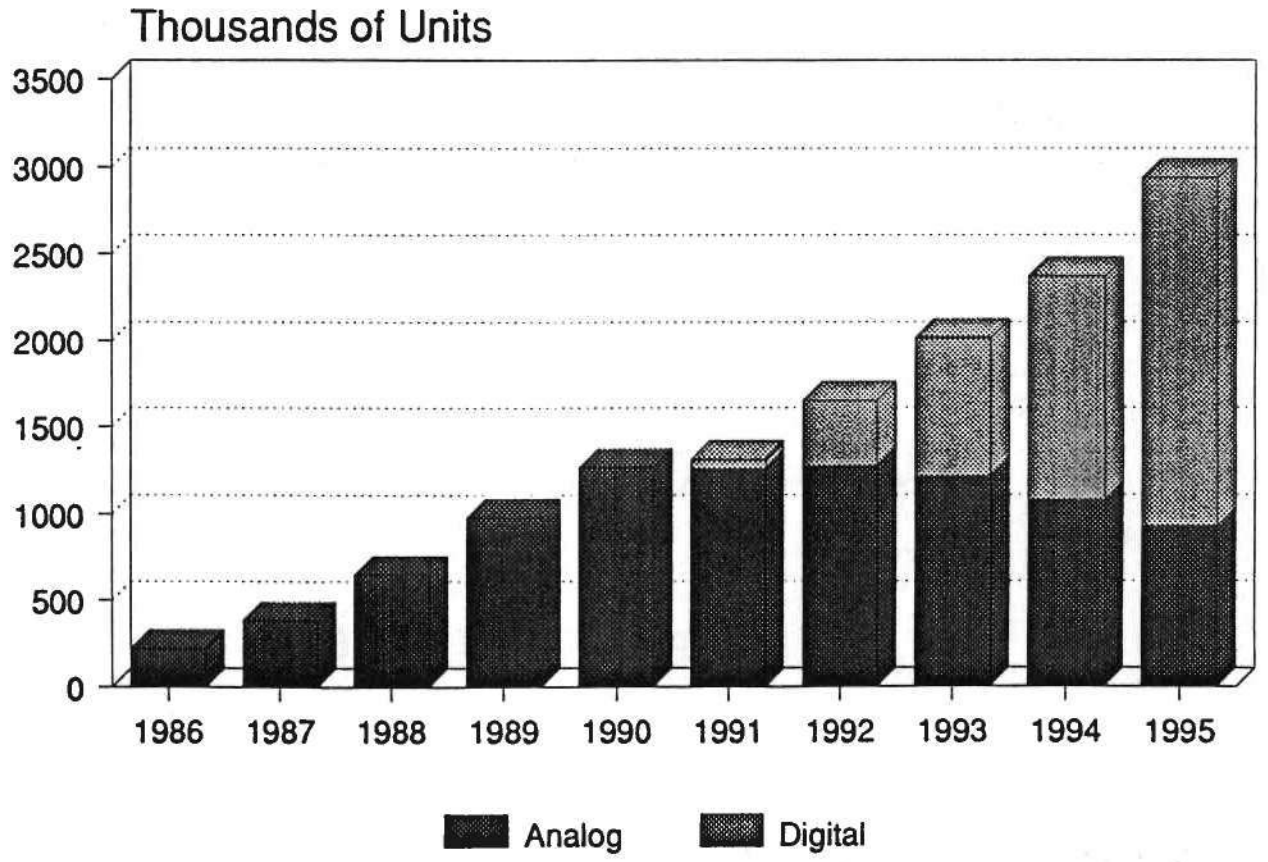
Source: Dataquest

REASONS FOR GSM

- Realization of Spectrum Limitation
  - EC Directive to make available
- Harmonized System In All CEPT Countries
  - Economies of Scale
  - Cross-Border Roaming
  - Common Approvals
- Digital Technology
  - Greater Spectrum Efficiency
  - More Sophisticated Services
  - Compatibility with Fixed Networks
  - Security
- Gives Europe a Leading Edge

Source: Dataquest

EUROPEAN CELLULAR SHIPMENTS



Source: Dataquest

DIGITAL CORDLESS APPLICATIONS

- Residential - home base station
- Office System - CPBX / PBX platform
- Telepoint - public PSTN access service
- Local access - telepoint to the home/office
- Personal Communications Networks

Source: Dataquest

EUROPEAN TELECOMS OVERVIEW

- EASTERN EUROPE

EASTERN EUROPE

- Copper infrastructure virtually non-existent
- Some lines in E. Germany installed 1937
- Potential for non-copper solutions
  - Cellular
  - Satellite
- Opportunity to jump to the latest technology

EASTERN EUROPE

OPPORTUNITIES

PROs

- No installed base
- Can use latest technology
- No local competition

- Great potential growth
- Well educated population
- Telecom needed first for economic growth

CONs

- No real money!
- No real money!
- That's what everybody else thinks
- No real money!
- No competitive culture
- Bureaucracy could be slow to move

EUROPEAN TELECOMS OVERVIEW

- CONCLUSIONS

EUROPEAN TELECOMMUNICATIONS

CONCLUSIONS

- Datacoms and Personal Communications are the major growth areas, together with voice comms niches
- European Telecoms market is attractive, but there are very strong European players
- Standards are moving away from proprietary, towards general
- Mergers and acquisitions will continue, as liberalisation gathers pace

EUROPEAN TELECOMMUNICATIONS

CONCLUSIONS

- 1992
  - Deregulation is progressing
  - Good for PTT's if they can meet the challenge
  - Good for manufacturers if they can win traditional PTT business
- Eastern Europe
  - Invest now for future market share
  - No Money!

EUROPEAN TELECOMMUNICATIONS

CONCLUSIONS

- ISDN
  - Delayed by standards & availability
  - Users need to be convinced

- CHANGE IN THE EUROPEAN TELECOMS MARKET HAS NEVER BEEN MORE DRAMATIC

Conference 참가자 명단

No.	회 사 명	성 명	직위
1	과학기술정책연구소	김 인 호	선임
2	금성사	김 필 태	과장
3	금성사	김 병 화	과장
4	금성사	서 영 철	과장
5	금성사	김 유 덕	과장
6	금성사	장 환	과장
7	금성사	최 민 규	대리
8	금성사	유 종 탁	부장
9	금성사	권 희 원	부장
10	금성사	오 영 호	사원
11	금성사	엄 광 섭	사원
12	금성사	윤 창 진	사원
13	금성사	이 장 규	상무
14	금성사	송 규 연	선임 연구원
15	금성사	김 영 진	이사
16	금성사	김 성 우	이사
17	금성사	안 상 식	팀장
18	금성일렉트론	최 동 원	과장
19	금성일렉트론	조 남 훈	과장
20	금성일렉트론	박 민 하	부장
21	금성일렉트론	이 찬 희	부장
22	금성일렉트론	김 양 규	부장
23	금성일렉트론	김 동 찬	부장
24	금성일렉트론	김 갑 술	부장
25	금성일렉트론	정 영 하	사원
26	금성일렉트론	김 홍 식	상무
27	금성정보통신	김 상 래	과장
28	금성정보통신	김 익 부	상무
29	금성통신	윤 진 혁	실장
30	금성통신	오 세 희	전무
31	금성하니웰	이 승 신	부장
32	내셔날반도체	정 상 길	과장
33	니콘	Yoshida	전무
34	대우전자부품	김 탁	부장
35	대우통신	김 윤 성	과장
36	대우통신	이 수 한	과장
37	대우통신	이 사 중	대리
38	대우통신	조 용 선	대리
39	대우통신	최 명 섭	부장
40	대우통신	이 정 행	부장
41	대우통신	임 왕 규	차장
42	데이타퀘스트	Champion	부사장
43	데이타퀘스트	Krueger	부사장
44	데이타퀘스트	Lair	부사장
45	데이타퀘스트	Sammann	부사장
46	데이타퀘스트	Devin	이사
47	데이타퀘스트	Seybold	이사
48	데이타퀘스트	Young	이사
49	데이타퀘스트 유럽	Woolley	이사
50	데이타퀘스트 재팬	Nakano	수석연구원

No.	회 사 명	성 명	직위
51	데이타퀘스트 재팬	Sakimura	연구원
52	데이타퀘스트 코리아	박 정 민	비서
53	데이타퀘스트 코리아	손 종 형	지사장
54	데이타퀘스트 코리아	이 호 상	차장
55	데이타통신(주)	김 대 규	상무
56	도시바 서울지점	홍 도 선	과장
57	도시바 서울지점	이또 준시	부장
58	동덕여대	김 영 인	교수
59	동아컴퓨터	라 제 훈	사장
60	디지탈 코리아	신 동 찬	부장
61	럭키금성그룹	한 이 성 갑	사장
62	메가테스트 코리아	이 춘 동	사장
63	모토롤라 코리아 마케팅	전 완 수	사장
64	삼보컴퓨터	김 지 욱	연구원
65	삼보컴퓨터	한 상 기	이사
66	삼성그룹	길 영 준	차장
67	삼성그룹	이 나 우	차장
68	삼성물산	오 영 주	사원
69	삼성전자	이 재 한	과장
70	삼성전자	김 환 희	과장
71	삼성전자	최 종 명	과장
72	삼성전자	엄 석 호	과장
73	삼성전자	박 병 현	과장
74	삼성전자	조 손 병 학	과장
75	삼성전자	황 영 진	대리
76	삼성전자	김 미 정	대리
77	삼성전자	김 정 곤	대리
78	삼성전자	박 승 덕	대리
79	삼성전자	이 용 남	대리
80	삼성전자	김 용 철	대리
81	삼성전자	김 정 용	부장
82	삼성전자	정 천 의	사원
83	삼성전자	전 현 영	사원
84	삼성전자	전 현 중	사원
85	삼성전자	김 주 영	사원
86	삼성전자	김 기 원	사원
87	삼성전자	이 호 재	사원
88	삼성전자	정 재 호	사원
89	삼성전자	Chen, I.C.	이사
90	삼성전자	김 경 수	이사
91	삼성전자	박 학 송	이사
92	삼성전자	김 진 구	이사
93	삼성전자	한 정 탁	이사
94	삼성전자	김 현 곤	전무
95	삼성종합기술원	소 진 화	부원장
96	삼성종합기술원	위 영 철	선임
97	상공부	송 봉 식	계장
98	상공부	김 광 식	과장
99	상공부	이 기 성	국장
100			

No.	회 사 명	성 명	직위
101	생산기술연구원	조 위 덕	교수
102	승전상사	박 상 학	전무
103	시카고은행	Ibasco	부사장
104	시카고은행	Sirovatka	부사장
105	신관호 국제특허	신 관 호	사장
106	쌍용컴퓨터	전 성 원	사원
107	아남반도체설계	김 무	사장
108	아라 인터내쇼날	김 찬 영	전무
109	에이 엠 케이	이 성 근	과장
110	에이 엠 케이	이 윤 진	과장
111	에이엠디 코리아	주 재 량	지사장
112	에이직 테크놀로지	신 재 풍	부사장
113	엘 에스 아이 로직 K.K.	Yawata	사장
114	엘티엑스 한국지점	이 주 훈	지사장
115	웨스턴디지탈 코리아	최 성 룡	부장
116	인텔 코리아	민 창 기	부장
117	인텔 코리아	우 기 섭	이사
118	인텔렉트	민 병 준	사장
119	인포텍	김 영 수	사장
120	일진	최 형 석	사원
121	일진	황 욱 하	사원
122	장은창업투자	김 덕 수	대리
123	정풍물산	문 종 석	전무
124	제철전기콘트롤	이 상 현	부장
125	코오롱정보통신	최 헌	대리
126	테라다인 코리아	이 형 연	지사장
127	텍사스인스트루먼트	이 동 현	부장
128	트라이폴전자	강 진	이사
129	포스데이타	신 인 균	과장
130	포항종합제철	유 은 재	부장
131	한국기술개발	임 명 식	심사역
132	한국통신	강 민 호	단장
133	현대전자	조 용 광	과장
134	현대전자	전 영 준	대리
135	현대전자	신 양 수	대리
136	현대전자	윤 길 근	부장
137	현대전자	심 종 익	부장
138	현대전자	이 성 희	부장
139	현대전자	이 재 명	부장
140	현대전자	김 용 진	사원
141	현대전자	박 노 삼	사원
142	현대전자	정 구 학	사원
143	현대전자	최 필 영	사원
144	현대전자	신 영 건	사원
145	현대전자	한 광 수	수석연구원
146	현대전자	최 일 현	수석연구원
147	현대전자	장 병 준	이사
148	현대전자	박 종 섭	전무
149	현대전자	유 민 권	차장
150	현대전자	최 윤 식	책임 연구원

Attendee Lists
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#	Company	Name	Title
1	AMD Korea	Ju, Jay Lyang	General Manager
2	ASIC Technology	Shin, Jai P.	Vice President
3	Anam Semiconductor	Kim, Stephen M.	President
4	Applied Materials Korea	Lee, Yoon Jin	Manager
5	Applied Materials Korea	Lee, Sung	Manager
6	Ara International	Kim, Chan Young	Sr. Managing Dir.
7	Bureau of E&E Appliances Industry	Lee, Ki Sung	Director General
8	Daewoo Electronics Components	Kim, Tark	General Manager
9	Daewoo Telecom	Jo, Yong Sun	Assistant Manager
10	Daewoo Telecom	Lee, Sa Joong	Assistant Manager
11	Daewoo Telecom	Lee, Jung Haeng	General Manager
12	Daewoo Telecom	Choi, Myung Sup	General Manager
13	Daewoo Telecom	Kim, Yun Seong	Manager
14	Daewoo Telecom	Lee, Soo Hwan	Manager
15	Daewoo Telecom	Lim, Wang Kyu	Senior Manager
16	Data Communication Corp.	Kim Dae Kyu	Managing Director
17	Dataquest Europe	Duke-Woolley, Robin	Director
18	Dataquest Inc.	Seybold, Andy	Associate Director
19	Dataquest Inc.	Champion, Geoffery	Corporate Vice President
20	Dataquest Inc.	Young, Sam	Director
21	Dataquest Inc.	Devin, Phil	Director
22	Dataquest Inc.	Sammann, Frank	Senior Vice President
23	Dataquest Inc.	Krueger, Victor	VP & Director
24	Dataquest Inc.	Lair, Steve	VP & Director
25	Dataquest Japan	Keiko Sakimura	Research Associate
26	Dataquest Japan	Nagayoshi Nakano	Senior Industry Analyst
27	Dataquest Korea	Son, J. H.	General Manager
28	Dataquest Korea	Lee, Ho Sang	Manager
29	Dataquest Korea	Park, Jamie	Secratary
30	Digital Equipment Korea	Shin, Dong Chan	General Manager
31	Dongah Computer	Lah, Je Hoon	President
32	Dongduck Women's Univ.	Kim, Young In	Professor
33	First National Bank of Chicago	Sirovatka, Margaret	Asst. Vice President
34	First National Bank of Chicago	Ibasco, Ronaldo	Vice President
35	Goldstar Co.	Choi, Min Kyoo	Assistant Manager
36	Goldstar Co.	Oh, Young Ho	Employee
37	Goldstar Co.	Yoon, Chang Jin	Employee
38	Goldstar Co.	Eom, Kwang Sub	Employee
39	Goldstar Co.	Kim, Young Jin	Executive Director
40	Goldstar Co.	Kim, Sung Woo	Executive Director
41	Goldstar Co.	Kwon, Hee Won	General Manager
42	Goldstar Co.	Yu, Jong Tak	General Manager
43	Goldstar Co.	Kim, Yoo Duck	Manager
44	Goldstar Co.	Kim, Pil Tae	Manager
45	Goldstar Co.	Kim, Byeong Hwa	Manager
46	Goldstar Co.	Seo, Young Chul	Manager
47	Goldstar Co.	Jang, Whan	Manager
48	Goldstar Co.	Lee, Jang Kyu	Managing Director
49	Goldstar Co.	Ahn, Sang Sik	Senior Anlayst
50	Goldstar Co.	Song, Gyu Youn	Senior Researcher

#	Company	Name	Title
51	Goldstar Electron	Jeong, Yeong Ha	Employee
52	Goldstar Electron	Lee, Chan Hee	General Manager
53	Goldstar Electron	Kim, Yang Kyu	General Manager
54	Goldstar Electron	Kim, Dong Chan	General Manager
55	Goldstar Electron	Kim, Kab Sul	General Manager
56	Goldstar Electron	Jo, Nam Hun	Manager
57	Goldstar Electron	Choi, Dong Won	Manager
58	Goldstar Electron	Park, Min Ha	Managing Director
59	Goldstar Electron	Kim, Hong Sik	Managing Director
60	Goldstar Honeywell	Lee, Sheung Sin	General Manager
61	Goldstar Information & Commu.	Kim, Sang Rae	Manager
62	Goldstar Information & Commu.	Kim, I. B.	Managing Director
63	Goldstar Telecom	Yoon, Jin Hyuck	General Manager
64	Goldstar Telecom	Oh, Se Hee	Sr. Managing Dir.
65	Hyundai Electronics	Shin, Yang Su	Assistant Manager
66	Hyundai Electronics	Jeon, Yeong Joon	Assistant Manager
67	Hyundai Electronics	Choi, Pil Young	Employee
68	Hyundai Electronics	Chung, Gu Hak	Employee
69	Hyundai Electronics	Shin, Young Gun	Employee
70	Hyundai Electronics	Park, No Sam	Employee
71	Hyundai Electronics	Kim, Yong Jin	Employee
72	Hyundai Electronics	Chang, Byung Jun	Executive Director
73	Hyundai Electronics	Choi, Il Hyun	Executive Researcher
74	Hyundai Electronics	Hahn, Kwang Soo	Executive Researcher
75	Hyundai Electronics	Lee, Jae Myeong	General Manager
76	Hyundai Electronics	Shim, Chong Ik	General Manager
77	Hyundai Electronics	Yoon, Kil Geun	General Manager
78	Hyundai Electronics	Lee, Sung Hee	General Manager
79	Hyundai Electronics	Choi, Yoon Sik	General Manager
80	Hyundai Electronics	Cho, Yong Kwang	Manager
81	Hyundai Electronics	Yoo, Min Kwon	Senior Manager
82	Hyundai Electronics	Park, Chong Sup	Senior Vice President
83	Iljin	Choi, Hyung Seok	Employee
84	Iljin	Whang, Ook Ha	Employee
85	Infotech Systems	Kim, Young S.	President
86	Intel Korea	Woo, Kee Sup	Director
87	Intel Korea	Min, Chang Ki	General Manager
88	Intellect, Inc.	Min, P. June	President
89	Jung Pung Mool San	Moon, Chong Suk	Sr. Managing Dir.
90	KAI Tech.	Cho, We Duke	Professor
91	KAIST	Kim, In Ho	Senior Researcher
92	KLB Investment	Kim, Deok Soo	Assistant Manager
93	KTDC	Yim, Myung Sik	Financing Officer
94	Kolon Data Communication	Choi, Heon	Assistant Manager
95	Korea Telecommunication Authority	Kang, Min Ho	Executive Vice President
96	LSI Logic K.K.	Yawata, Keiske	President & C.E.O.
97	LTX Korea	Lee, Joo Hoon	General Manager
98	Lucky Goldstar	Hahn, Soung Kap	President
99	Megatest Korea	Lee, Chun Dong	General Manager
100	Ministry of Trade & Industry	Kim, Kwang Sik	Director

#	Company	Name	Title
101	Ministry of Trade & Industry	Song, Bong Sik	Senior Chief
102	Motorola Korea	Chun, Wan Soo	President
103	National Semiconductor Korea	Chung, Sang Kil	Manager
104	Nikon Corporation	Yoshida, Shoichiro	Sr. Managing Dir.
105	POSCO	Yoo, Eun Jae	General Manager
106	POSCON	Lee, Sang Hyun	General Manager
107	Samsung Co. LTD.	Lah, Woo Joo	Employee
108	Samsung Electronics	Mi Jung Hwang	Assistant Manager
109	Samsung Electronics	Lee, Yong Nam	Assistant Manager
110	Samsung Electronics	Son, Young Jin	Assistant Manager
111	Samsung Electronics	Kim, Yong Cheol	Assistant Manager
112	Samsung Electronics	Park, Seung Deok	Assistant Manager
113	Samsung Electronics	Kim, Jeong Kon	Assistant Manager
114	Samsung Electronics	Jeon, Hyun Jung	Employee
115	Samsung Electronics	Kim, Ju Young	Employee
116	Samsung Electronics	Jeon, Hyun Young	Employee
117	Samsung Electronics	Kim, Ki Won	Employee
118	Samsung Electronics	Cheon, Mi Hee	Employee
119	Samsung Electronics	Lee, Ho Jae	Employee
120	Samsung Electronics	Jung, Jae Ho	Employee
121	Samsung Electronics	Kim, Kyung Soo	Executive Director
122	Samsung Electronics	Chen, I Ching	Executive Director
123	Samsung Electronics	Han, Jeong Lark	Executive Director
124	Samsung Electronics	Park, Hak Song	Executive Director
125	Samsung Electronics	Kim, Jin Koo	Executive Director
126	Samsung Electronics	Jeong, Eui Yong	General Manager
127	Samsung Electronics	Park, Pyung Hyun	Manager
128	Samsung Electronics	Oh, Young Han	Manager
129	Samsung Electronics	Kim, Jai Hwan	Manager
130	Samsung Electronics	Um, Suk Ho	Manager
131	Samsung Electronics	Jo, Pyung Hak	Manager
132	Samsung Electronics	Choi, Jong Myung	Manager
133	Samsung Electronics	Lee, Hee	Manager
134	Samsung Electronics	Kim, Hyun Kon	Sr. Managing Dir.
135	Samsung Group	Gil, Young Joon	Senior Manager
136	Samsung Group	Lee, Pyoung Ha	Senior Manager
137	Samsung Institute	Wee, Young Cheul	Senior Researcher
138	Samsung Institute	Soh, Jin Wha	Vice President
139	Seung Jun Sang Sa	Park, Sang Hark	Sr. Managing Dir.
140	Shinn Patent & Law Firm	Shinn, Kwan Ho	President
141	Ssangyong Computer	Chun, Sung Won	Employee
142	Teradyne Korea	Lee, Hyung Yun	General Manager
143	Texas Instruments Korea	Lee, Dong Hyun	General Manager
144	Toshiba, Seoul Branch	Itoh, J.	Manager
145	Toshiba, Seoul Branch	Hong, Do Sun	Manager
146	TriGem Computer	Kim, Ji Wook	Analyst
147	TriGem Computer	Han, Sang Ki	Director
148	Tripole Electronic Industry	Kang, Jay	Managing Director
149	Western Digital Korea	Choi, Sung Lyong	General Manager
150	posDATA	Shin, In Kyun	Manager

Dataquest

a company of
The Dun & Bradstreet Corporation

1991 High-Tech Electronics Industry Conference Questionnaire
September 30, 1991
Shilla Hotel, Seoul, Korea

In order to continually improve out conference, we wish to gain your insights through this questionnaire. Please help us by completing the following questions.

1. Which of the following best describes your position/title?

____CEO, President, Executive
____Operations Management
____Sales and Marketing Management
____Product Development/R&D Engineering Management
____Purchasing/Vendor Selection
____Product Management
____Startegic Planning/Business Development
____Other, please specify _____

2. How did you learn about this conference?

____Received brouchure directly
____Dataquest called me
____Company received brochure
____Other:_____

3. Rank the reason you attended this conference in order of importance.(5 is most important)

	Least				Most
To hear Dataquest's forecast	1	2	3	4	5
To hear industry leaders	1	2	3	4	5
To exchange opinions	1	2	3	4	5
To get information for new business opportunities	1	2	3	4	5
Other, please specify _____	1	2	3	4	5

4. How well did the conference meet these objectives? 1 2 3 4 5

5. Please rank satisfaction on the followings.

Speech content	1	2	3	4	5
Interpretation	1	2	3	4	5
Conference hall	1	2	3	4	5

6. Did you attend Asian Semiconductor & Electronics Technology Conference in November, 1988?

____Yes ____No

7. Which of the presentations meet your needs the best-please rank.

8. What areas of focus would you like to see added at the next confernece?

9. Comments--including the topics/speakers you would like to hear at future conferneces. (Please write on back side, if you need more space.)

Thank you for your cooperation