

# Semiconductor Design in a Global Knowledge Network

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# Overview of Presentation

- Chip design introduction
- The geography of chip design
- Outsourcing and offshoring
- Conclusions

# Semiconductor Revenue

	Revenue (\$ Billions)
1998	\$ 120.6
1999	\$ 147.2
2000	\$ 227.1
2001	\$ 152.5
2002	\$ 155.6
2003	\$178.2
2004	\$219.9

Source:  
Gartner

C.A.G.R  
10.5%

# Design Under Pressure

- Cost per design increasing rapidly
  - Design productivity increasing more slowly than process technology
  - Cost of fixing problems after prototype stage has increased disproportionately
- Higher integration requires more system knowledge, IP, software
- Cost pressures high in consumer market, product cycles short
- Greater global competition

# Cost and Location of Designers and IP Protection

	Design Eng Salary (ann.)	# of chip designers	IP protection (World Econ Forum)
U.S.	\$ 90,000	45,000	8.7
Japan	\$ 60,000	--	6.2
Taiwan	\$ 30,000	14,000	6.7
China	\$ 15,000	5,000	4.0
India	\$ 15,000	5,000	4.2

Note: Salary for design engineers with 5 to 10 years in US and Japan, and 3 to 5 years in China and India.

# Chip Design Capabilities

- Taiwan
  - Second to U.S. in successful fabless firms
  - Mostly fast followers and chip redesign for Asian markets
- China
  - Government sponsorship, local access to system firms, and involvement of expatriates returning from U.S.
  - Some use of illegal reverse engineering
  - Some advanced design in local firms started by returnees
- India
  - Software skills and English
  - Local firms predominantly in design services
  - Leading in offshoring: TI in India since 1985

# Design Outsourcing

- Some outsourcing done in the form of “bodyshopping” (on-site temp engineers)
- Many ways to carve up the design process
  - Typical outsourced functions are logic verification and physical design
  - Can also outsource complete functional blocks
  - Architecture (at block or chip level) is least likely to be done externally
- Outsourced design helps start-ups keep down their overhead (esp. design software licenses)

# Offshore Subsidiaries: Reasons

- Development of markets
  - Motive for 1970s offshoring to Europe and Japan
  - Now relevant for “growth markets” like India and China
- Access to engineering talent
  - Often occurs through acquisition
  - Europe acquisitions often involve IP
- Cost reduction
  - Net savings in India and China about 25 to 50%
  - Important option for start-ups, especially with foreign-national founders

# Hidden Costs of Design Offshoring

- Need to codify/specify task requirements more precisely
- Extra controls over intellectual property
- Management costs (especially monitoring and recruitment)
- Increased travel and communication requirements
- Cultural misunderstandings
- Reduced productivity and/or slower time to market

Q: Can current offshoring help U.S. chip industry maintain innovation leadership?

- Development of markets and improved global competitive position for U.S. firms
  - reduced design costs improved U.S. competitive position
  - lower costs grow markets
- Rise of new rivals in other countries?
  - Observed in Taiwan; attempted in China
  - capability of Asian engineers will improve with experience and exposure to world-class design