

Outsourcing by the Japanese semiconductor industry - New relationship in Asia -

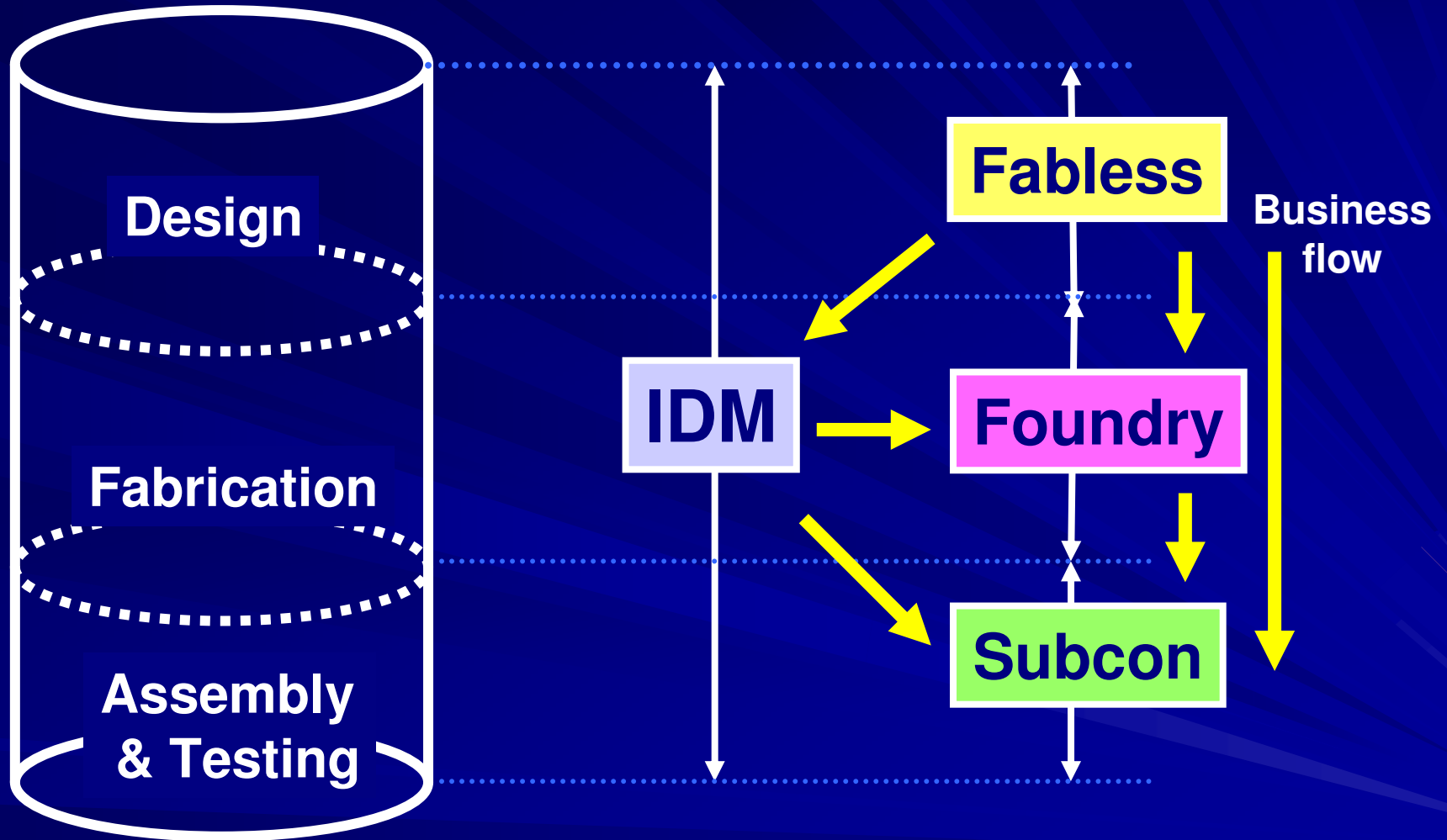
October 21, 2004
Hajime Sasaki
Chairman of the Board
NEC Corporation

1) Historical Review of Outsourcing business

2) Future Overview

3) Summary

- What is the business flow of outsourcing in the semiconductor industry? -



IDM: Integrated Devices Manufacturer
Subcon: Subcontractor

- Who were the historical players in the semiconductor outsourcing business? -

	Fabless	Foundry	Subcontractor
Late 1960s - 1970s			Micro Electronics (1964, Hong Kong) Anam (1968, Korea) Stanford Microelectronics (1971, Philippine) Carsem (1972, Malaysia)
1980s	Weitek (1981, USA) Altera (1983, USA) Cirrus Logic, Chips & Tech., Xilinx (1984, USA) Qualcomm (1985, USA)	UMC (1980, Taiwan) TSMC (1987, Taiwan) Chartered (1987, Singapore)	Testing was subcontracted in addition to packaging.
1990s	Broadcom (1991, USA) NVIDIA (1993, USA)	Tower Semicon (1993, Israel)	IDM asked subcon for high-end assembly. (e.g., BGA and CSP)

Outsourcing Market Trend

\$Million

24,000

20,000

16,000

12,000

8,000

4,000

0

1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004

- Subcon/Testing
- Subcon/Asmbly
- IDM Foundry
- Pure Foundry
- Foundry/WSTS
- Subcon/WSTS

%

10

5

0

(Source: Estimation by Intercovrage)

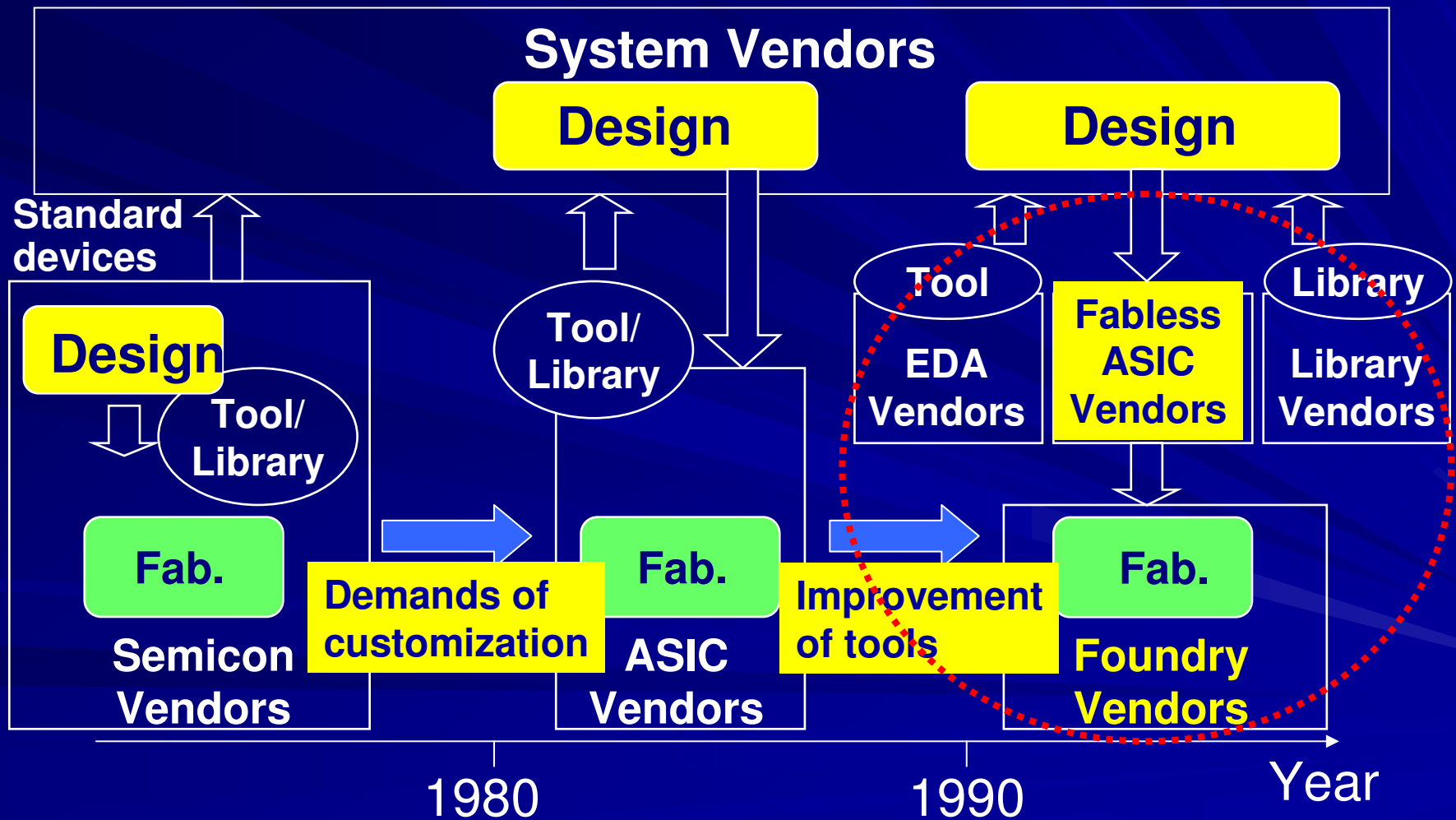
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- What were the factors that prompted fabless - foundry business models?

- **Fabless companies outsourced from IDMs, but the priority of fab capacity allocation might not be committed.**
- **Logistics capabilities of foundry companies were superior for wafer supply.**
- **Foundry companies in Taiwan obtained tax benefits, which allowed them to expand fab capacity with competitive wafer cost.**
- **Expansion of foundry companies obtained cooperative relationships from EDA vendors and Library vendors.**

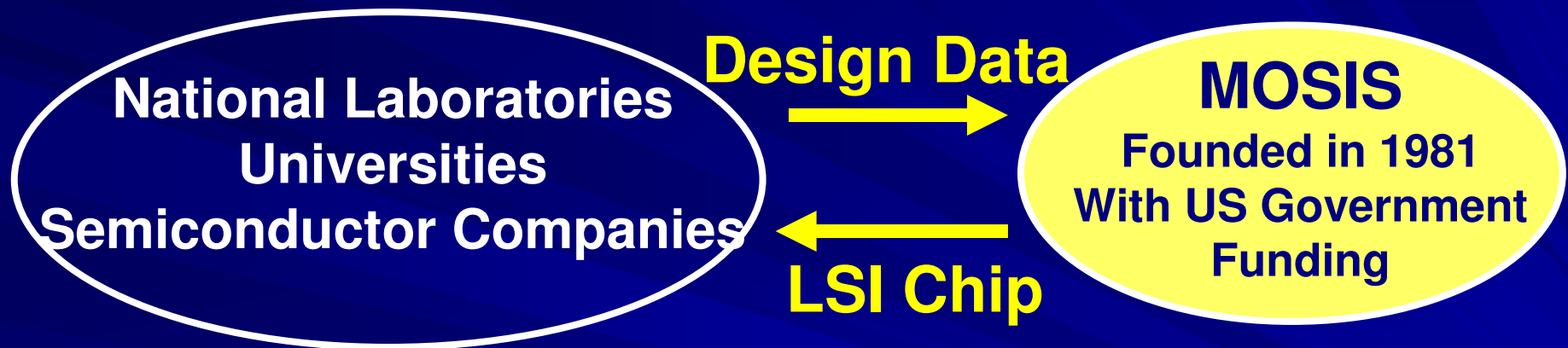
- What were the factors that promoted fabless - foundry business models?

Fabless + Foundry model



- What were the factors that promoted fabless - foundry business models?

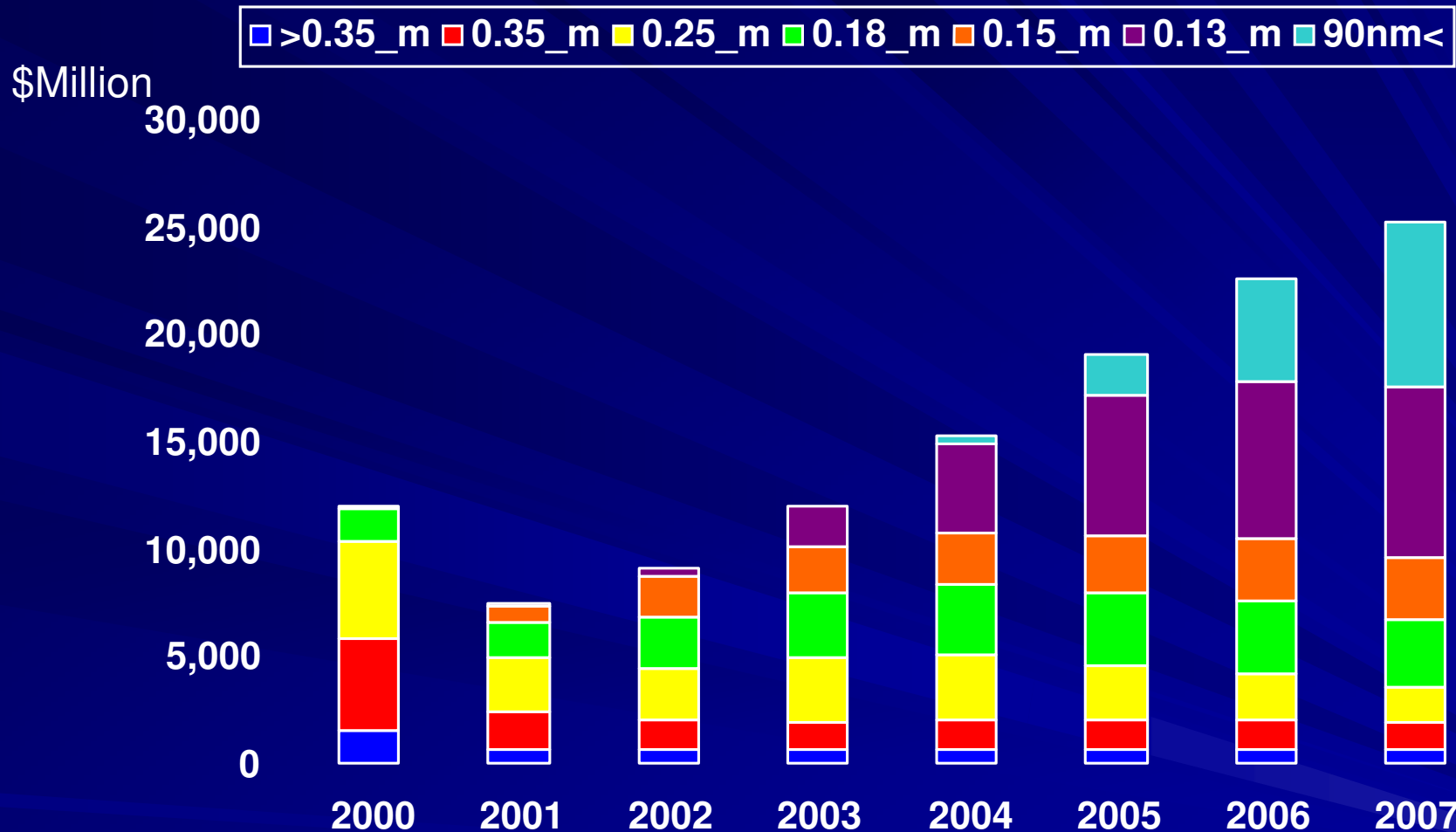
MOSIS service generated the easy scheme of test production of LSI chip.



Examples of Successful Product Development Based on MOSIS Service

UC Berkeley → SPICE, Magic
Stanford → MIPS, RISC
UCLA → Broadcom

Foundry Market by Feature Dimension



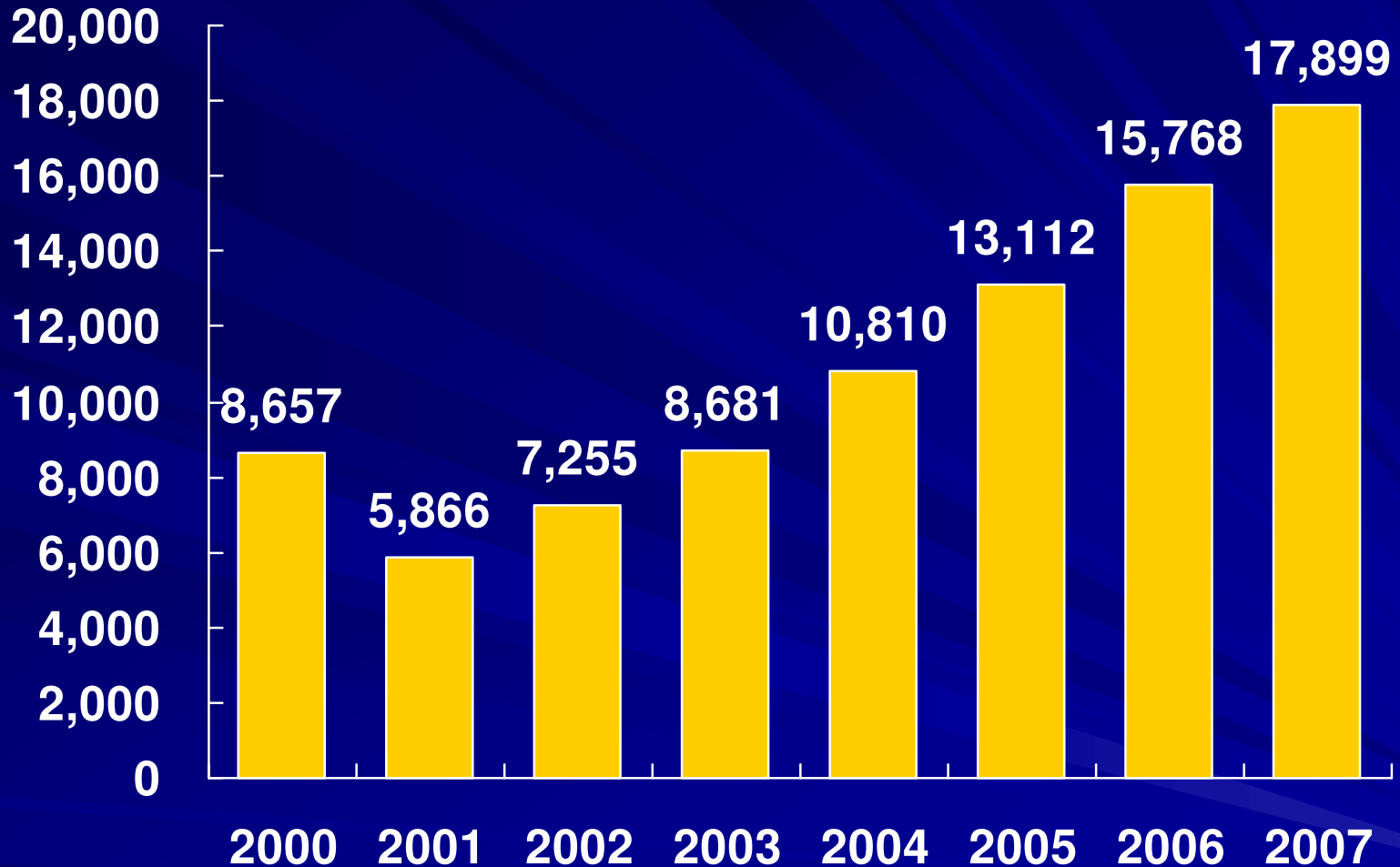
% of Total IC Market	2000	2001	2002	2003	2004	2005	2006	2007
	7%	6%	8%	9%	9%	10%	12%	13%

(Source: Estimation by IBS)

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Worldwide Fabless Semiconductor Market

\$Million



	2000	2001	2002	2003	2004	2005	2006	2007
% of world wide IC Market	5%	5%	6%	6%	7%	7%	8%	8%

(Source: Estimation by IBS)

Top 10 Pure Foundries Revenue

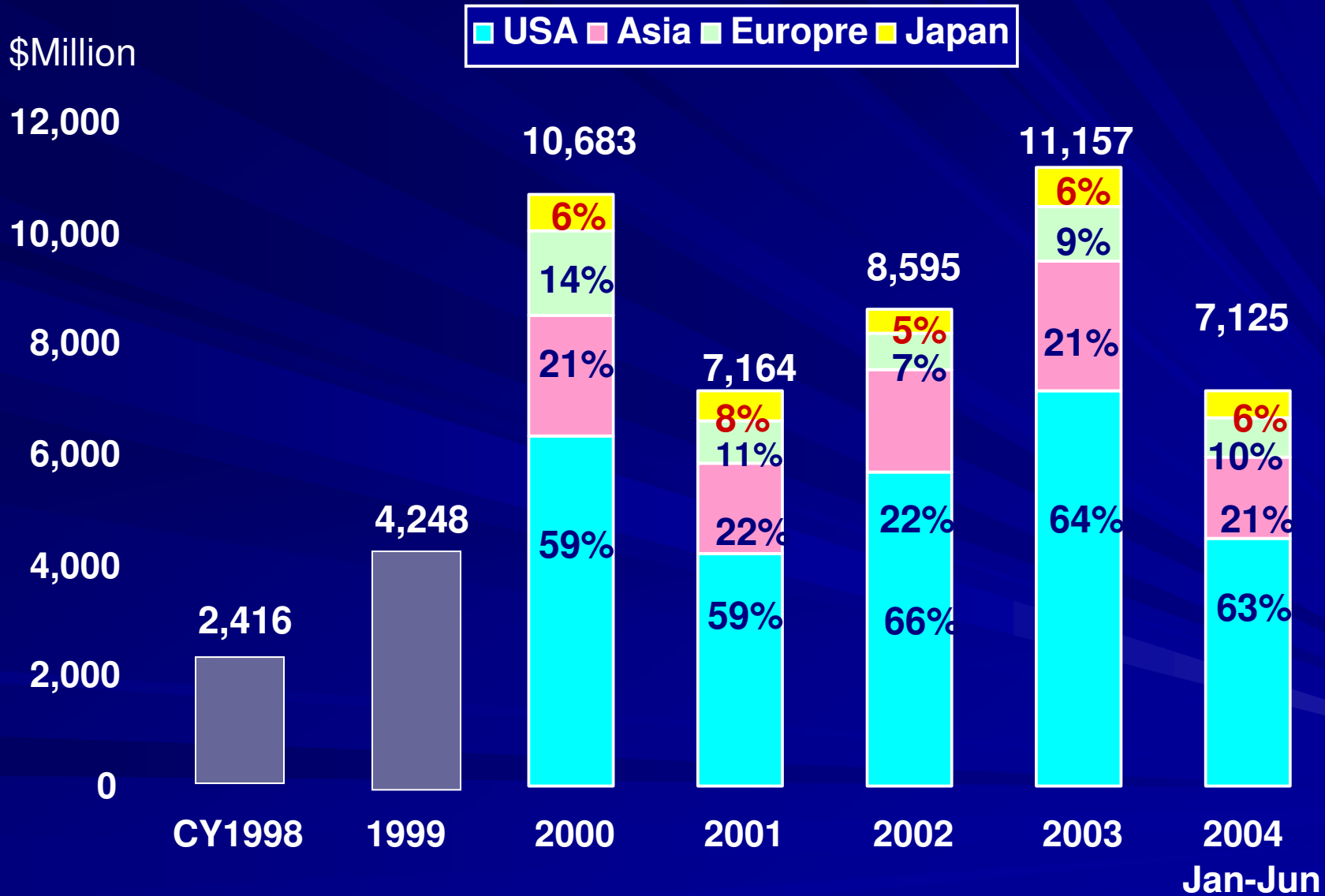
	(\$Million)	HQ location	2003	2004	Growth
1	TSMC	Taiwan	5,855	8,030	37%
2	UMC	Taiwan	2,740	4,200	53%
3	Chartered	Singapore	728	1,215	67%
4	SMIC	China	366	1,030	181%
5	DongbuAnam	Korea	330	450	36%
6	SSMC	Singapore	155	270	74%
7	HHNEC	China	170	255	50%
8	Jazz	USA	185	240	30%
9	Siltera	Malaysia	82	210	156%
10	X-Fab	Germany	127	200	57%
	Top 10		10,738	16,100	50%
	Share of Top10		95%	91%	
	Worldwide Sales		11,330	17,710	56%

(Source: Estimation by IC Insight)

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Top 4 Foundry Sales by Region

(TSMC, UMC, Chartered Semiconductor and SMIC)



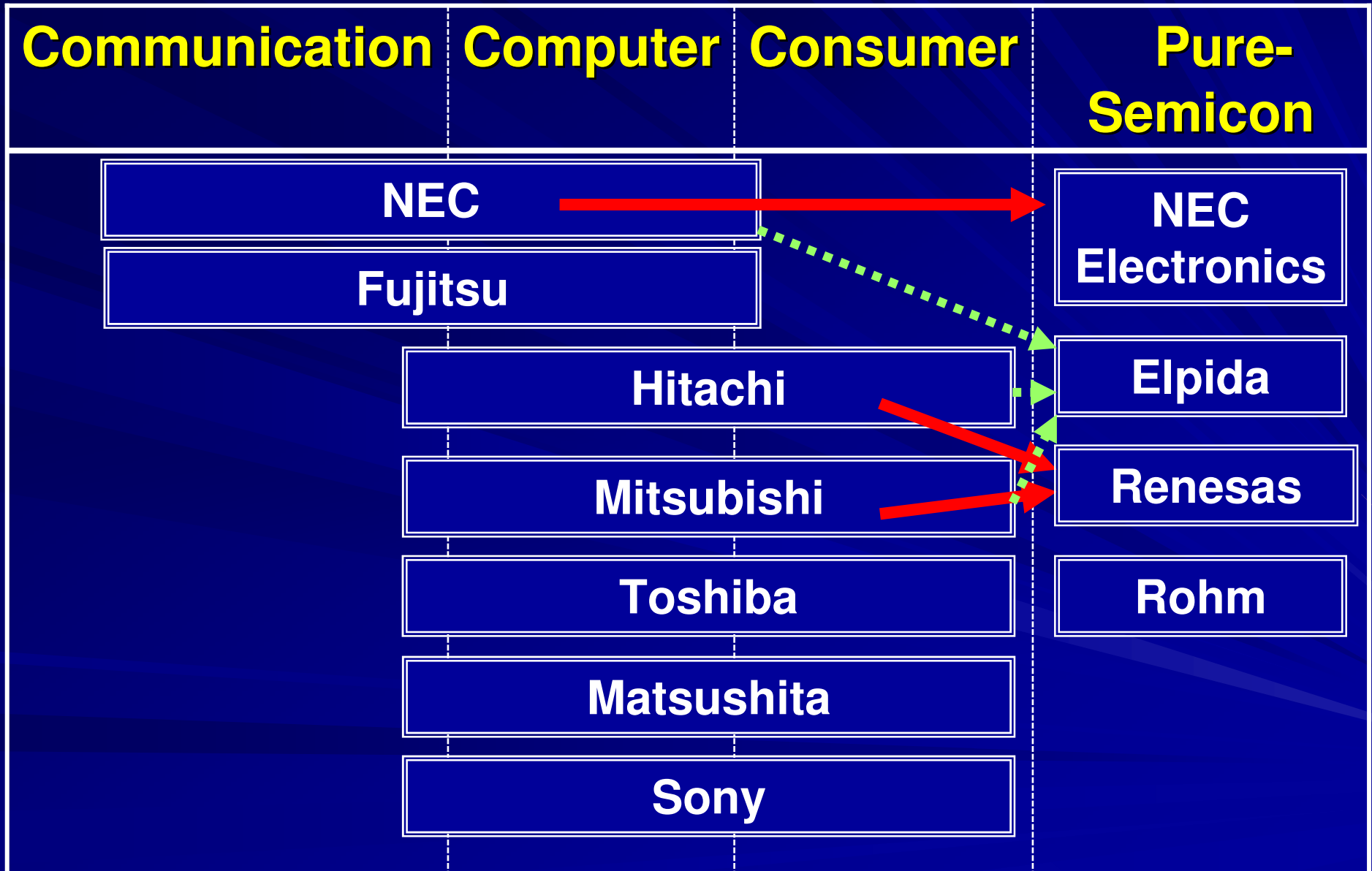
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Outsourcing by Japanese Semiconductor companies

- **Outsourcing by Japanese semiconductor companies have been limited by following reasons:**
 - => Internal customers demanded optimum performance from LSIs in order to meet the requirements of their end products.**
To realize this, design had to be tightly coupled with manufacturing technology.

Characteristics of Japanese Semiconductor companies



Japanese semiconductor companies
can be categorized as follows:

Commodity Products	Rohm Elpida	IDM IDM+Outsourcing
System LSI supplier	NEC Electronics Renesas Toshiba	IDM IDM IDM
Priority of Internal supply	Matsushita (CCD) Fujitsu Sony	IDM IDM IDM

Top 10 Subcontractors Revenue

	(\$Million)	HQ location	2002	2003	Growth
1	ASE Group	Taiwan	1,323	1,669	26%
2	Amkor Technology	USA	1,407	1,604	14%
3	SPIIL	Taiwan	646	797	23%
4	ChipPAC	USA	364	429	18%
5	STATS	Singapore	226	381	69%
6	ChipMOS	Taiwan	137	220	60%
7	Carsem	Malaysia	177	215	22%
8	KYEC	Taiwan	155	198	27%
9	Orient Semiconductor	Taiwan	188	189	0%
10	Signetics Korea	Korea	150	180	20%
	Top 10 Subcontractors		4,772	5,880	23%
	Share of Top10		51%	45%	
	Worldwide Subcontractors		9,390	12,924	38%

(Source:
Estimation by Intercoverage)

Subcontractors: Assembly, Testing and Packaging of ICs.

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ASE Group

1) Major Customers

Communications	Personal Computers	Consumer Electronics, Industrial and Automotive
Agilent Technologies, Inc. Conexant Systems, Inc. Koninklijke Philips Electronics Motorola, Inc. Qualcomm Incorporated RF Micro Devices, Inc. STMicroelectronics N.V.	ATI Technologies, Inc. IBM Corporation NVIDIA Corporation Silicon Integrated Systems Corp. VIA Technologies, Inc. Winbond Electronics Corp. Marvell Technology Group Ltd.	Altera Corporation LSI Logic Corporation Motorola, Inc. ON Semiconductor Co., Ltd. STMicroelectronics N.V. Sunplus Technology Co., Ltd. Micronas Semiconductor Holding

2) Sales by Region

	2001	2002	2003
U.S.A.	65.0%	59.1%	60.2%
Taiwan	26.7%	24.9%	27.0%
Europe	3.9%	6.1%	8.3%
Others	4.4%	9.9%	4.5%
Sales(\$M)	1,096	1,323	1,686

(Source: Company Information)

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Amkor Technology

1) Japanese Customers within Top 50 customers

Fujitsu, Hitachi, Mitsubishi Electric, NEC, Oki, Omachi Fuji Co., Ricoh, Sanyo, Sony Semicon, Toshiba,

2) Sales by Region

	2001	2002	2003
U.S.A.	34%	32%	31%
China/Honk Kong	6%	5%	6%
Ireland	6%	5%	5%
Japan	21%	23%	22%
Singapore	11%	11%	11%
Taiwan	5%	8%	9%
Others	17%	17%	17%
Sales(\$M)	1,336	1,405	1,603

(Source: Company Information)

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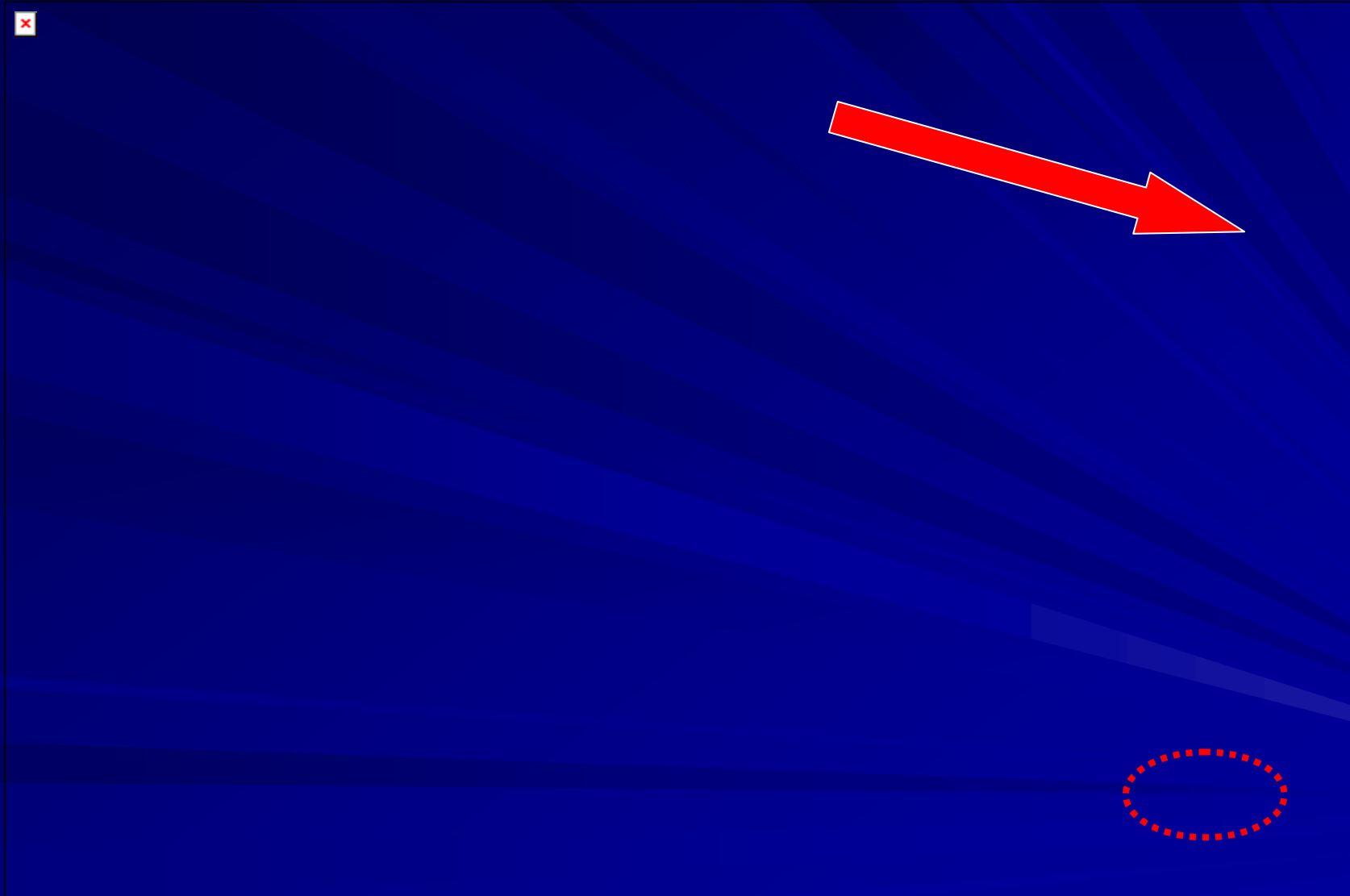
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- What is happening in sub deep micron technologies? -

Probability of Designs Operating as Expected

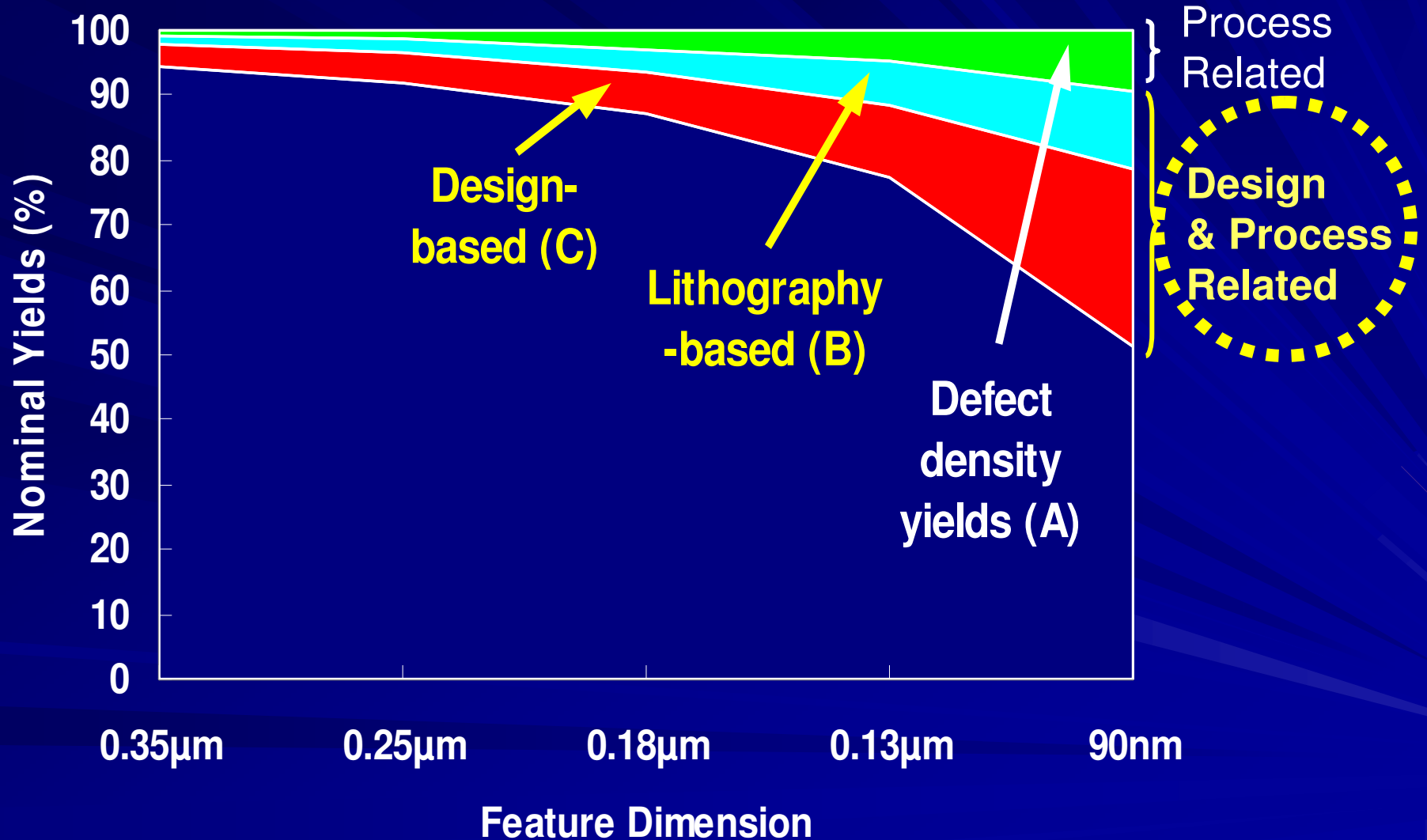


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- What is happening in sub deep micron technologies? -

Yields by Feature Dimension

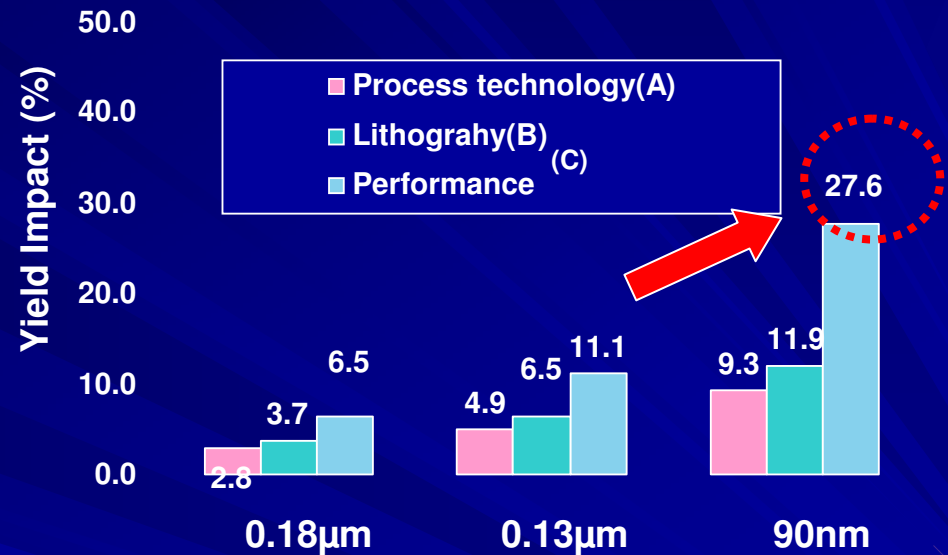
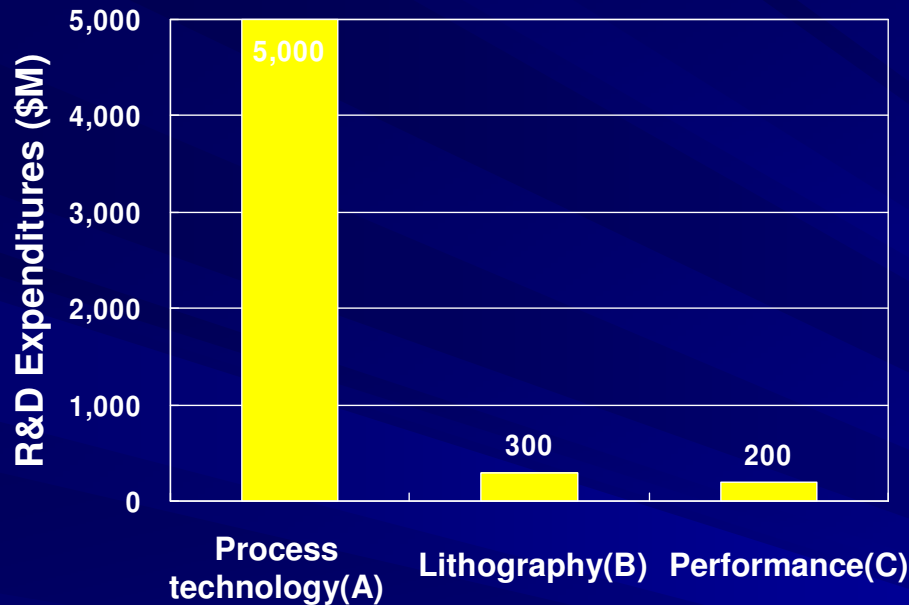


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- What is happening in sub deep micron technologies? -

Impact on Yield Potential

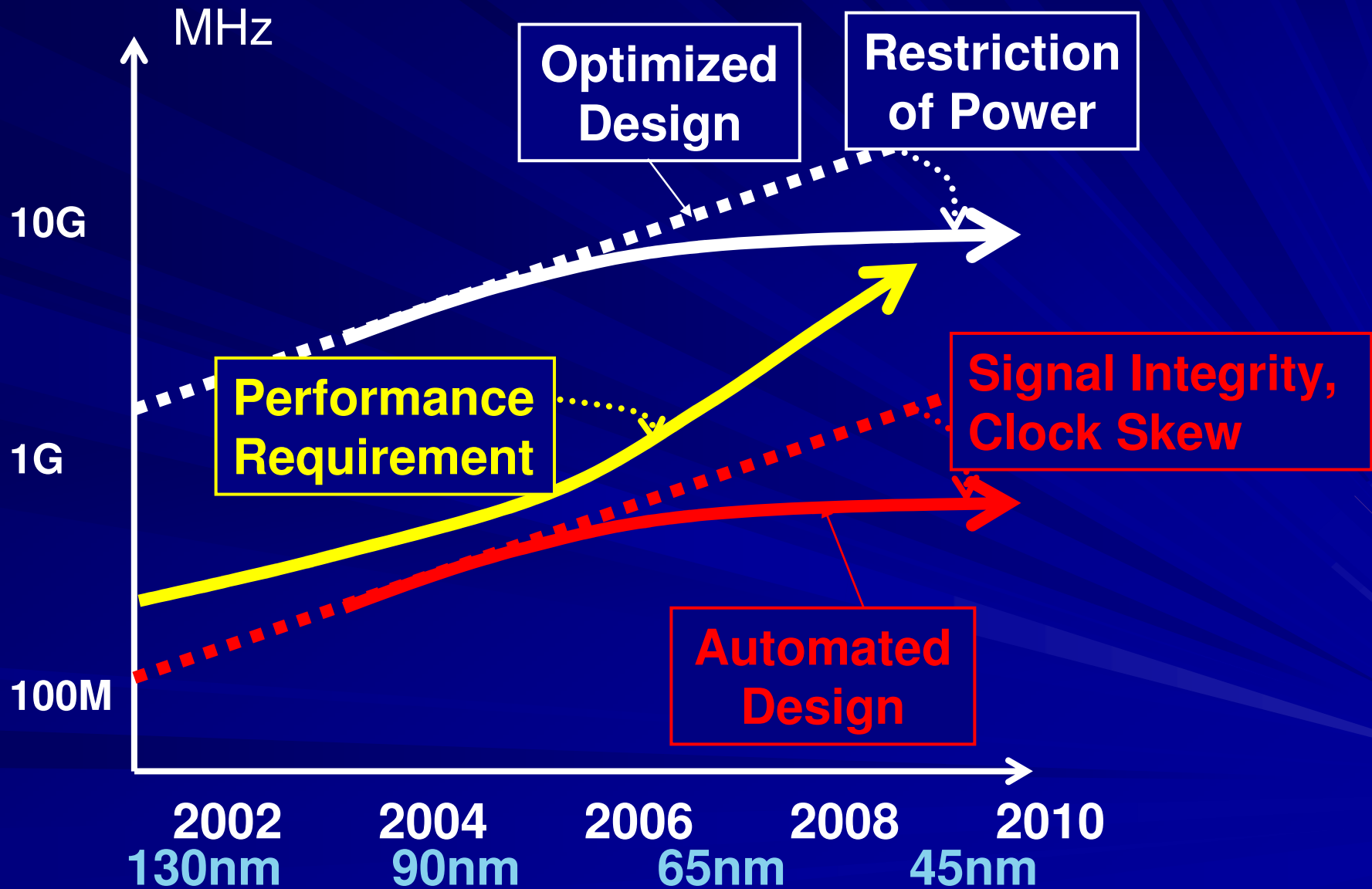


	R&D (\$M)	Yield impact		
		0.18µm	0.13µm	90nm
Process technology(A)	5,000	2.8	4.9	9.3
Lithography(B)	300	3.7	6.5	11.9
Performance(C)	200	6.5	11.1	27.6

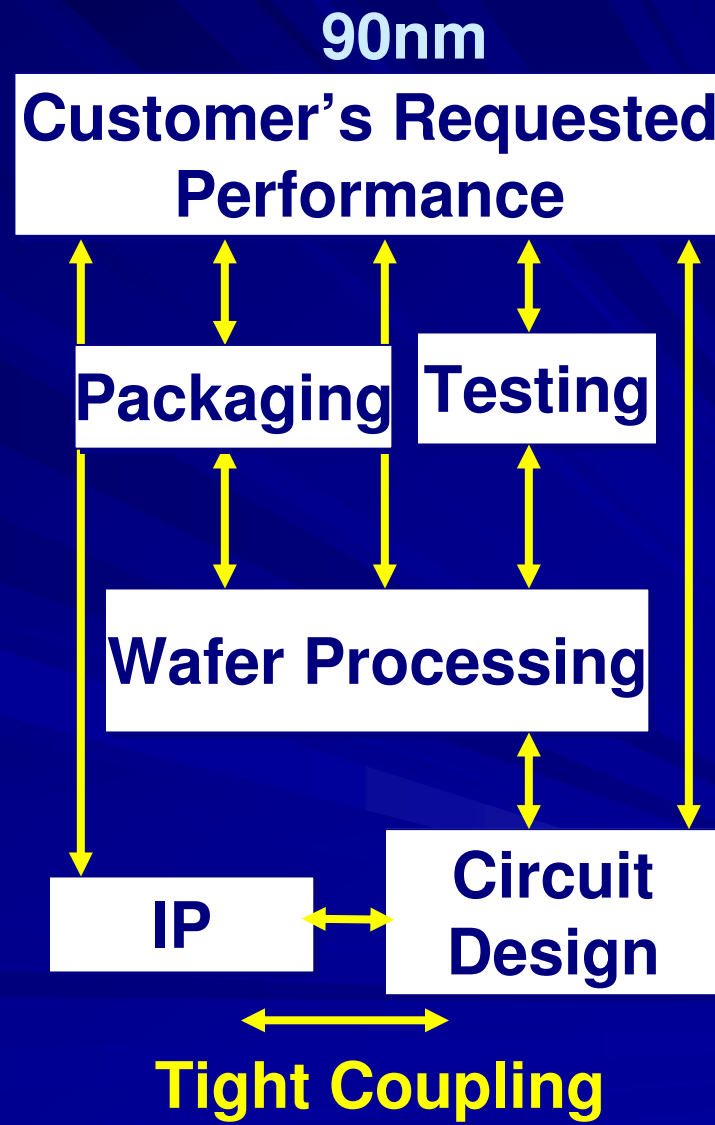
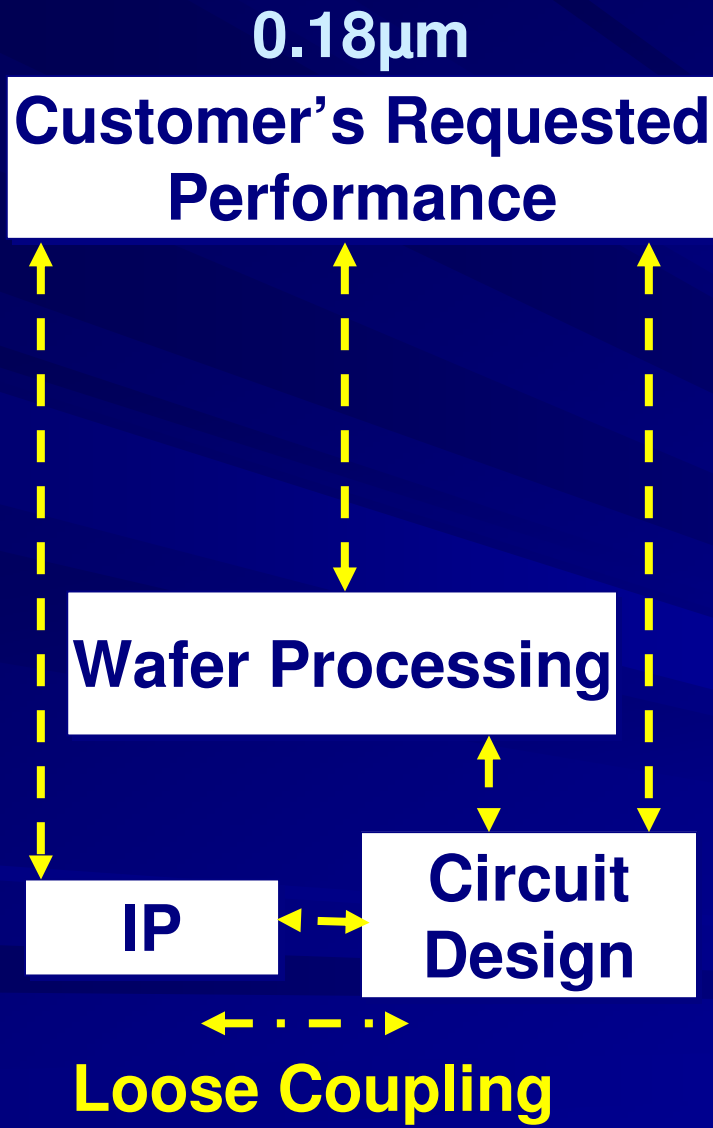
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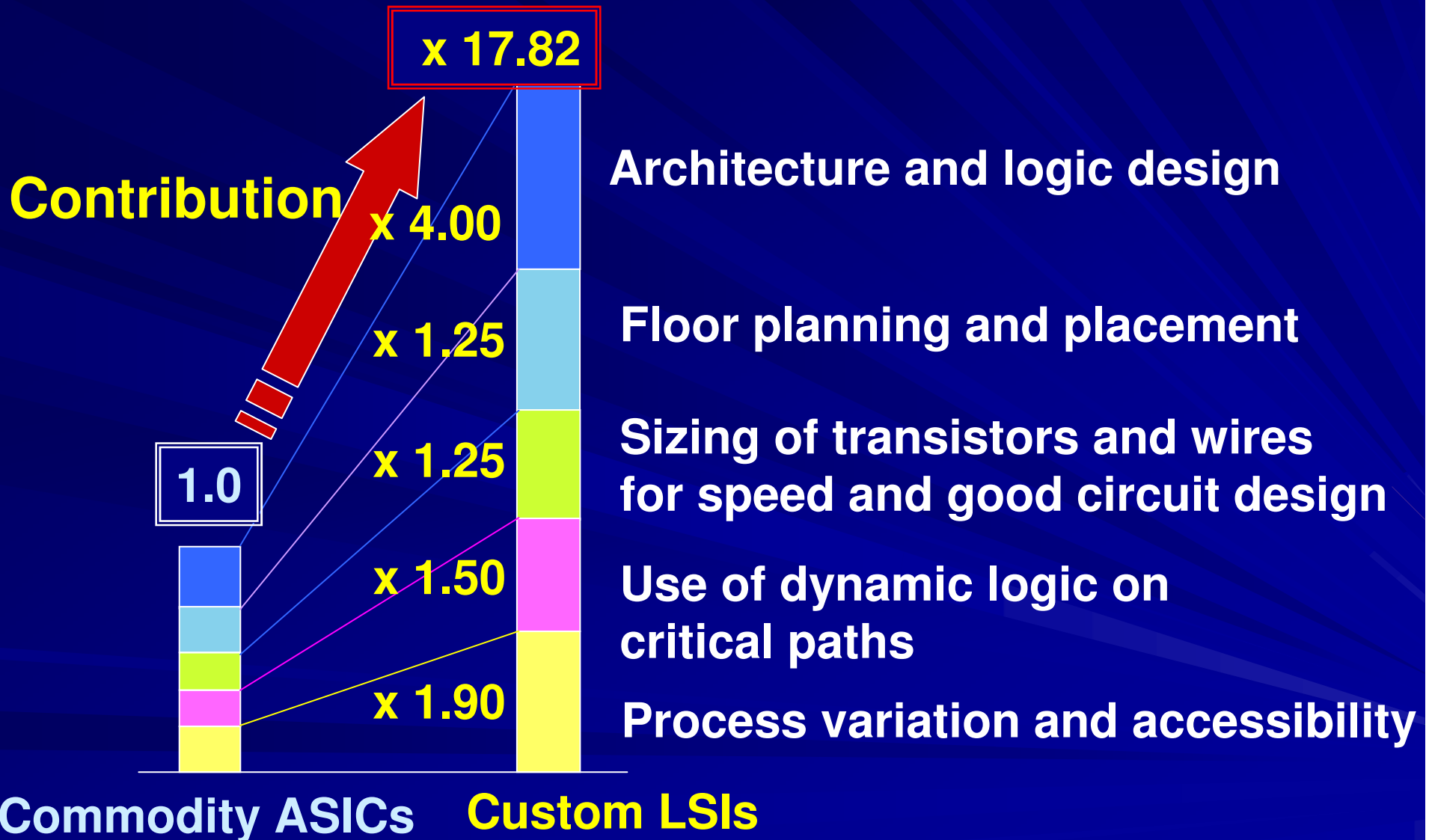
- What will be the technological differentiation between IDM vs. Fabless & Foundry be likely in the future? -



Tight Coupling is requested at 90nm Technologies



Maximum Contribution of factors to the Speed Differentiation



(Source: Estimation by UC Berkley)

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For the Future

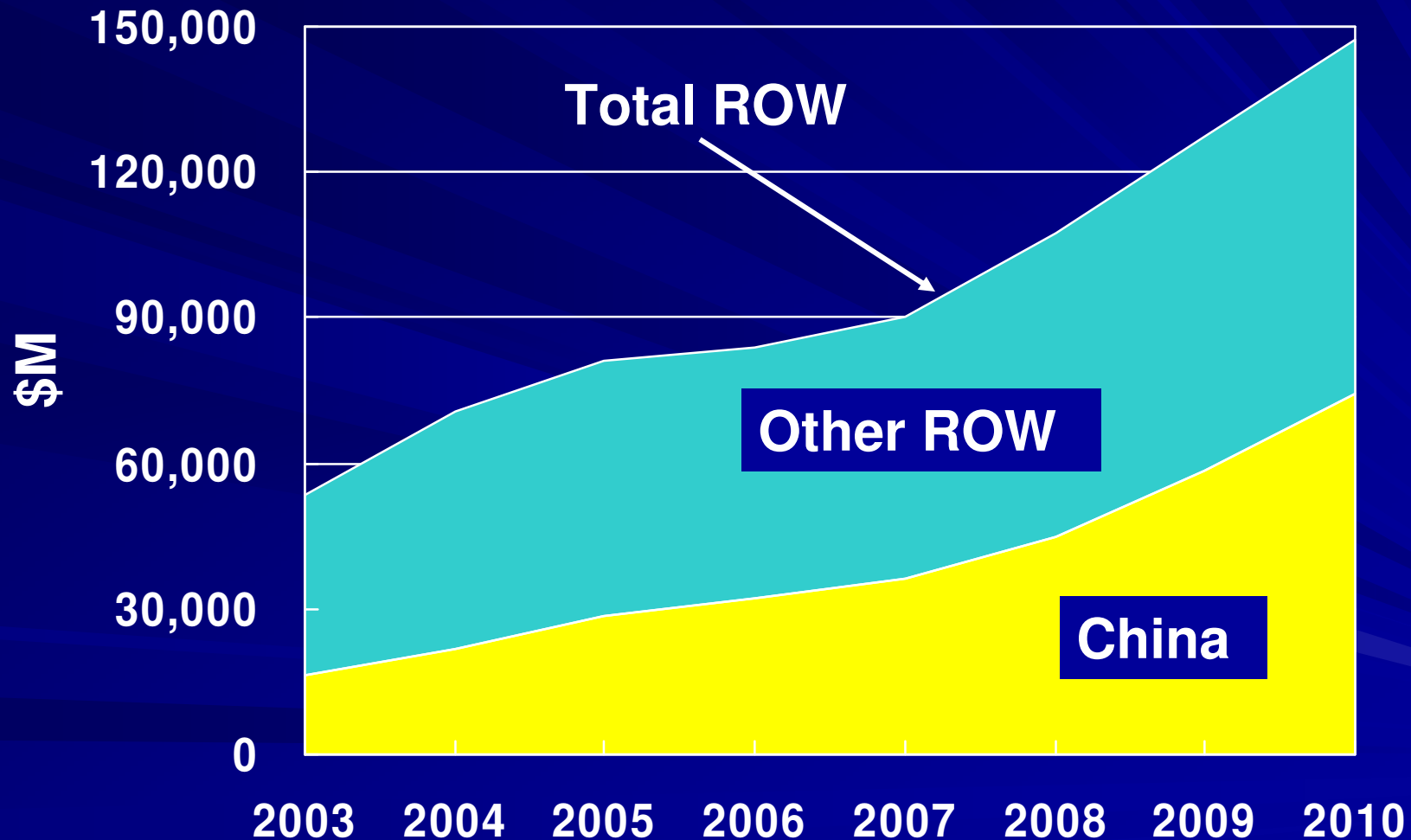
- **In Japanese semiconductor industry, IDMs will continue to be major players.**
- => Therefore, outsourcing will be limited for the products with matured and standardized technologies.**
Advanced products of competitive fields will not be outsourced, because of the optimized requirements between design and wafer process.
- => As for packaging, outsourcing will be used to complement package lineups and to complement production capacity.**

Outsourcing by start-up semiconductor companies in Japan

- **In Japan, there are over 300 semiconductor venture companies.**
- **Revenue of fabless companies in Japan is estimated as around 3-5% of total fabless IC market, which is 1% of total IC market.**
- **Japanese fabless companies ask wafer fabrication to Japanese IDM and Taiwanese Foundry companies.
(e.g., THine Electronics outsourcers from Kawasaki Microelectronics, Yamaha, UMC Japan and TSMC)**

- How does Japanese semiconductor industry position China market? -

Chinese Semiconductor market will grow.



(Source: Estimation by IBS)

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- How does Japanese semiconductor industry position China market? -

- **For Japanese semiconductor industry, China is a huge market.**
- **Relationship between semiconductor companies and Chinese system companies will be more strengthened.**
- **Outsourcing to Chinese semiconductor industry will increase for the products with standard process technology to China market.**

90nm 300mm Foundry Wafer Fab Capacity Available in 2006

Company	Mo. Wafer volumes	Comments
TSMC	50,000 to 60,000	Could be increased if demand is strong
UMC	30,000 to 40,000	CAPEX is being increased
SMIC	20,000 to 30,000	Does not include DRAM capacity and metallization capacity
Japan Inc.	20,000 to 25,000	Capacity Available for foundry supply
Samsung	10,000 to 15,000	Capacity Available for foundry supply
IBM	7,000 to 8,000	IBM wafer prices higher than industry average
Chartered	9,000	Initial capacity (based on publicly available information)
TOTAL	146,000 to 187,000	\$8.76B to \$11.22B at \$5,000 per wafer \$7.88B to \$10.1B at \$45,00 per wafer

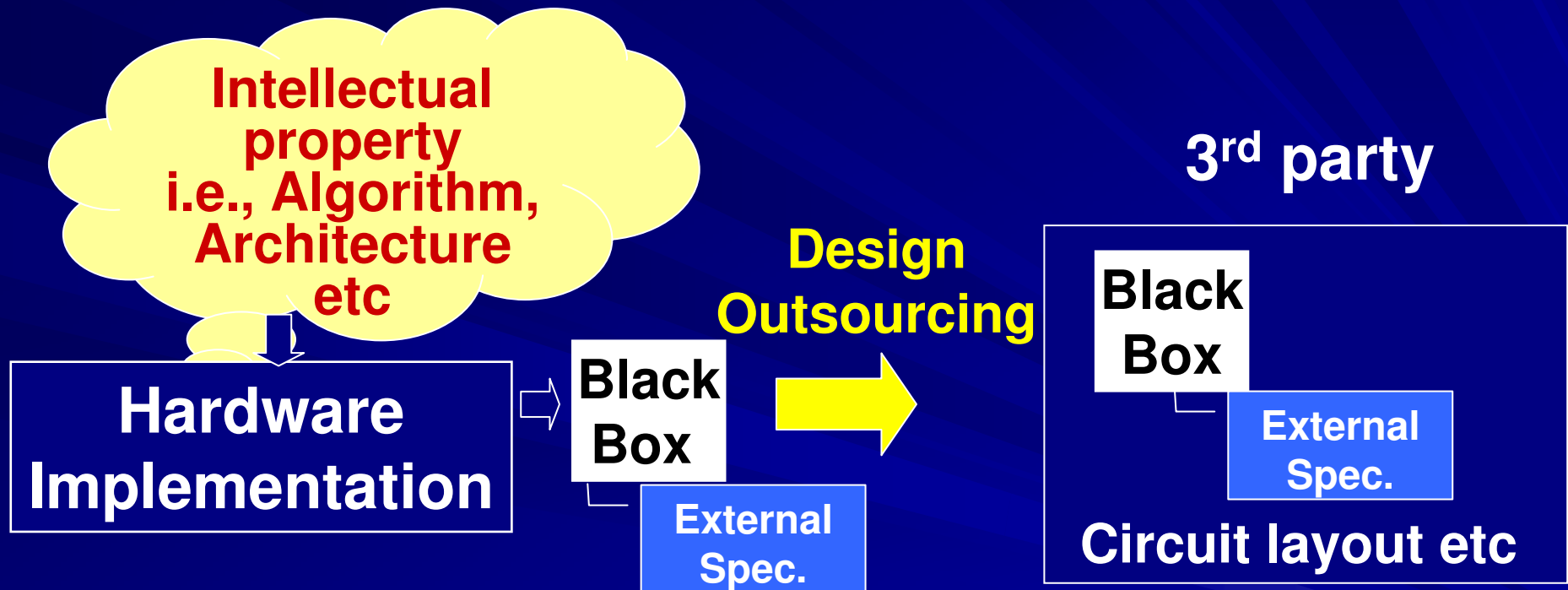
(Source: Estimation by IBS)

Number of Engineering Graduates (2003 Estimates)

Country	Number of graduates	Comments
China	240,000	Level of educational levels is mixed
Japan	85,000	Continued strong base
Russia	70,000	Underutilized
U.S.	55,000	Slow decline in engineering emphasis
South Korea	48,000	Strong emphasis on education
Germany	36,000	35 hours/week and 10 weeks vacation/year
India	35,000	Additional 50K in mathematics
France	25,000	35 hours/week and 10 weeks vacation/year
U.K.	22,000	Emphasis on engineering is declining

- How to protect Intellectual Property through outsourcing? -

Protecting intellectual property through design outsourcing



Black box with the external spec. make it possible:
=> Protect the intellectual property
=> Enable the Circuit layout work by 3rd party

Thank you for your attention.

**Now, I would like to take questions
from you!**

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