

Dynamic Catch-up Strategy and Sustaining Industrial Leadership in the Memory Industry - The Case of Samsung Electronics

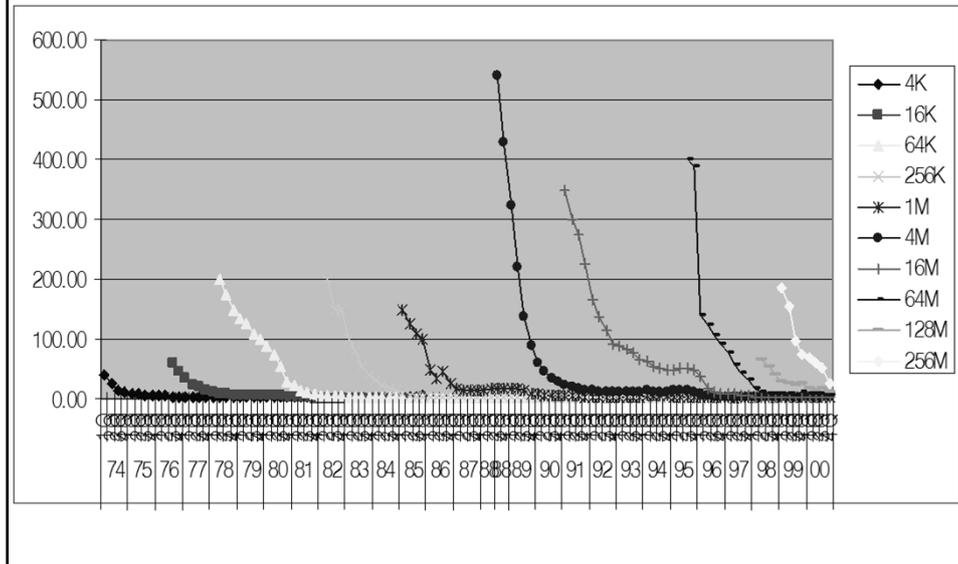
**Jang-Sup SHIN
National University of Singapore**

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First-mover advantages in memories

- **Great first-mover advantages**
 - heavy investments in R&D and facilities
: the most capital-intensive segment in the semiconductor industry
 - short life-cycle of each generation of products

DRAM Price Changes



Surprising history?

- Continual industrial leadership changes in memories
 - Overtaking of US companies by Japanese in 1981
 - continual leadership changes among Japanese companies up to the early 1990s
 - Samsung's taking the leadership from 1993
- Latecomers overcoming disadvantages with their ingenuity and determination?

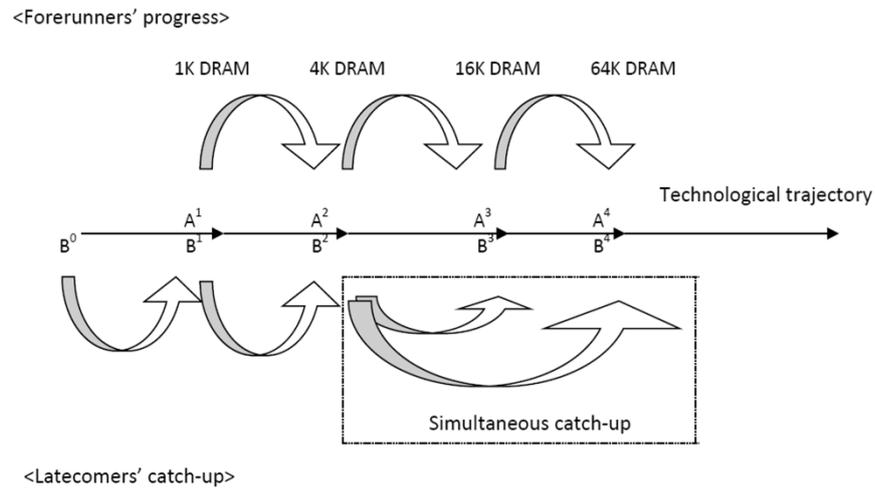
Return to the normal?

- Sustaining industrial leadership by Samsung from 1993
 - a clear divide in the history of the memory industry
- Stronger first-mover advantages?
 - combination of capacity expansion and accidental factors

Dynamic catch-up strategy

- Catch-up with moving targets
 - simple catching-up is followed by falling behind
 - (1) Simultaneous catch-up
 - catch up with the current-generation and next-generation technologies nearly at the same time
 - (2) Overtaking in process technologies

Figure 1. Dynamic catch-up strategy in the memory industry



Overtaking in process technologies

- HP's evaluation in 1980
 - comparing quality of 16K DRAMs from 3 American and 3 Japanese manufacturers
 - "The parts that came from the very best American firm showed six times as many errors as those from the worst Japanese firm" (Jackson 1997: 247)

Table 2.9. *Maximum Market Share in DRAMs by American and Japanese Companies, by Device*

Device	Maximum Market Share (%)	
	United States	Japan
1K	95	5
4K	83	17
16K	59	41 1979
64K	29	71
256K	8	92 1982
1M	4	96
4M	2	98

Source: Dataquest, cited in Methé (1991, p 69).

Institutional underpinnings

- Mass production capability
 - established from their engagement in the consumer electronics
- The *keiretsu* & *chaebol* system
 - stable & long-term commitment for investment race
- The developmental state

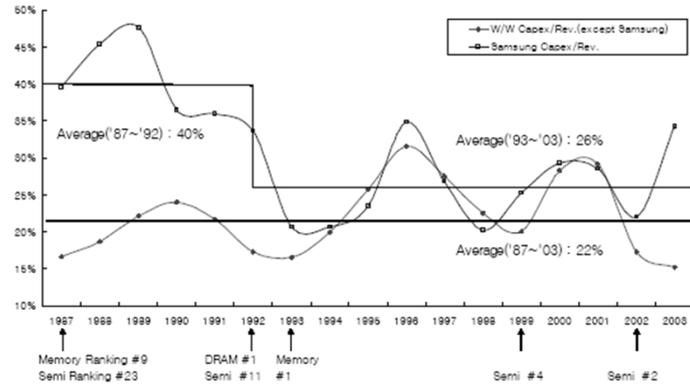
Samsung's sustaining leadership

- Fear of 'commodity trap'
 - Japanese investments for 'upgrade' into ASICs
 - Koreans cannot but invest and improve in DRAMs
 - "incumbent trap"?

Extending superiority in the investment race

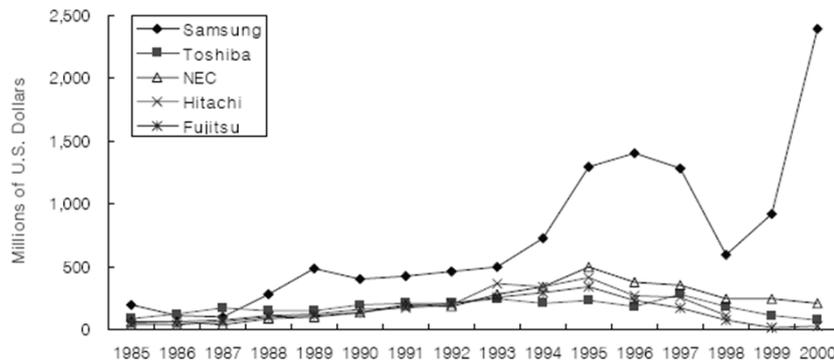
- The catching-up period
 - Capex/revenue nearly double the industry average
 - Inv. in DRAMs 2.3 times of Toshiba, 2.8 times of the average of 4 Japanese firms
- The leadership period
 - Inv. in DRAM 4.7 times of the average of 4 Japanese firms, larger than the combined investment of Japanese firms

Figure 1. Trend of Samsung's Capital Expenditure
(%, capital expenditure/revenue)



Source: Samsung Electronics and Dataquest

Figure 2. An Estimate of Major Firms' Investments in DRAMs
(US\$ millions)



Ramp-up capability

- Overtaking Toshiba in 16M DRAM in 1991
- Strengthened during the leadership period
 - Samsung's competitive advantage about which its "competitors feel most curious and are most inquisitive"
 - "Samsung always gives out its hands later in a scissors-paper-stone game"

Ramp-up capability

- (1) Fuller integration between development and production
 - directing engineers from every stage, from design to mass-production, to take part in the entire development process together
 - better at problem-solving and information-sharing

Ramping-up capability

- (2) “Samsung-style TF”
 - “different from Japanese-style TF”
 - mastering ‘parallel problem-solving capability’ as against ‘serial problem-solving capability’

Ramping-up capability

- (3) Testing yield rates with pilot production lines
 - made in possible to solve many of possible production problems at the development stage
 - attained a near ‘golden yield rate (80%)’ in the initial mass production of the 12-inch line in 2001

Emergence of flash memories

- Mobile-related technologies & products
 - “total mobile solution provider”
 - Flash memories
 - low-voltage DRAMs
- Emerging new technology standards
- Greater “economies of scope” for the first-movers in DRAMs

Table 6. A Comparison of Mobile Solution Capability between Samsung and its Competitors

	NAND	NOR	MCP	Mobile AP	Imaging	DDI	Display
Samsung	◎	▲→◎	◎	▲	▲→◎	◎	◎
A	◎	▲	▲	-	◎	▲	◎
B	▲	▲	▲	▲	▲	◎	▲
C	-	▲	▲	▲	-	▲	▲
D	-	-	-	◎	▲	▲	-

Source: Samsung Electronics' internal assessment in 2004

Notes: ◎:Strong, ▲:Weak, -:None. MCP: Multi-Chip Package, Mobile AP: Mobile Access Point, DDI: Display Driver IC. Names of the competitors are not specified for obvious reasons.

Conclusions

- Endogeneity of leadership
- External conditions
 - substantial increase in number of technology standards
 - moving towards mobile technologies

Conclusions

- Integration vs. disintegration
 - trend of 'de-coupling' in the semiconductor industry
 - Samsung: a case for integration?
 - timely decisions on technologies and investments, speedy ramping-up through close integration between development and production ...