

## **New Product Development in a Global Knowledge Network: The Notebook PC Industry**

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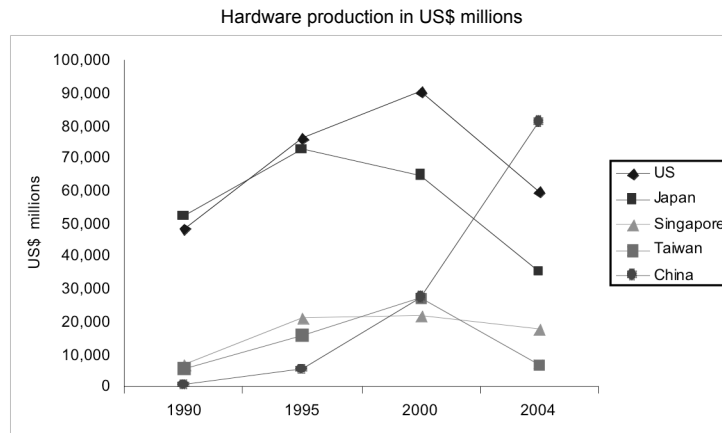
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## **Globalization: from manufacturing to knowledge work**

- PC manufacturing has shifted from U.S. to Taiwan and SE Asia, then to China
- Will knowledge work follow?
- Case study of new product development in notebook PCs illustrates factors and trends in knowledge-intensive part of the PC industry

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## Leading computer producers by location



Source: Reed Electronics Research, *Yearbook of World Electronics Data*

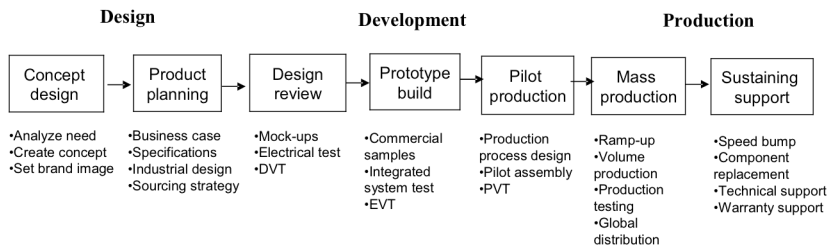
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## Taiwanese companies: key link in PC industry globalization

- Manufacturing
  - #1 makers of notebook PCs, motherboards, scanners, keyboards, add-on cards, optical drives, monitors, some network equipment.
  - Driving shift of production to China.
- New product development
  - Original design manufacturers (ODMs) develop over half the world's notebook PCs.
  - Customers include all major PC vendors.

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## Notebook NPD process



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## Interdependencies

- Concept design and product planning are linked by need to translate technology and market trends into specific product designs.
- Development and manufacturing are closely linked by need for manufacturability.
- Design and development can be separated organizationally and geographically. Product plans are codified and can be handed off.

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## Organizational forms

- Notebook NPD follows three patterns
  - Inhouse design/development by PC company (Lenovo, Toshiba).
  - Joint design/development – (Dell, HP) : PC maker does design, ODM does development and mfg.
  - Pure ODM design – PC makers choose ODM designs off-the-shelf to sell.
- Share of global market: 20% in-house; 60% joint vendor/ODM; 20% pure ODM

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## Location factors: skill and proximity

- Concept design and product planning.
  - Skill in translating market and technology trends into product concepts. Proximity to lead markets. Analytical/managerial skills.
- Development
  - Specialized engineering skills, e.g. board design, thermal, EMI, power management, materials, software. Hands-on skills.
- Production engineering and sustaining support
  - Process engineering skills and proximity to production processes. Hands-on skills.

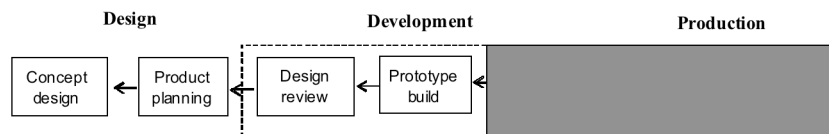
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## Skills and costs by location

- Characteristics
  - U.S./Japan: strong analytical and management skills, creative problem solving; leading markets
  - Taiwan: specialized notebook competencies, strong hands-on but weaker analytical and management skills
  - China: mixed engineering skills, gaining hands-on experience. Weak analytical, managerial and independent problem solving skills.
- Average base salary for electronic engineers
  - U.S.: \$82K
  - Japan: \$63K
  - Taiwan: \$20K
  - China: \$10K

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## Production “pull” of NPD activities



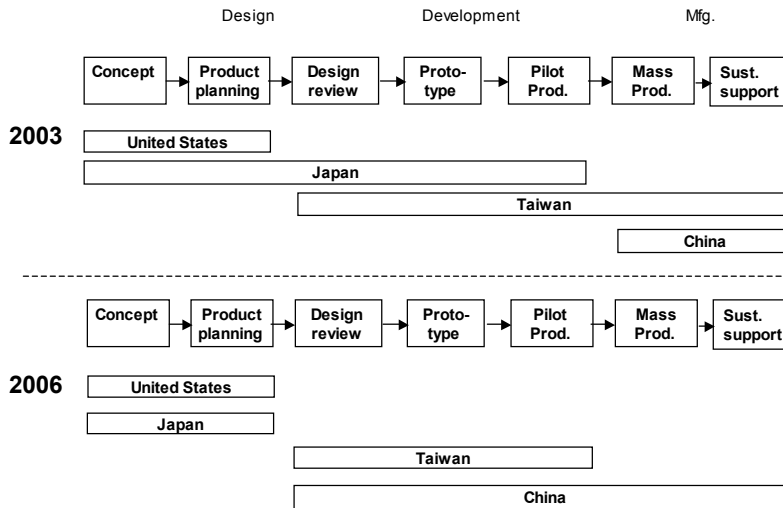
- Testing equipment can be moved to product site for faster prototype testing.

- Pilot production at manufacturing site eliminates need for pilot assembly lines.

- Need for manufacturability links development & production.

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## Shifting location of NPD activities



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## Implications for knowledge workers

- Overall, number of jobs is small (<20K).
  - But notebook market growing—now 30% of PC sales, likely to reach 50%.
- Beyond notebooks
  - Design and development important in other IT products, e.g. cell phones, game machines, PDAs, portable music and video players.
  - May see similar patterns in other industries where more jobs are involved, e.g., 45,000 chip designers in U.S.

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