Chip Design and Chindia: Implications for the United States

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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

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<th>System-level design (architecture)</th>
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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