

Chip Design and Chindia: Implications for the United States

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Sloan Industry Studies Annual Conference

April 25, 2007

Technology Skill Ladders

- Industries in which technical staff move from more rudimentary to more complex tasks over time due to on-the-job training and experience can be said to have technology skill ladders
- Offshoring rungs of the ladder may undermine innovation at home by eliminating the next generation of skilled technical staff able to move up the technology ladder
 - Are any rungs moved entirely abroad?
 - If so, does this practice disrupt the technology ladder at home?

Digital IC Design Flow: Not a Technology Ladder

System-level design (architecture)
Behavioral design
RTL design
Gate level design
Circuit level design
Physical layout
Post-verification

Technology Skill Ladder in IC Design

- **Entry-level:** initial two years of design work with entry at any point in the design flow
 - **Independent responsibilities:** 2+ years
 - **Assistant design team lead [India]:** 4+ years
 - **Design lead:** 5+ years
- Broader skill set across design functions as move up the technology ladder

Design in India

- Limited number of design leads in India
- Indian design teams still only a small fraction of the designers of American MNCs [number of designers]
- Few MNCs have full design flow in India
 - All design flow steps still exist onshore in US
 - Trend toward design for Indian telecommunications industry
- MNCs have higher value added activities than Indian design service firms
 - Design service firms grow revenues linearly with head count
- Design service- and MNC subsidiary-driven growth leads to lower revenue capture in India
- Concern that Indian educational system is not going to provide enough talent for growth

Design in China

- Little American participation
 - Taiwanese are biggest foreign presence
- Few design service firms
 - Of 58 firms interviewed, found three small design service firms
- General skill level lower than India
- Better revenue capture than India
 - Few MNCs, more local design houses
- China growing in a mature industry
 - Weight of industry (designer employment) will shift somewhat away from the United States
 - 5-10 years many Chinese firms will do chip definition for Chinese market
 - Lost opportunity for the US

Undermining Technology Ladders in the United States

- Threats
 - Entry-level/independent responsibilities/design lead positions move entirely offshore
 - Certain design flow steps move entirely offshore disrupting opportunity to gain the broad experience needed to become design lead
- Actual Situation
 - Entry-level positions still found in the US and design leads can and do train designers remotely
 - Simply has not happened and design lead trainees can and do acquire knowledge from a distance

Longer term: Offshoring versus Outsourcing

- Offshoring (MNC subsidiaries abroad)
 - Does not undermine technology ladder at home
 - In part because remote training possible
- Outsourcing (purchase designs from others)
 - Full chip design service model has not taken off
 - Design service firms in India and China stuck in the low value-added steps of gate level to post-verification
- Potential negative impacts on designers in the US
 - How severe?
- Rise of China's own design firms
 - Could partially displace American designers but has nothing to do with offshoring/outsourcing to China by American firms