Retaining semiconductor manufacturing expertise and value chain

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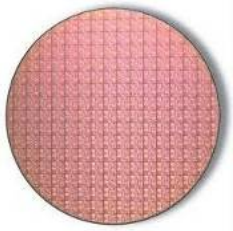
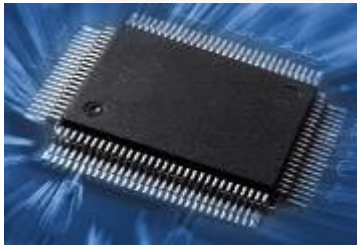
About SEMI

Semiconductor Equipment and Materials International

- **Global** industry association
- **1800 Members**
- **Established in 1970** to serve the semiconductor supply chain
- Today serves members in the following industries
  - Semiconductor
  - Flat Panel Display
  - Photovoltaic/Energy
  - Nanotechnology
  - MEMS





Characteristics of the SEMI industry

- Enabling technology
- Pervasive technology
- 2nd most R&D intensive
- Global industry
- SEMI (semiconductor equipment and materials international)
  - Industry association since 1970, 11 offices
  - 1800 members worldwide
  - 85% are SMEs (Small and Medium sized Enterprises)
  - SMEs drivers of innovation
- Strongly interlinked eco-system

- **Strongly interconnected supply chain**
- **The fab is the lab & the lab is the fab**
- **SEMI members benefit of working closely with their customer and suppliers**

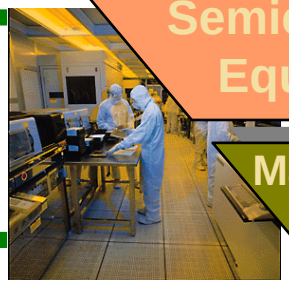
“… *in the long run R&D activities are likely to follow production to third countries*”

Source: Communication from the European Commission COM(2009) 512 "Preparing for our future: Developing a common strategy for key enabling technologies in the EU“

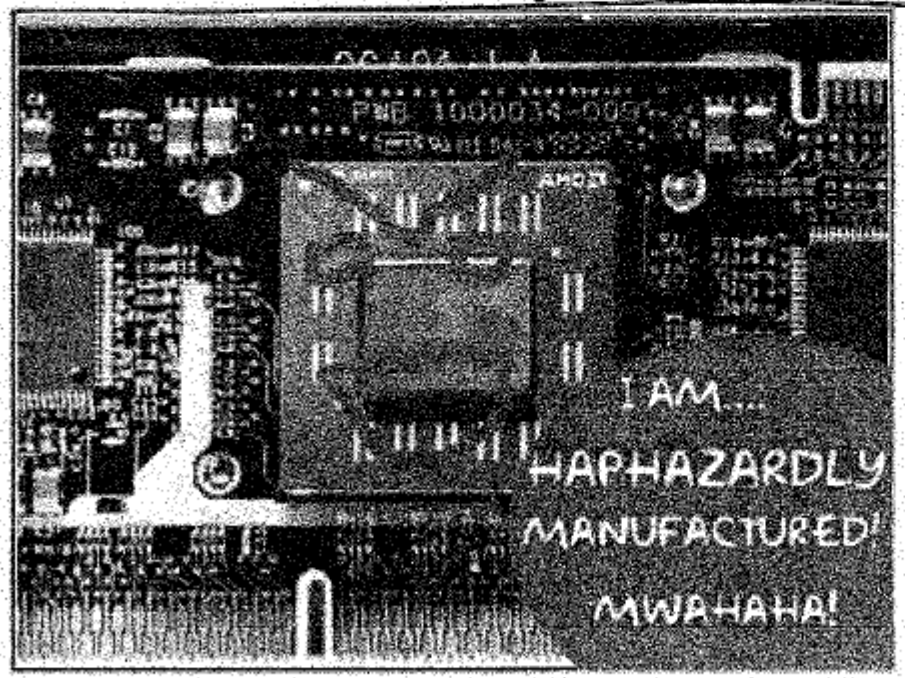
Semiconductors are the innovation enablers, also for aerospace, security and defence

	Estimate 2007	Forecast 2009
Electronic End Equipment	$1,570B	$1,846B
Semiconductors	$256B	$296B
Semiconductor Equipment	$43B	$45B
Materials	$42B	$50B

SEMI® membership



Fake Electronic Components Cause Military Malfunctions, Possibly International Espionage



BusinessWeek reports that counterfeit hardware has been found to be the cause of several malfunctions in high-level military machinery. The phony infiltration has a distinct possibility of leading to espionage or sabotage. In other words, move over, [illegible]: you're not the biggest faker in town anymore.

Several crashes of military aircraft can be attributed to knockoff chips, but more insidiously, internal military data might be at risk. Melissa E. Hathaway, a head of cybersecurity at the FBI,

IN DEPTH October 2, 2008, 5:00PM EST

Dangerous Fakes

How counterfeit, defective computer components from China are getting into U.S. warplanes and ships

By Brian Grow, Chi-Chu Tschang, Cliff Edwards and Brian Burnsed

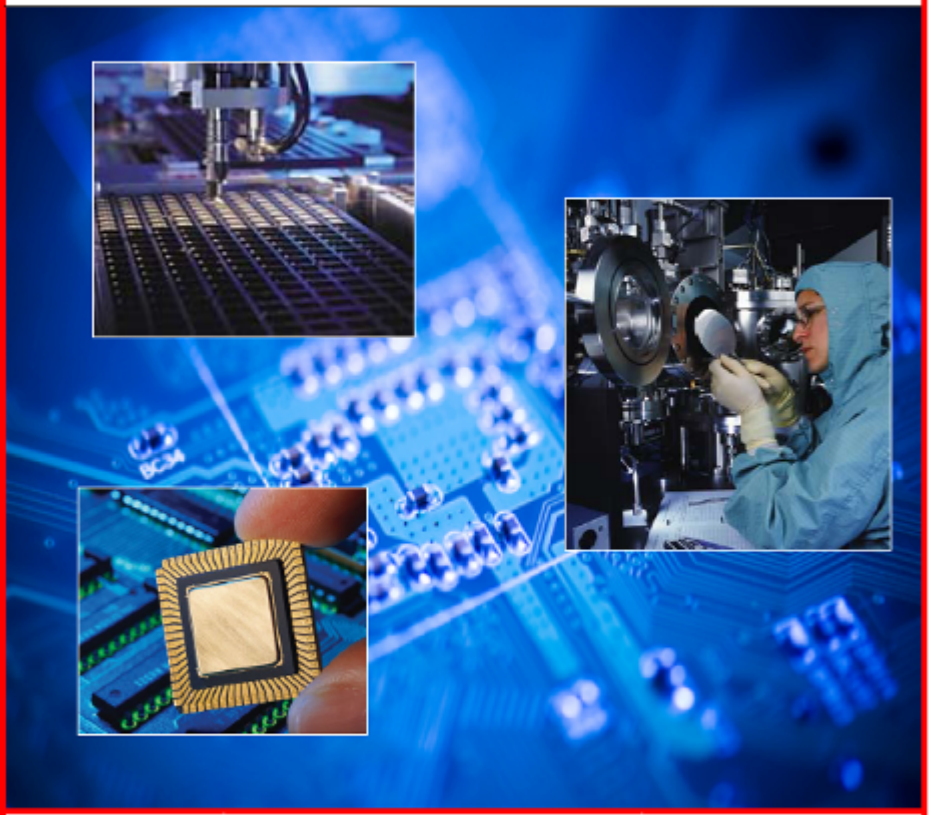
The American military faces a growing threat of potentially fatal equipment failure—and even foreign espionage—because of counterfeit computer components used in warplanes, ships, and communication networks. Fake microchips flow from unruly bazaars in rural China to dubious kitchen-table brokers in the U.S. and into complex weapons. Senior Pentagon officials publicly play down the danger, but government documents, as well as interviews with insiders, suggest possible connections between phony parts and breakdowns.

In November 2005, a confidential Pentagon-industry program that tracks counterfeits issued an alert that "BAE Systems experienced field failures," meaning military equipment malfunctions, which the large defense contractor traced to fake microchips. Chips are the tiny electronic circuits found in computers and other gear.

The alert from the Government-Industry Data Exchange Program (GIDEP), reviewed by *BusinessWeek* (MHP), said

Defense Industrial Base Assessment:

U.S. Integrated Circuit Design and Fabrication Capability



U.S. Department of Commerce
Bureau of Industry and Security
Office of Technology Evaluation

March 2009

DEFENSE INDUSTRIAL BASE ASSESSMENT: COUNTERFEIT ELECTRONICS

PREPARED BY

U.S. DEPARTMENT OF COMMERCE
BUREAU OF INDUSTRY AND SECURITY
OFFICE OF TECHNOLOGY EVALUATION

January 2010

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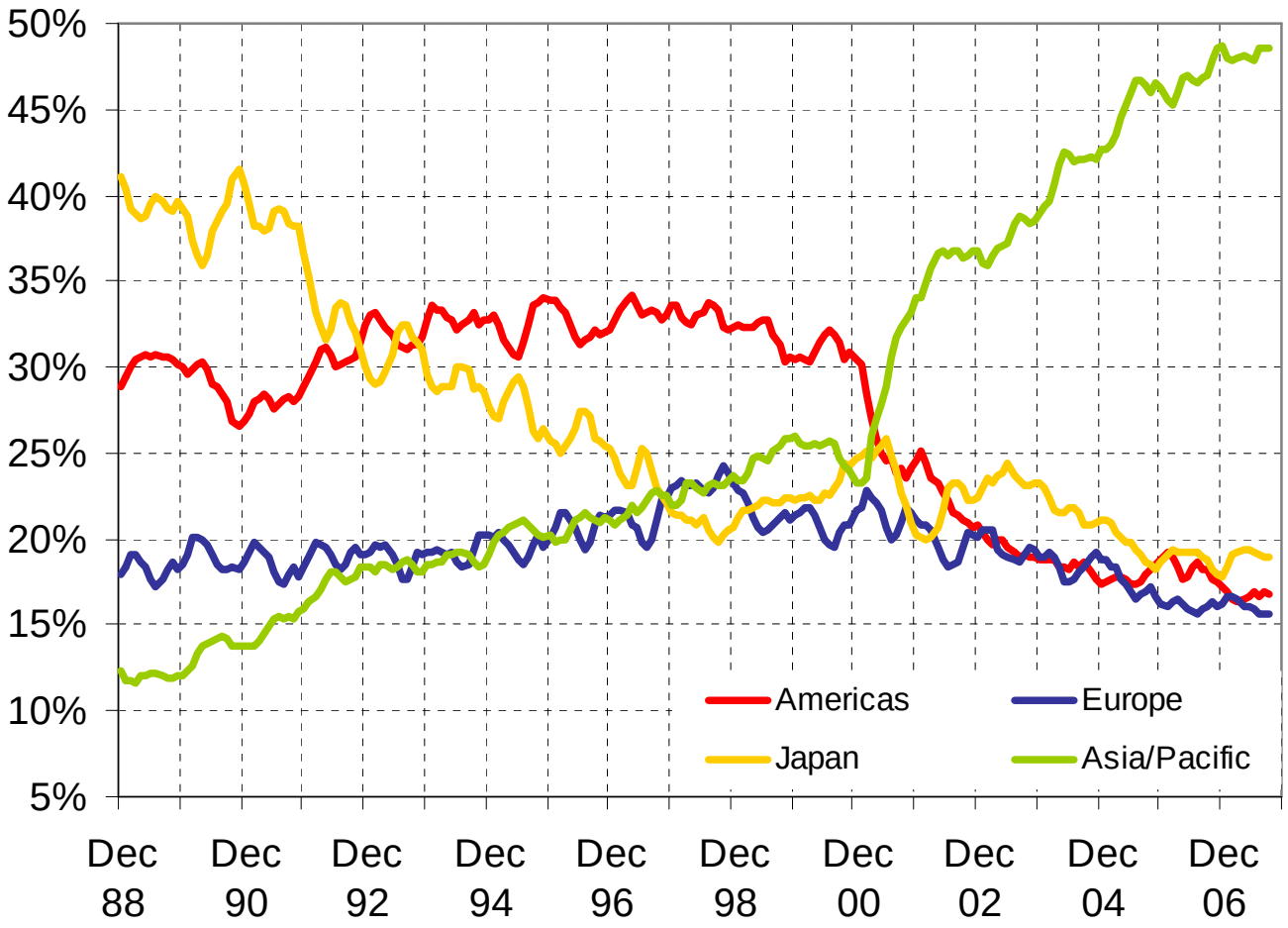
For more information about the Bureau of Industry and Security, please visit:
http://www.bis.doc.gov/defenseindustrialbaseprograms/index.htm

Manufacturing delocalization trend due to strong incentives



Typical incentive package

National Microelectronics Institute

Chinese Incentive Program For Foreign Fabless Design

- Grants of up to $30m over 4 years
- 15% cap on Corporation Tax
  - Likely to be 0%
- Rent free premises for first 2 years
  - Negotiable for following 2 years
- Staff living expenses for 2 years
- 100% refund on personal income tax for up to 5 years
- "Improved access" to the Chinese market

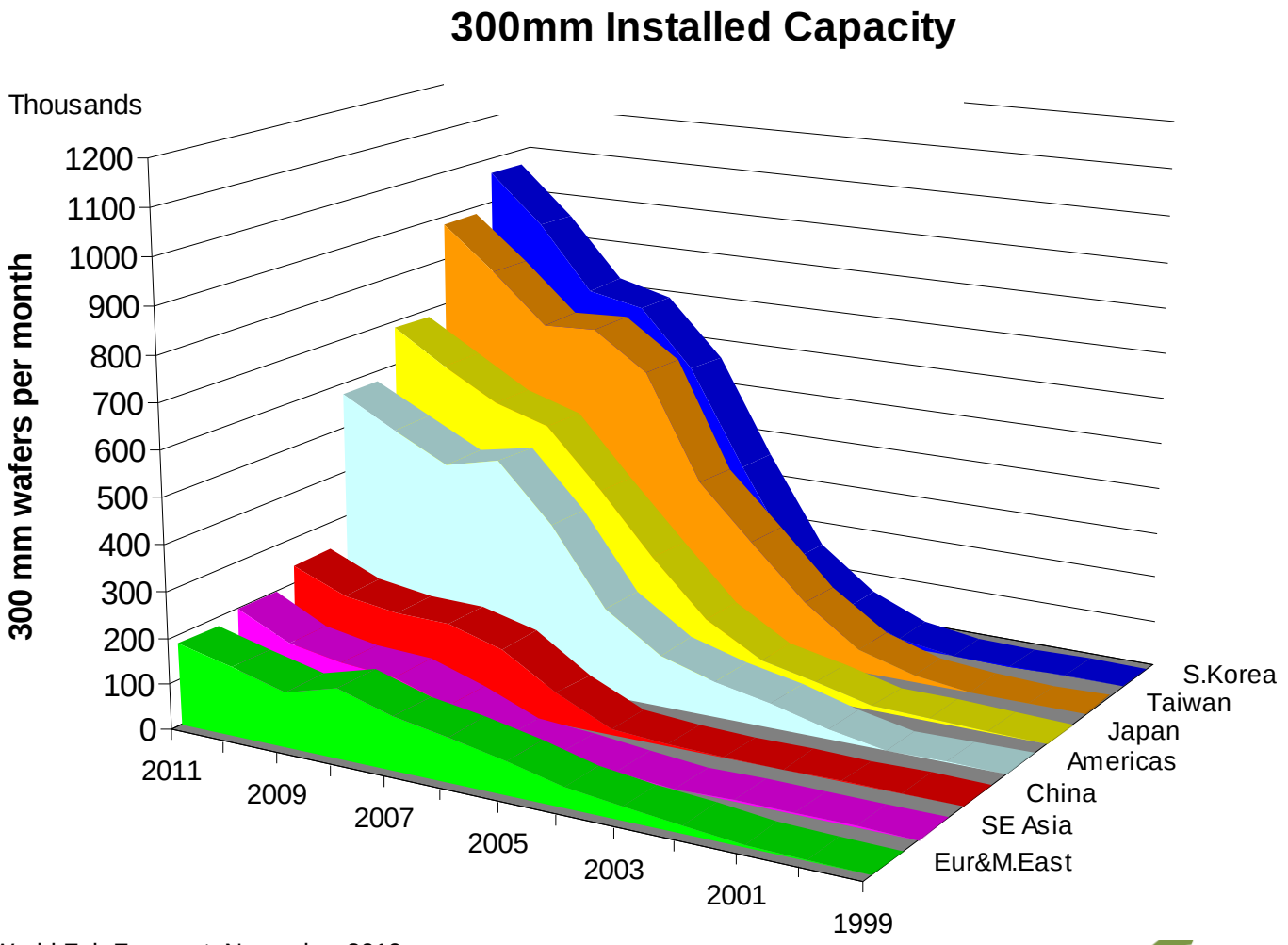
- Conditions
  - Set-up a design site in one of 6 Chinese cities
  - Work with SMIC as your fab

Typical Incentive Package Asia

(source A) (*name removed for confidentiality)*

- Land, building, facilities
  - Land for free
  - Loan for 20 /25 years covering Building Facilities investments, with free leasing up to 5 years
  - Land reserved for future expansion over next 10 years
- Low rates for public utility fee
  - Electricity, Water and Gas : Fixed rates for a period from 5 to 10 years:
  - Rates below 20% at least from Market Price
- Corporate Income Tax (CIT)
  - Years 1 to 10 : exemption between 50% and 100%
  - Years 11 to 20 : partial refunding
- Business Tax : From year 1 to year 5 : 100% of local retention of the business tax returned to the Company
- Individual Income Tax : From year 1 to year 5, at least 50% of local part refunded to the Company
- Local VAT rebate : From year 1 to year 5 : exemption up to 100%
- Subsidies for Environment protection : 10% of Investment deducted from CIT
- Subsidies for R&D : 150% of cost for development of new technologies, new products, deducted from CIT
- Cash subsidies for training, environment, interest for bank loan and others to support start up of the project
- Preferential conditions for operators housing
- Preferential conditions for new suppliers implementation
- Customs:
  - Free trade zone with preferential tax and duties exemption in certain location
  - Preferential conditions on importations
  - Clearance procedures simplified
- Commitment from the Authorities to provide at least a similar incentive package for further extension project

Global 300 mm Fab Capacity



Source: SEMI® World Fab Forecast, November 2010

"Power" Ranking of the 300mm Wafer Capacity Leaders (2010)

300mm "Power" Ranking	Company	Headquarters Region	300mm Capacity Rank for 2010	Capital Spending Rank for 2010	300mm "Power" Rating*
1	Samsung	Korea	1	1	2
2	Hynix	Korea	2	4	6
3	Intel	U.S.	3	3	6
4	TSMC	Taiwan	5	2	7
5	Toshiba/SanDisk	Japan/U.S.	4	6	10
6	Micron	U.S.	6	9	15
7	GlobalFoundries/AMD	U.S.	10	5	15
8	Nanya Technology	Taiwan	9	8	17
9	Elpida Memory	Japan	7	11	18
10	UMC	Taiwan	12	7	19
11	Renesas	Japan	14	13	27
12	Texas Instruments	U.S.	17	10	27
13	IBM	U.S.	13	15	28
14	ProMOS	Taiwan	11	19	30
15	SMIC	China	18	14	32
16	STMicroelectronics	Europe	20	12	32
17	Powerchip	Taiwan	8	26	34
18	Fujitsu	Japan	16	21	37
19	Winbond	Taiwan	15	25	40
20	Panasonic	Japan	19	22	41
	TOTAL	—	—	—	—

*Combined capacity and capital spending rankings (lower figure is best)

Source: Companies, IC Insights

Semiconductor Leaders

2010 Top 10 Semiconductor Sales Leaders ($M)

2010F Rank	2009 Rank	Company	Headquarters	2009 Total Semi	2010 Total Semi	10/09 % Change	Business Model
1	1	Intel	U.S.	32,325	40,154	24%	IDM
2	2	Samsung	South Korea	21,273	32,455	53%	IDM
3	6	TSMC	Taiwan	8,989	13,307	48%	Foundry
4	3	TI	U.S.	9,697	13,037	34%	Fab-lite
5	5	Toshiba	Japan	9,537	13,028	37%	Fab-lite
6	4	Renesas*	Japan	9,649	11,650	21%	Fab-lite
7	9	Hynix	South Korea	6,320	10,432	65%	IDM
8	7	ST	Europe	8,466	10,212	21%	Fab-lite
9	10	Micron	U.S.	5,450	9,057	66%	IDM
10	8	Qualcomm	U.S.	6,409	7,204	12%	Fabless

*The merged entity of Renesas and NEC

Source: IC Insights, company reports

2010 Major IC Foundries

2010 Major IC Foundries

2010 Rank	2009 Rank	Company	Foundry Type	Location	2008 Sales ($M)	2009 Sales ($M)	09/08 Sales (%)	2010 Sales ($M)	10/09 Sales (%)
1	1	TSMC	Pure-Pla	Taiwan	10,556	8,989	-15%	13,307	48%
2	2	UMC	Pure-Pla	Taiwan	3,070	2,815	-8%	3,965	41%
3	4	GlobalFoundries	Pure-Pla	U.S.	0	1,101	N/A	3,510	219%
4	5	SMIC	Pure-Pla	China	1,353	1,070	-21%	1,555	45%
5	6	Dongbu	Pure-Pla	South Korea	431	378	-12%	512	35%
6	9	TowerJazz	Pure-Pla	Europe	252	300	19%	509	70%
7	7	Vanguard	Pure-Pla	Taiwan	511	382	-25%	508	33%
8	8	IBM	IDM	U.S.	400	335	-16%	430	28%
9	10	Samsung	IDM	South Korea	340	290	-15%	420	45%
10	12	MagnaChip	IDM	South Korea	346	262	-24%	405	55%

Source: IC Insights, company reports

Wafer – Technology – Product

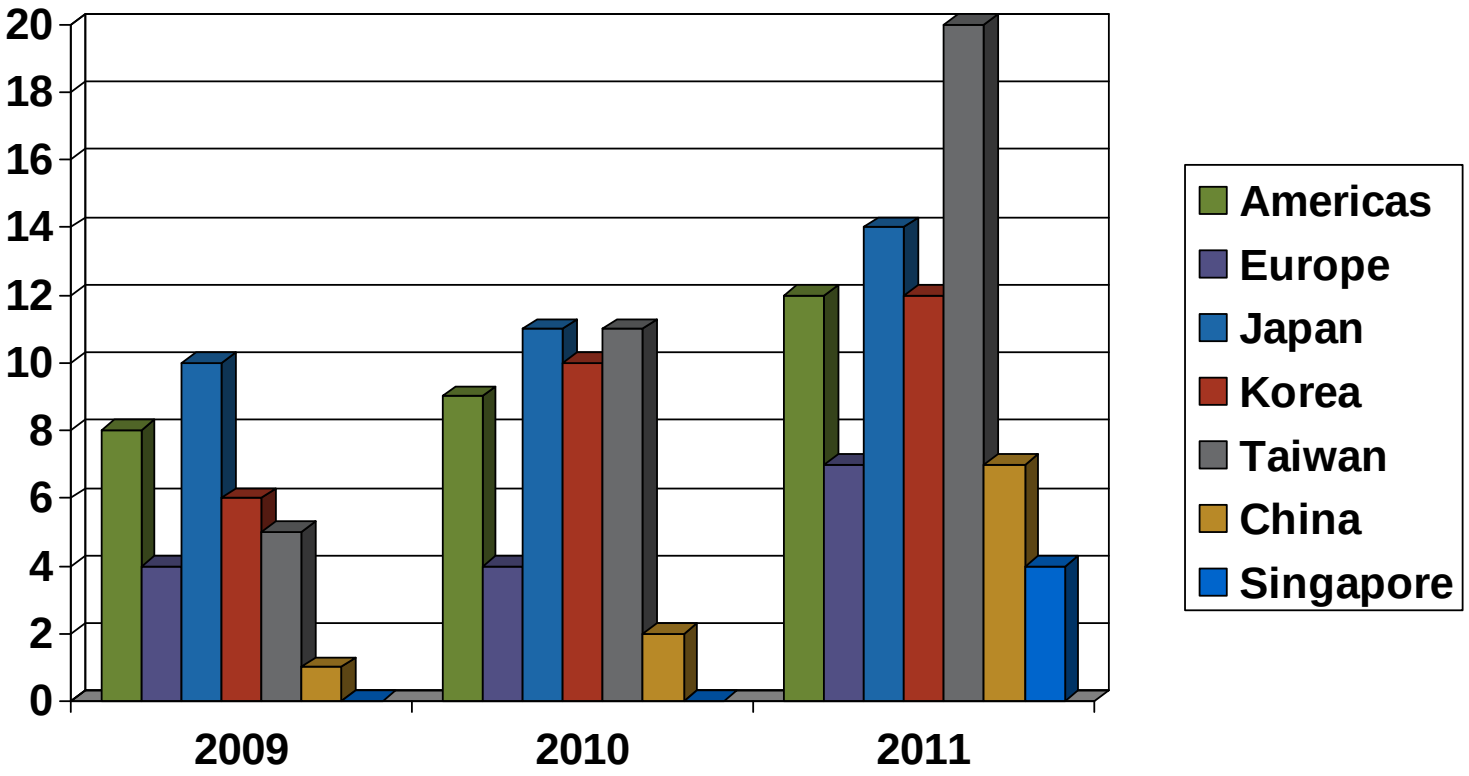
Source: Future Horizons

Wafer Size	Share
300mm	49.6%
200mm	34.9%
150mm	12.9%
125mm	2.2%
100mm	0.4%

Technology	Share
<60nm	30.9%
60-80nm	15.5%
80-120nm	10.5%
0.12-0.20um	15.5%
0.20-0.40um	10.8%
>0.40um	16.8%

Product	Share
Analog	9.1%
Memory	38.4%
Logic	12.7%
Micro	11.6%
Foundry	24.4%
Other	3.8%

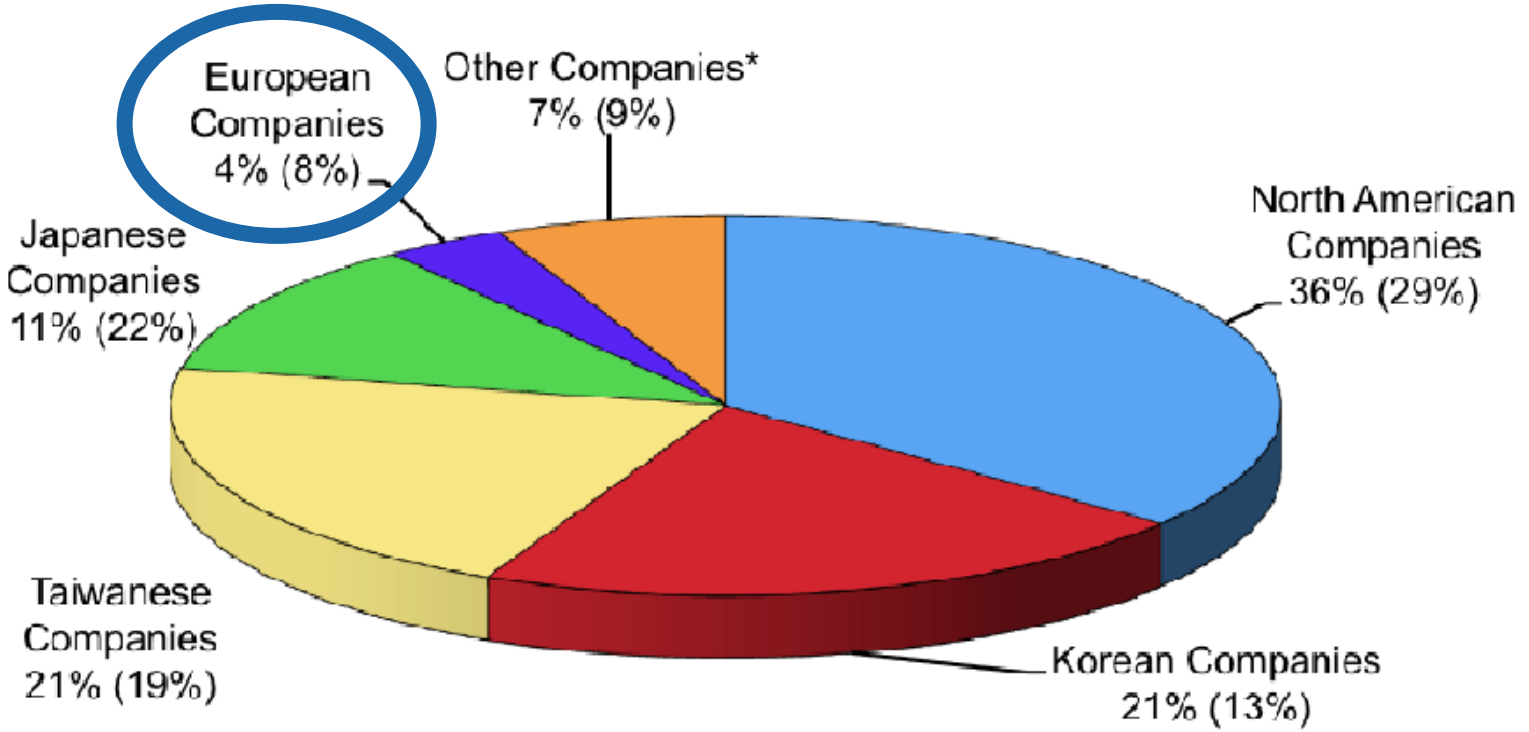
Fabs with 45 nm and below technology capability



Note: Covers production fabs with at least 10,000 wafers per month capacity

Source: SEMI World Fab Forecast, November 2010

2011 Forecast (2005) Share of Capital Spending



Source: IC Insights

( ) = 2005 Share

*Includes contract assembly and test houses

Further Considerations

- EU funding is far below other regions in the world(US), it does not look like we can afford funding several competitive projects.
- Europractice and support education in micro-electronics.
- Ensure smaller countries access to EU funding.

- Space industry is too small for IC manufacturers to be attractive by itself.
- But dual sourcing is welcome.
- ESA to help new entrants in getting up to speed in design rules for RadHard devices, ITAR/Export control regulations, …. for example via consulting?

The Fabless/Fab-Lite Extrapolation

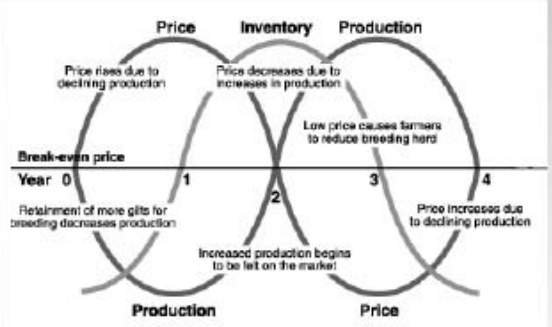
(PS … There's Not Much Choice At 45nm & Below)

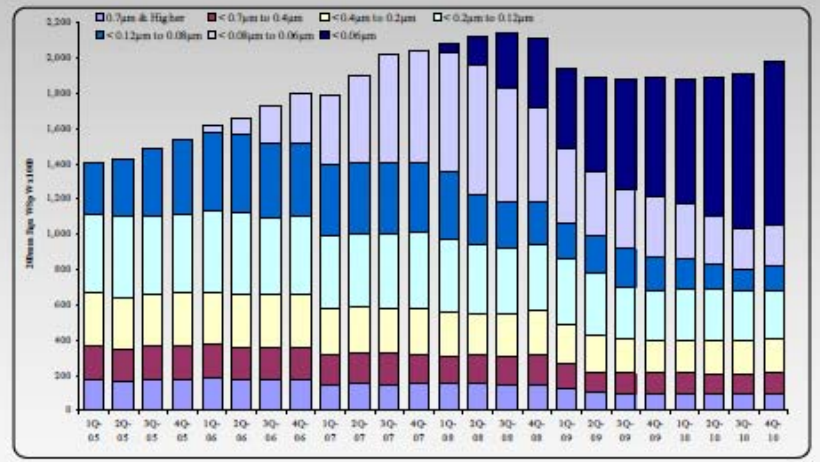
Industrial Fundamental #3 - Fab Capacity

IC Manufacturing Fundamentals … 4 Qtr Min. Lag From Decision To Impact

- Total Equipment Cap Ex = 85% Of The Total Cap Ex
- Wafer Fab Cap Ex = 70% Total Equipment Cap Ex
- Order Today = Wafer Fab Cap Ex One Quarter Later
- Wafer Fab Cap Ex = Additional Capacity Two Quarters Later
- Additional Capacity = IC Units Out One Quarter Later

Pig Cycles & Cobwebs … Due To Long Supply-Side Lead Times (4 Months - Production / 2 Years - Fabs / 5+ Years - Design)

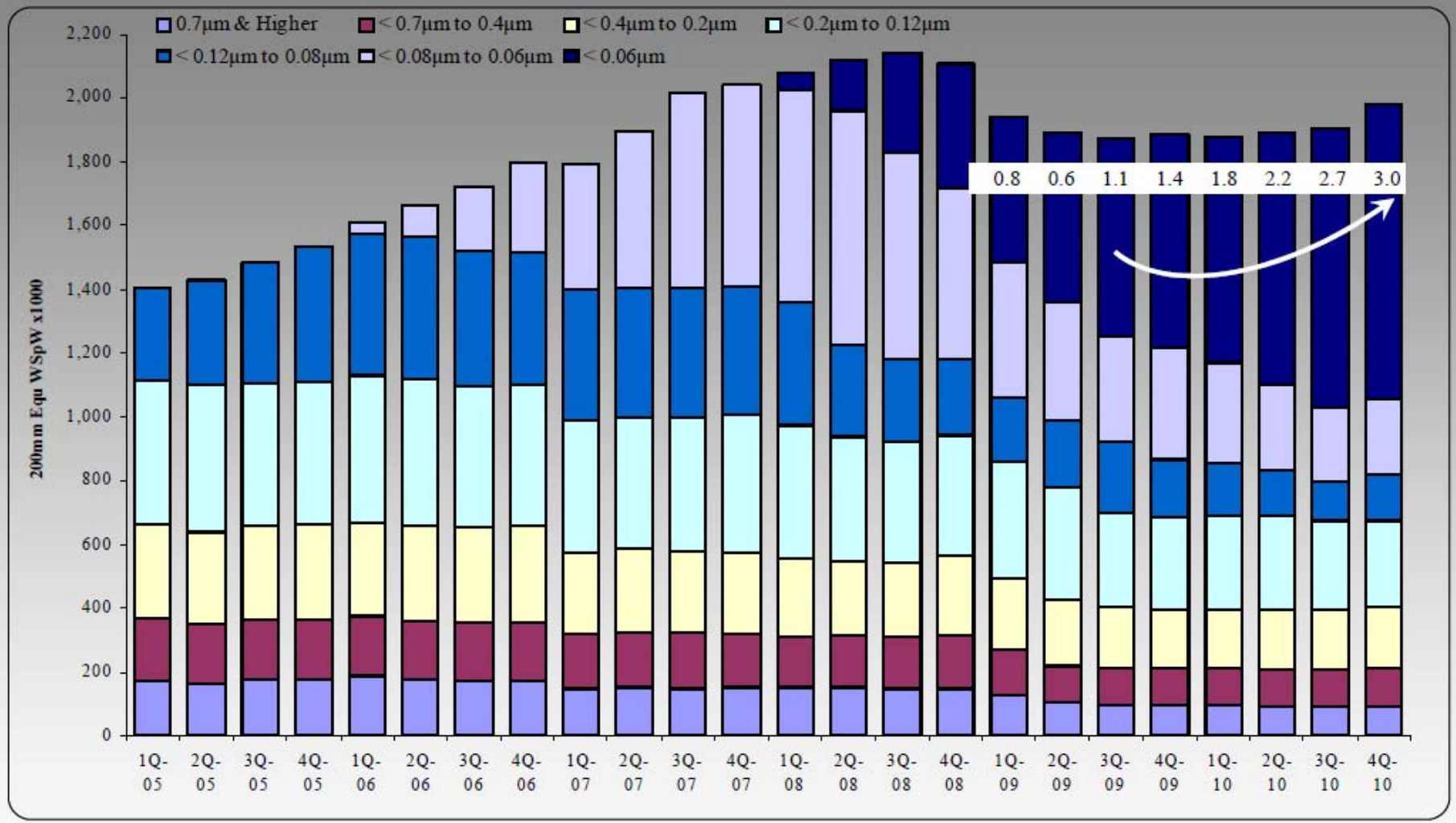




Fab Capacity Still Seriously Tight: Q4-10 Still Down 7.5% vs Q3-08 Peak
First Relief Q4-10 (From Q3/Q4-09's Spend) Following Six Flat Quarters

Source: SICAS/SEMI/Future Horizons

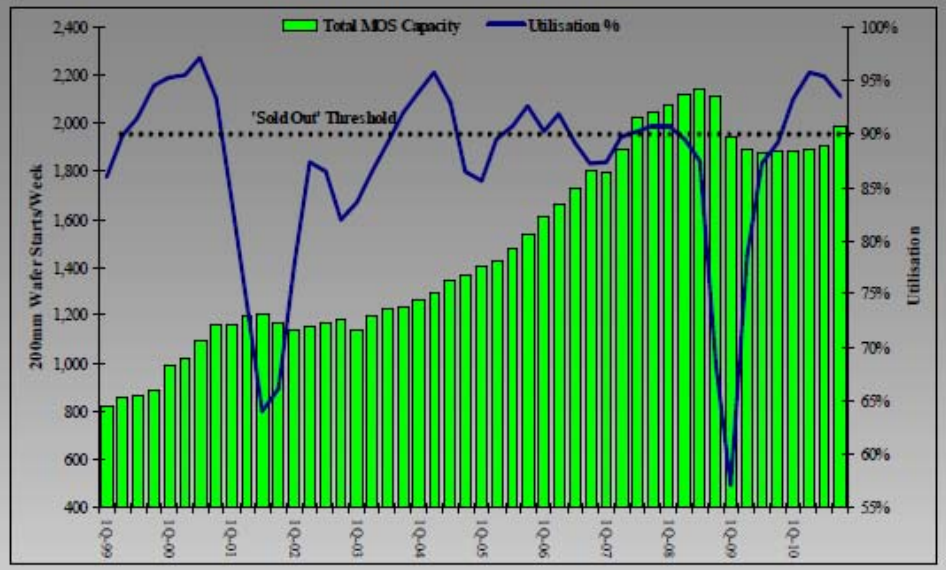
IC Wafer Fab Capacity

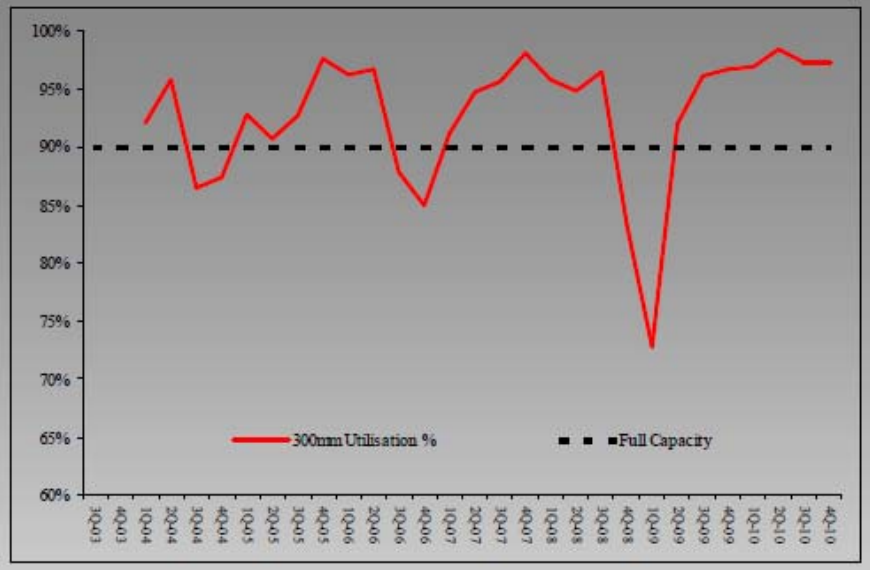


Q3/Q4-09 Spend = +80k ws/w In Q4-10

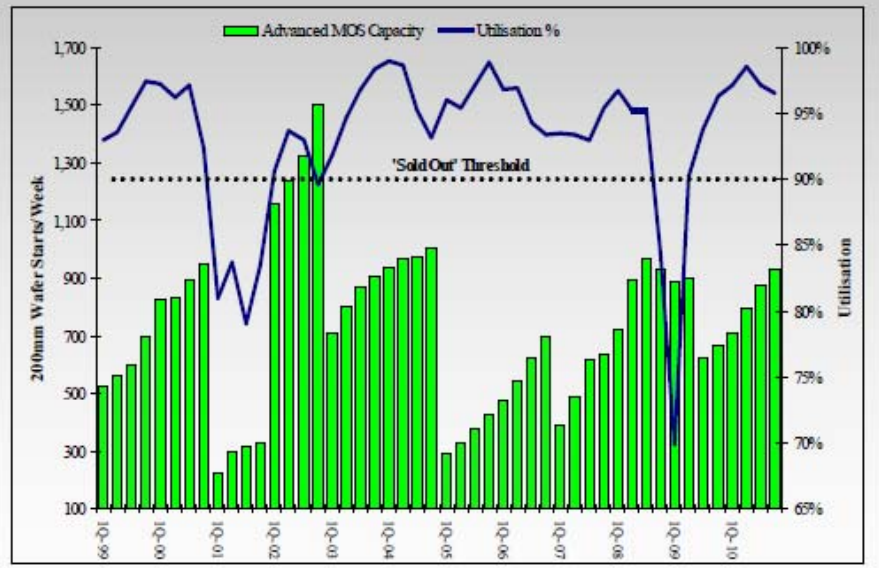
2010 Spend = ~400k ws/w Additional By Q4-11?

Units Are Up ... Fab Utilisation's Still High



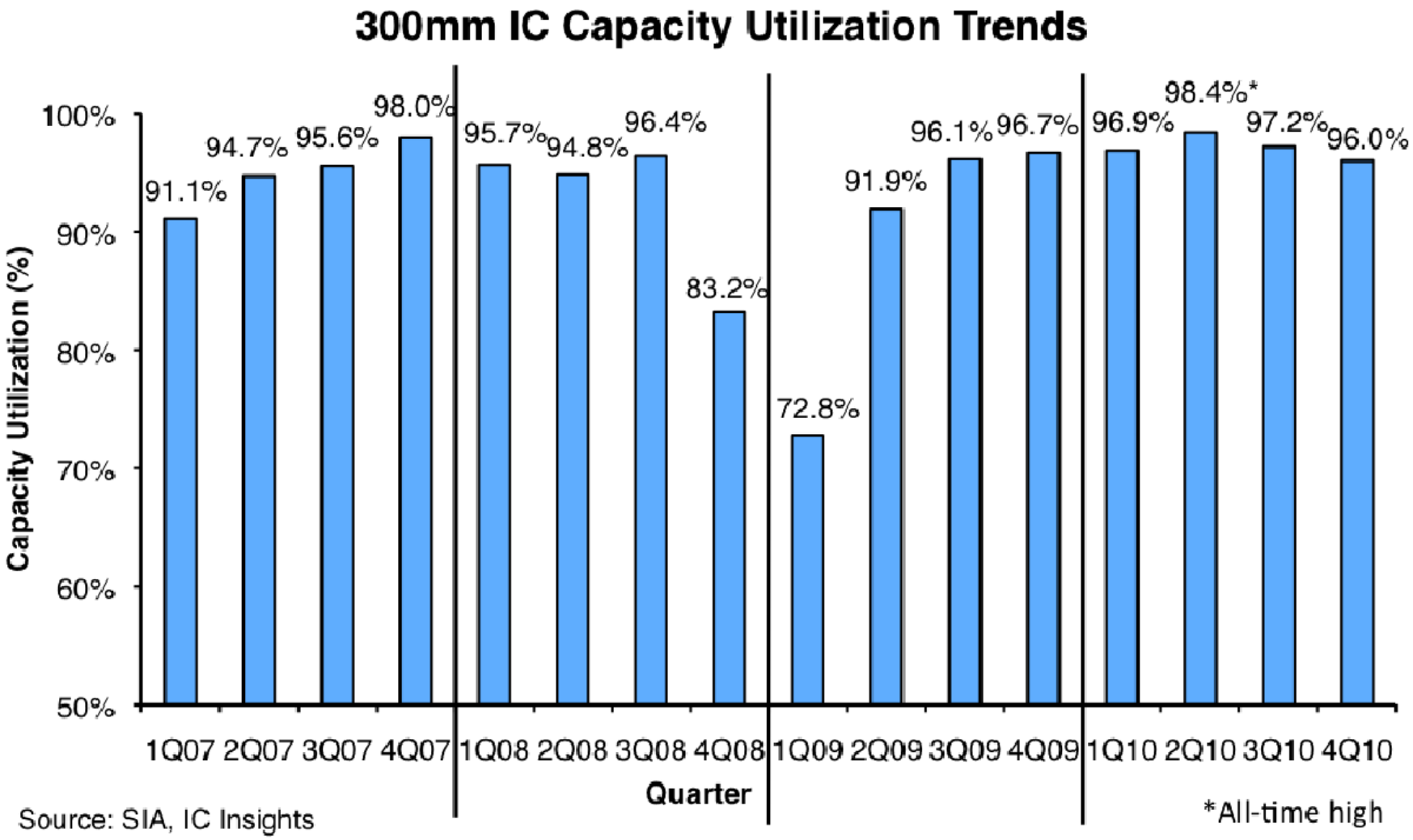


Quarter	IC Units (B)	Capacity (k ws/w)	Utilization (%)
Q4-07	39.9	2045	91%
Q4-08	34.0	2110	68%
Q4-09	42.4	1880	89%
Q4-10	46.6	1985	94%
Q4-11	52.0	~2400	~90%



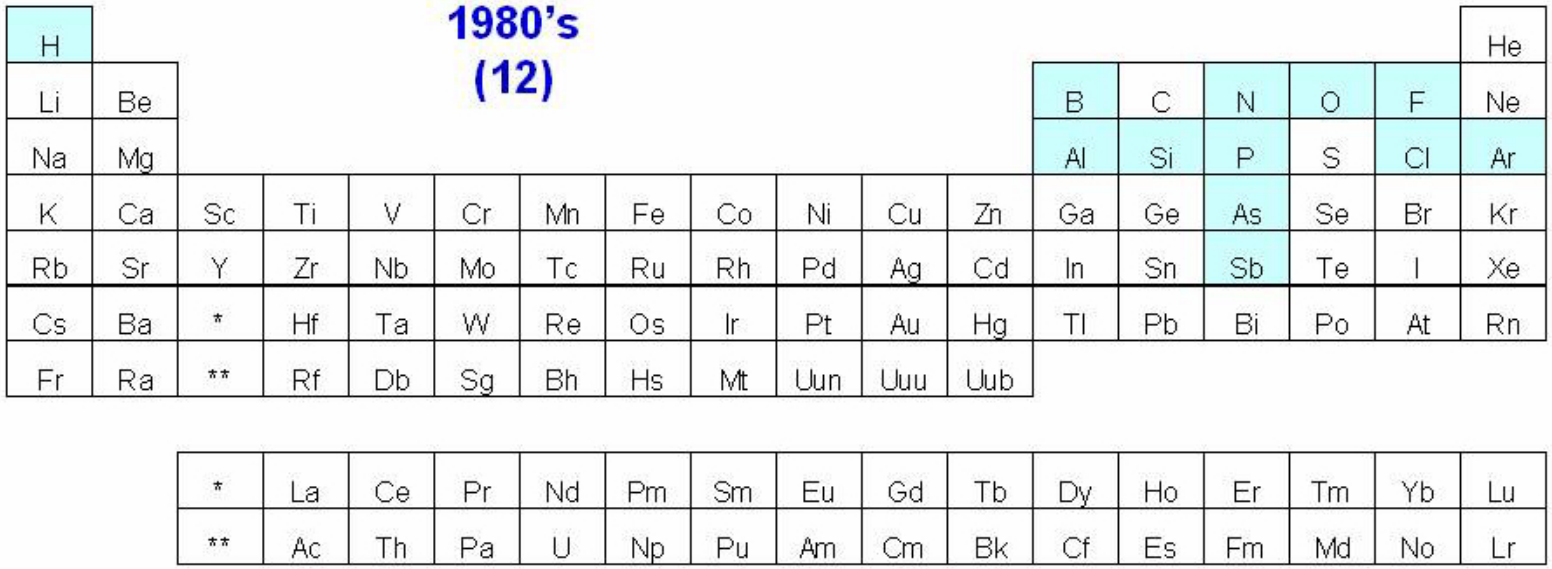
Source: WSTS/SEMI/SICAS/Future Horizons

Capacity Utilization Trends



Increasing Process Complexity

Elements Used for IC Fabrication



Source: Applied Materials, Intel IDF '03

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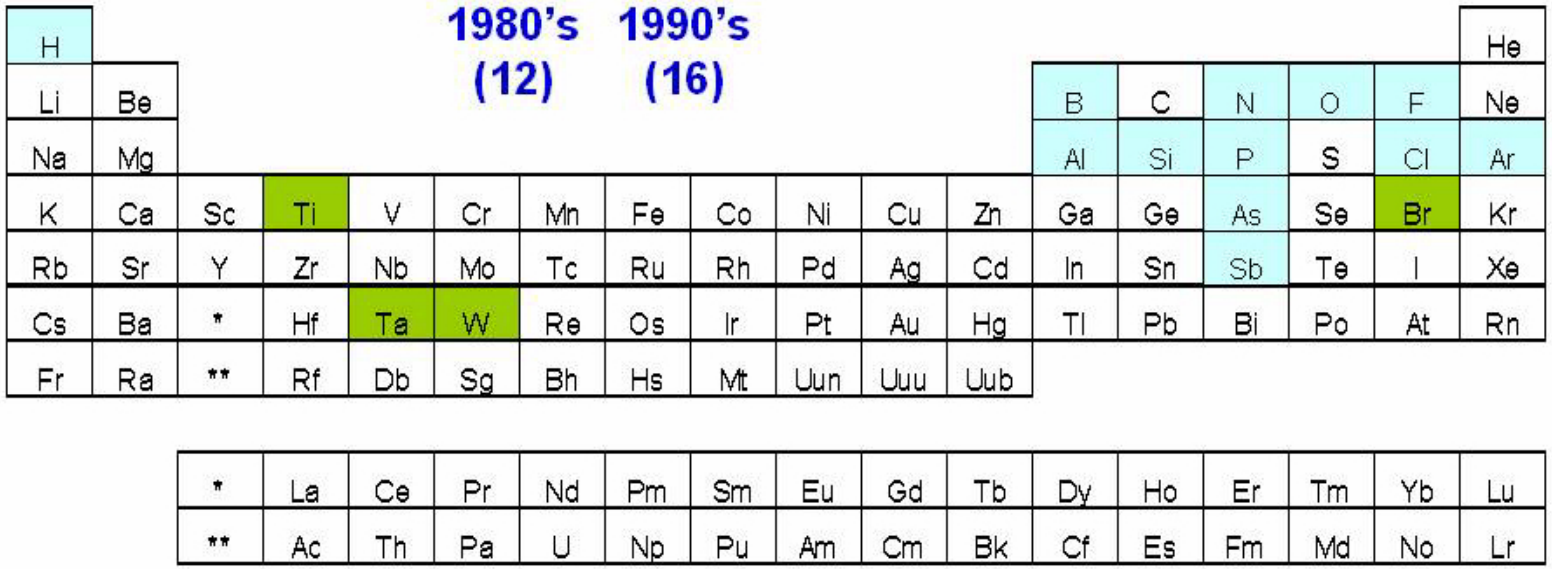

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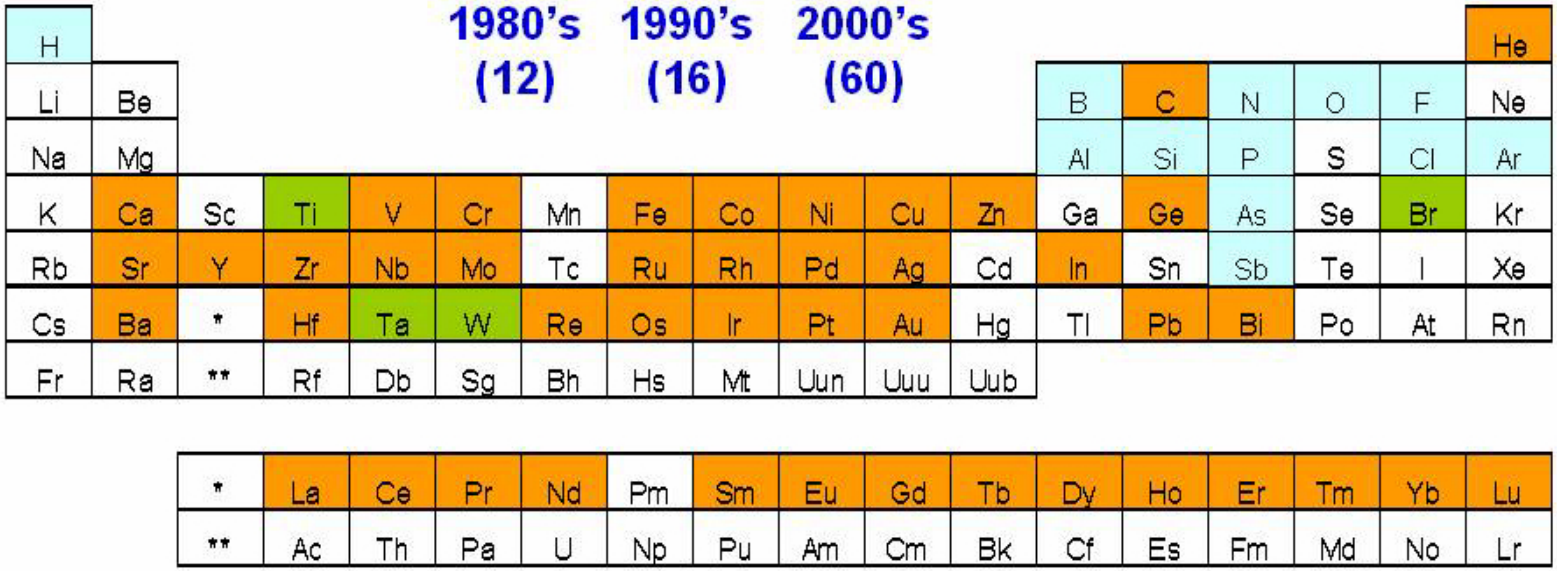
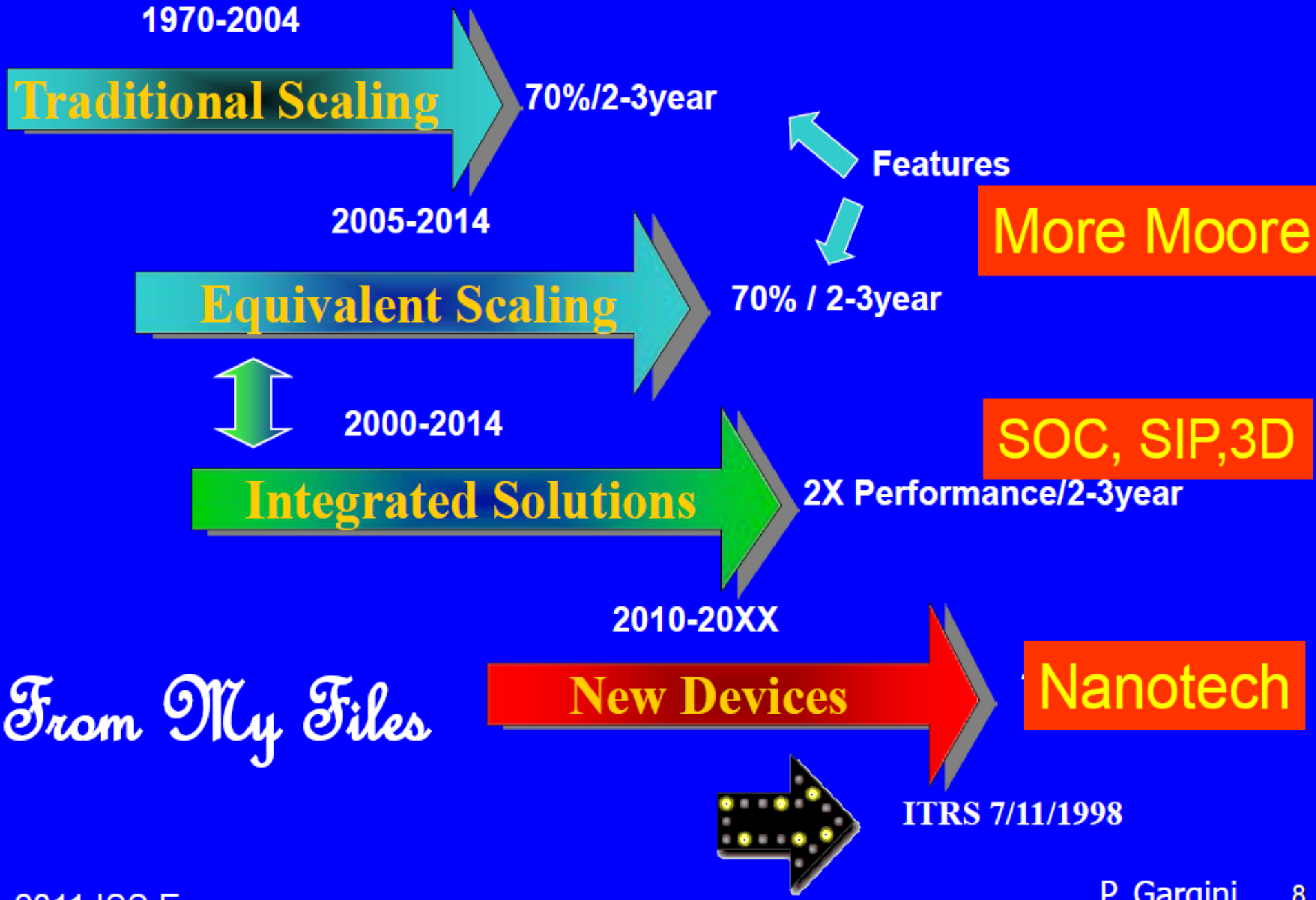


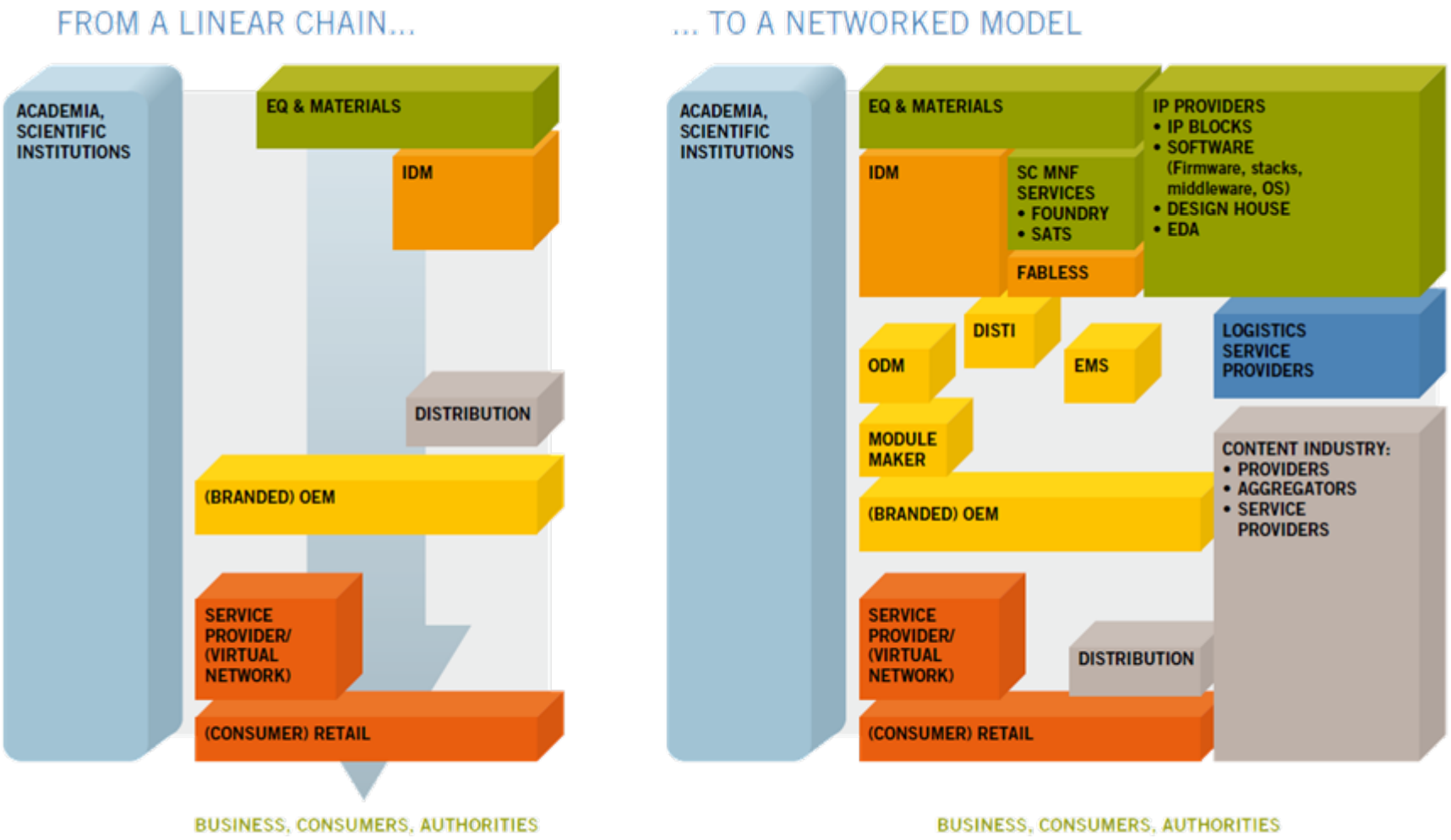
Source: Applied Materials, Intel IDF '03

CMOS Future Directions



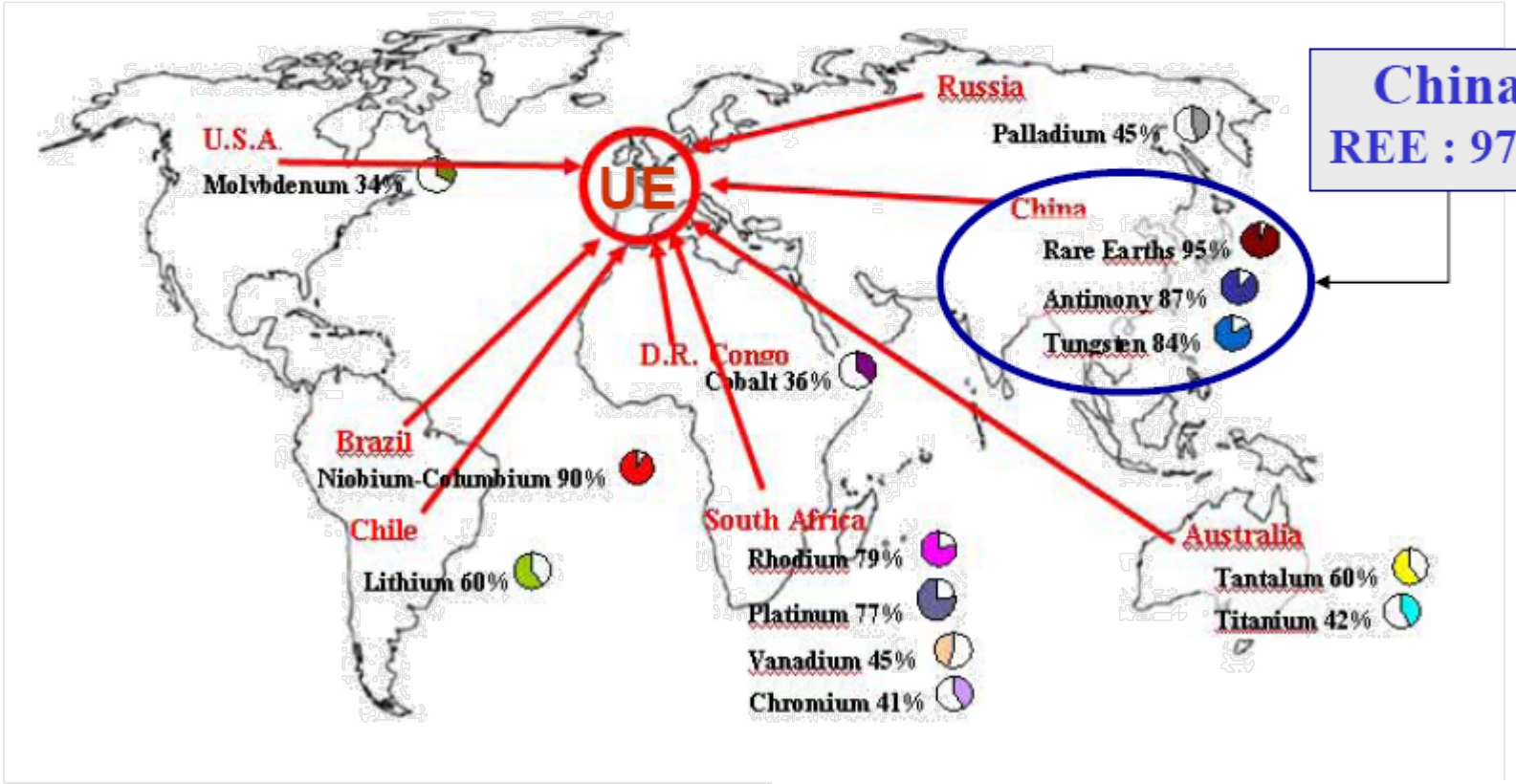
From My Files

Semiconductor landscape more complex



Rare Metals

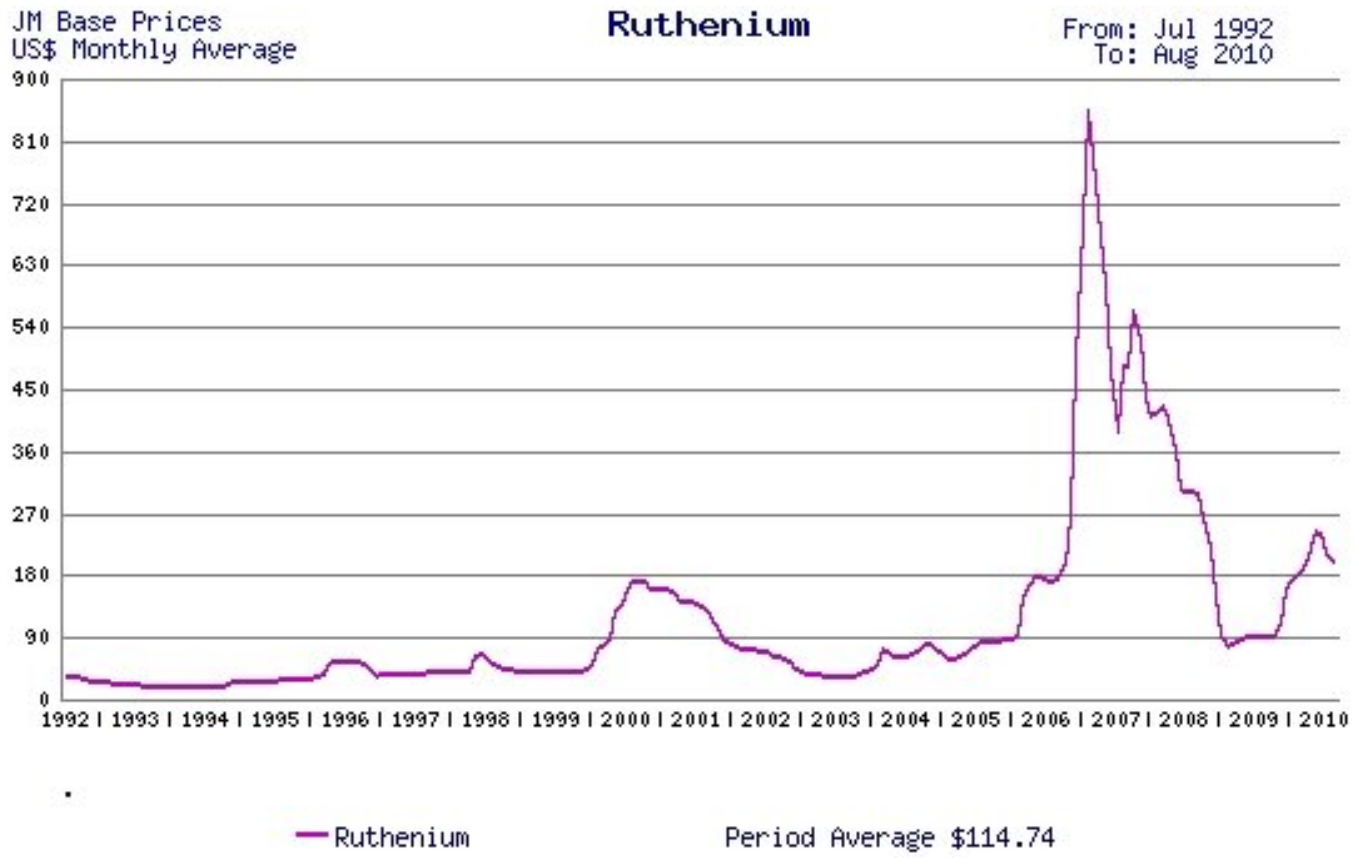
A strong UE importation dependancy &
Some countries with a monopolistic production



Christian Hocquard

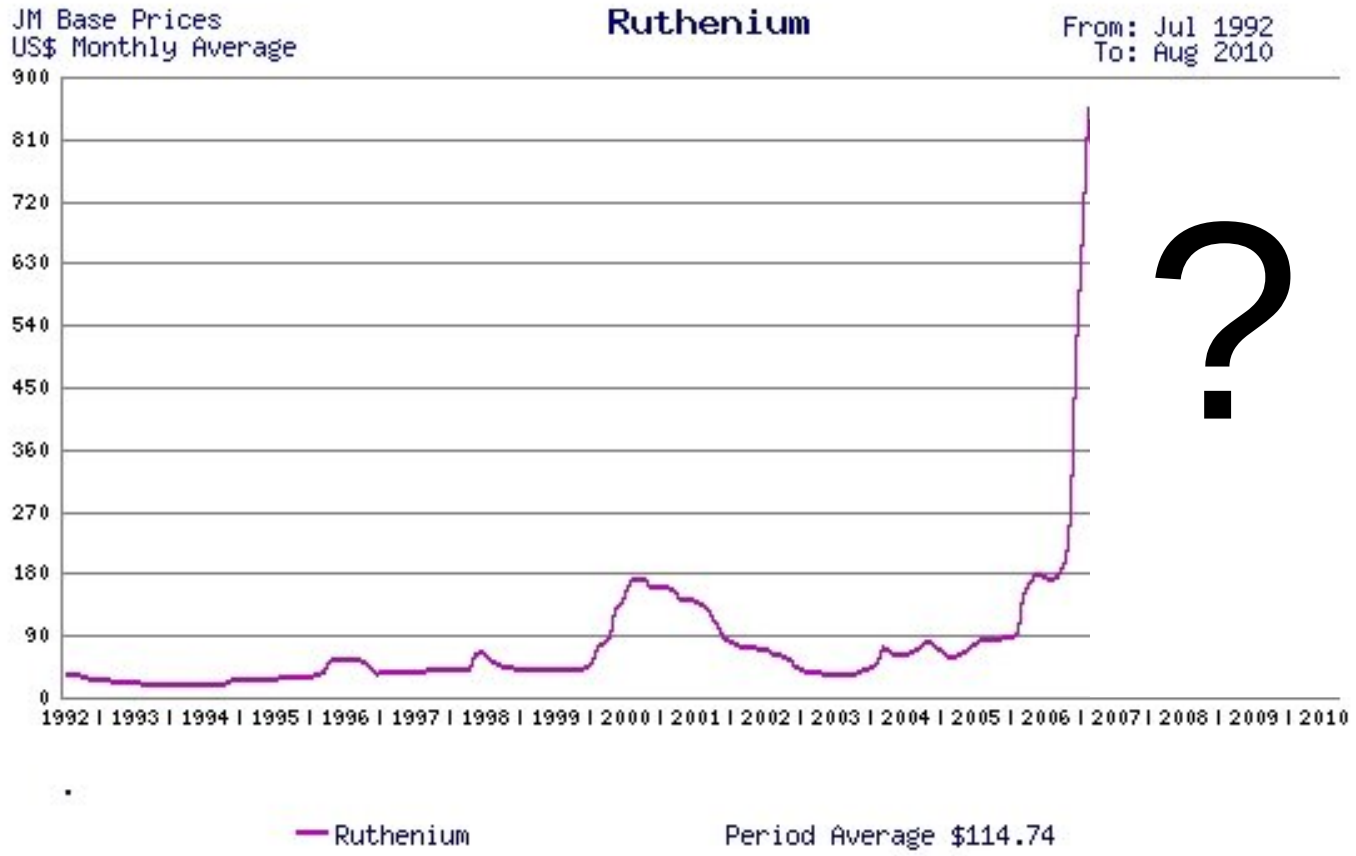
Ifri Energy Breakfast Rountable, May 20 th, 2010, Brussels

Raw Materials
Timely access at stable price



Example: Ruthenium, used in the semiconductor back-end of line for metallization, as well as applications in magnetic disc recording.

Raw Materials
Timely access at stable price



Example: Ruthenium, used in the semiconductor back-end of line for metallization, as well as applications in magnetic disc recording.

What impact of the European aerospace, security and defence markets?

- Access to key technologies
  - Origin?
  - Time?
  - Cost?
  - Quality control?
  - Content control?

- For security and defence: Trust cannot be added to integrated circuits after fabrication

Aerospace requirements of semiconductors / avionics

- Sensors and Actuators
- Radars
- Electric Brakes
- Oil and Fuel Pumps
- Landing Gears and Flaps
- General Energy Consumption Reduction

➔ For which elements is it critical to retain expertise in Europe?

A European issue

- Affects all European countries
- Affects many key sectors for Europe (automotive, telecom, medical equipment, industrial machinery, photovoltaic, military, …)

- **Issue needs to be addressed by all stakeholders**

Opportunities for Advanced Wafer Manufacturing in Europe

- **Expand our Leadership in R&D**
  - World-Class industrial Institutes (Fraunhofer, IMEC, LETI…)
  - High census of PhD's in process development & design
  - High level of R&D efforts from IDM's and equipment/materials sector
  - Significant funding support from National & EU Authorities
- **Clustering**
  - Regional Excellence Centers in R&D, Design & Manufacturing with proximity of Suppliers and Application Centers
- **Market**
  - European leadership in strategic markets where IC's are providing innovation (Medical, Power, Automotive, Environment ect)
  - European Leadership in the Equipment, Materials and Design areas.
- **Human Resources**
  - Undisputed technical expertise, stability & engagement

SEMI White Paper

Release October 2008, available on
www.semi.org/europewhitepaper

SEMI® WHITE PAPER

6 Recommendations to the European Union and National Governments to Increase Europe's Microelectronic Industry Competitiveness

SEMI White Paper

www.semi.org/europewhitepaper

6 Recommendations to the European Union and National Governments to Increase Europe's Microelectronic Industry Competitiveness

1. Develop a European Vision for the Industry
2. Increase Funding for R&D and Manufacturing
3. Promote the Microelectronics Supply Chain
4. Cultivate Education and Welcome Talent
5. Protect and Enforce Intellectual Property
6. Involve SEMI Europe in New EHS Legislation

European Commission
Key Enabling Technologies

http://ec.europa.eu/enterprise/sectors/ict/key_technologies

- High Level Group established July 2010
- Interim report completed Feb 2011
- Final report scheduled for July 2011

Theme supported by many stakeholders! 24 May 2011 - www.semi.org/BrusselsForum

Confirmed Partners

Summary

- A critical issue
- Concern of dependency
- Affects entire supply chain
- A European issue, question of regional security!
- Opportunity to cooperate
- SEMI looking forward to continue the dialogue