Who Profits from Innovation in Global Value Chains? iPhones and Windmills

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Based on work with
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Innovation in Global Value Chains

• Innovation is believed to be a key driver of economic growth and job creation
  – But what happens when innovation and production are distributed globally?
  – Who captures the value from innovation?

• Do trade data capture the full picture?
Global Value Chains: The iPod Case

- “Designed in California, assembled in China”
- Who captures the value from Apple’s success?
- Obama to Steve Jobs: “What would it take to move those manufacturing jobs back to the U.S.?”

School of Information Studies, Syracuse University
Personal Computing Industry Center, UC Irvine and Syracuse University
## Value capture in the 30GB Video iPod

<table>
<thead>
<tr>
<th>Type</th>
<th>Input</th>
<th>Supplier</th>
<th>Supplier HQ Country</th>
<th>Estimated Input Price</th>
<th>Gross Profit Rate</th>
<th>Value Capture</th>
</tr>
</thead>
<tbody>
<tr>
<td>Storage</td>
<td>Hard Drive</td>
<td>Toshiba</td>
<td>Japan</td>
<td>$73.39</td>
<td>26.5%</td>
<td>$19.45</td>
</tr>
<tr>
<td>Display</td>
<td>Display Assembly</td>
<td>Toshiba-Matsushita</td>
<td>Japan</td>
<td>$23.27</td>
<td>28.7%</td>
<td>$6.68</td>
</tr>
<tr>
<td>Processors</td>
<td>Video/Multimedia Processor</td>
<td>Broadcom</td>
<td>US</td>
<td>$8.36</td>
<td>52.5%</td>
<td>$4.39</td>
</tr>
<tr>
<td>Processors</td>
<td>Controller chip</td>
<td>PortalPlayer</td>
<td>US</td>
<td>$4.94</td>
<td>44.8%</td>
<td>$2.21</td>
</tr>
<tr>
<td>Battery</td>
<td>Battery Pack</td>
<td>Unknown</td>
<td>Japan*</td>
<td>$2.89</td>
<td>30%*</td>
<td>$0.87</td>
</tr>
<tr>
<td>Memory</td>
<td>Mobile SDRAM Memory - 32 MB</td>
<td>Samsung</td>
<td>Korea</td>
<td>$2.37</td>
<td>28.2%</td>
<td>$0.67</td>
</tr>
<tr>
<td>Memory</td>
<td>Mobile RAM - 8 MBytes</td>
<td>Elpida</td>
<td>Japan</td>
<td>$1.85</td>
<td>24.0%</td>
<td>$0.46</td>
</tr>
<tr>
<td>Memory</td>
<td>NOR Flash Memory - 1 MB</td>
<td>Spansion</td>
<td>US</td>
<td>$0.84</td>
<td>10.0%</td>
<td>$0.08</td>
</tr>
</tbody>
</table>

8 key parts sub-total $117.91
433 other parts $22.79
Estimated assembly and test $3.86
Estimated factory cost $144.56

Source: Portelligent, Inc., 2006 and authors’ calculations.
Share of value captured: profits

Share of value capture, $299 iPod

- Apple margin, 25%
- Distribution and retail, 25%
- Japan margins, 9%
- Unmeasured inputs and direct labor, 36%
- Taiwan margins, 1%
- Korea margins, 1%
- Non-Apple U.S. margins, 2%
iPad value capture

Cost of inputs: Non-China labor 5%
Cost of inputs: China labor 2%
Cost of inputs: materials 31%
Unidentified profits 5%
S. Korea profits 7%
Japan profits 1%
Taiwan profits 2%
Apple profits 30%
Distribution and retail profits 15%
Non-Apple U.S. profits 2%
Is Apple Unique? (HP notebook)

- HP Share, 28%
- Microsoft and Intel shares, 18%
- Other US shares, 1%
- Other supplier shares, 5%
- Taiwan and Korea shares, 3%
- Japan shares, 7%
- Cost of Goods, 38%
Where’s China?

• Value added
  – All products studied assembled in China
  – Value added from final assembly a few dollars of direct labor
  – Additional assembly of components and subassemblies in China
  – Total less than 5% of final value

• Value capture
  – No Chinese firms in major suppliers
  – Assembly done by Taiwanese and multinational companies in China, who capture value in gross profit

• Exception: Chinese-branded products
  – Lenovo notebook: China captures over 20% of wholesale price
China capturing value: Lenovo

Value capture for $1479 Lenovo notebook

- Lenovo margin, $212
- Distribution and retail, $370
- Japan Inputs, $81
- Taiwan Inputs, $22
- Korea Inputs, $15
- U.S. Inputs, $214
- Other inputs and direct labor, $565
Trade data

- Bilateral trade deficits can be misleading
  - $299 iPod shows up as $144 trade deficit with China, but China’s input is only ~$5 of labor.
  - Most of the value is created and captured elsewhere in the value chain.
- Need better measures of global value chains.
  - Current efforts by USITC, OECD, WTO.
  - Important to guide policy
## Value capture: Jobs

### Worldwide iPod-related jobs, 2006

<table>
<thead>
<tr>
<th></th>
<th>Production</th>
<th>Retail/non-professional</th>
<th>Engineering/professional</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>U.S.</td>
<td>30</td>
<td>7,789</td>
<td>6,101</td>
<td>13,920</td>
</tr>
<tr>
<td>Non-U.S.</td>
<td>19,160</td>
<td>4,825</td>
<td>3,265</td>
<td>27,250</td>
</tr>
</tbody>
</table>

- U.S. has 1/3 of total jobs
- U.S. has 2/3 of professional jobs
### Worldwide iPod-related compensation, 2006

<table>
<thead>
<tr>
<th></th>
<th>Production</th>
<th>Retail/non-professional</th>
<th>Engineering/professional</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>U.S.</strong></td>
<td>$1,429,200</td>
<td>$220,183,310</td>
<td>$562,191,318</td>
<td>$753,287,510</td>
</tr>
<tr>
<td><strong>Non-U.S.</strong></td>
<td>$90,236,050</td>
<td>$96,500,000</td>
<td>$131,750,000</td>
<td>$318,486,050</td>
</tr>
</tbody>
</table>

- **U.S.** has more than twice the wages.
- **Because U.S.** has high-skilled engineering/professional jobs.
- **Wages in general** are much higher in the U.S.
Does America win in a global economy?

- U.S. profits when U.S. companies win.
  - Story would be much different if Sony or Samsung were the brand name.
- U.S. captures good jobs and wages when U.S. companies win.
  - R&D, engineering, management still cluster in home country of multinationals.
- There are losers—Apple used to manufacture computers in the U.S. Those jobs are gone.
Policy implications

- Electronics assembly not necessarily the path to good jobs.
  - Little value added
  - Asia supply base built up over decades
  - Steve Jobs said Apple would need to hire 30,000 manufacturing engineers/technicians to produce in the U.S.
  - Can the U.S. compete with $1 an hour labor?
Where can the U.S. compete?

- U.S. can compete in capital- and skill-intensive manufacturing in electronics
  - Semiconductor fabrication (Intel)
  - Glass for displays (Corning)
- Other industries
  - Informal policy support (autos)
  - Defense related
  - Bulky, expensive to ship (concrete)
  - Emerging industries (nanotech)
Clean energy: the right fit?

“We will put Americans to work in new jobs that pay well and can’t be outsourced - jobs building solar panels and wind turbines; constructing fuel-efficient cars and buildings; and developing the new energy technologies that will lead to even more jobs, more savings, and a cleaner, safer planet in the bargain,”

President-elect Obama, January 8, 2009.
Wind energy

• Favorable characteristics
  – Wind turbines are huge and costly to transport
  – Capital-intensive components
  – Supported by subsidies (Production tax credit)

• Yet the U.S. imported $2.6 billion in wind equipment and exported just $22 million in 2008.

• What’s the real story? New research on value capture and jobs.
Wind turbine “teardown”

Share of total cost

Source:
Wind Directions, 2007
**Gearbox** 12.91%
Gears increase the low rotational speed of the rotor shaft in several stages to the high speed needed to drive the generator.

**Generator** 3.44%
Converts mechanical energy into electrical energy. Both synchronous and asynchronous generators are used.

**Yaw system** 1.25%
Mechanism that rotates the nacelle to face the changing wind direction.

**Pitch system** 2.66%
Adjusts the angle of the blades to make best use of the prevailing wind.

**Power converter** 5.01%
Converts direct current from the generator into alternating current to be exported to the grid network.

**Transformer** 3.59%
Converts the electricity from the turbine to higher voltage required by the grid.

**Brake system** 1.32%
Disc brakes bring the turbine to a halt when required.

**Nacelle housing** 1.35%
Lightweight glass fibre box covers the turbine’s drive train.
Value capture in a 2.0 MW Clipper Liberty Turbine

- Clipper margin: 20%
- US input margins: 7%
- German input margins: 4%
- Brazil input margins: 4%
- Mexico input margins: 4%
- Other input margins: 1%
- Input COGS: 63%
Value capture in 2.0MW Gamesa G8 turbine

- Gamesa margin: 36%
- Input COGS: 57%
- Spanish input margins: 0.6%
- German input margins: 0.7%
- Other input margins: 6%
Summary

• Headquarters location of turbine manufacturer makes a big difference in value capture
  – Captures financial value that rewards owners
  – Creates jobs in R&D, administration, etc.
  – More likely to use domestic suppliers

• European vertical integration vs US use of external suppliers
  – Greater value capture for lead firm
  – Requires investment in R&D, plant, equipment
  – Mature industries moving in opposite direction (e.g. electronics, autos, aerospace)
Current research: Jobs in the wind industry

• Study of jobs associated with U.S. wind farms.
  – Number and types of jobs, wages
  – U.S. and non-U.S. jobs
  – Raw materials, components, turbines, planning, construction, operations, maintenance
• Using methodology from iPod study
Papers and contacts

Journal articles and working papers:

- iPod profits, *Communications of the ACM*,
- iPod and notebook PCs, *Industrial and Corporate Change*,
- iPod jobs, *Journal of International Commerce and Economics*,
- Smart phone profits, *Telecommunications Policy*,
- iPhone and iPad profits,

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