

Capturing Value in a Global Innovation Network: Comparing the iPod and Notebook PCs

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Benefit from U.S. IT Products Made Overseas?
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Agenda

- Overview: global innovation networks
- Incremental innovation in PCs
- Radical innovation in the iPod
- Capturing value from innovation
 - Methods, data, results
- Implications for competition
- Implications for the U.S.

Global innovation networks: Who benefits?

- Innovation is believed to be a key driver of economic growth and source of national competitiveness.
 - Academic literature supports this view
 - National policies reflect this belief
- But what happens when innovation and production are distributed across many countries?
 - Multinationals operate multiple R&D centers around the world
 - Industries becoming more modular, with production and product development outsourced to specialists in many countries
- Where is value created, and who captures that value?

How does innovation occur?

- Locus of innovation
 - Core technologies: e.g. semiconductors, hard drives, optical drives, displays, software, battery, materials
 - System integration: Brand name vendors incorporate core technologies in new products to meet market demand.
- Incremental vs. radical innovation
 - Incremental: improvements within existing product architectures, e.g., faster computers, bigger TVs
 - Radical: disruptive changes in core technologies or creation of new architectures, e.g., from CRT to flat-panel TVs

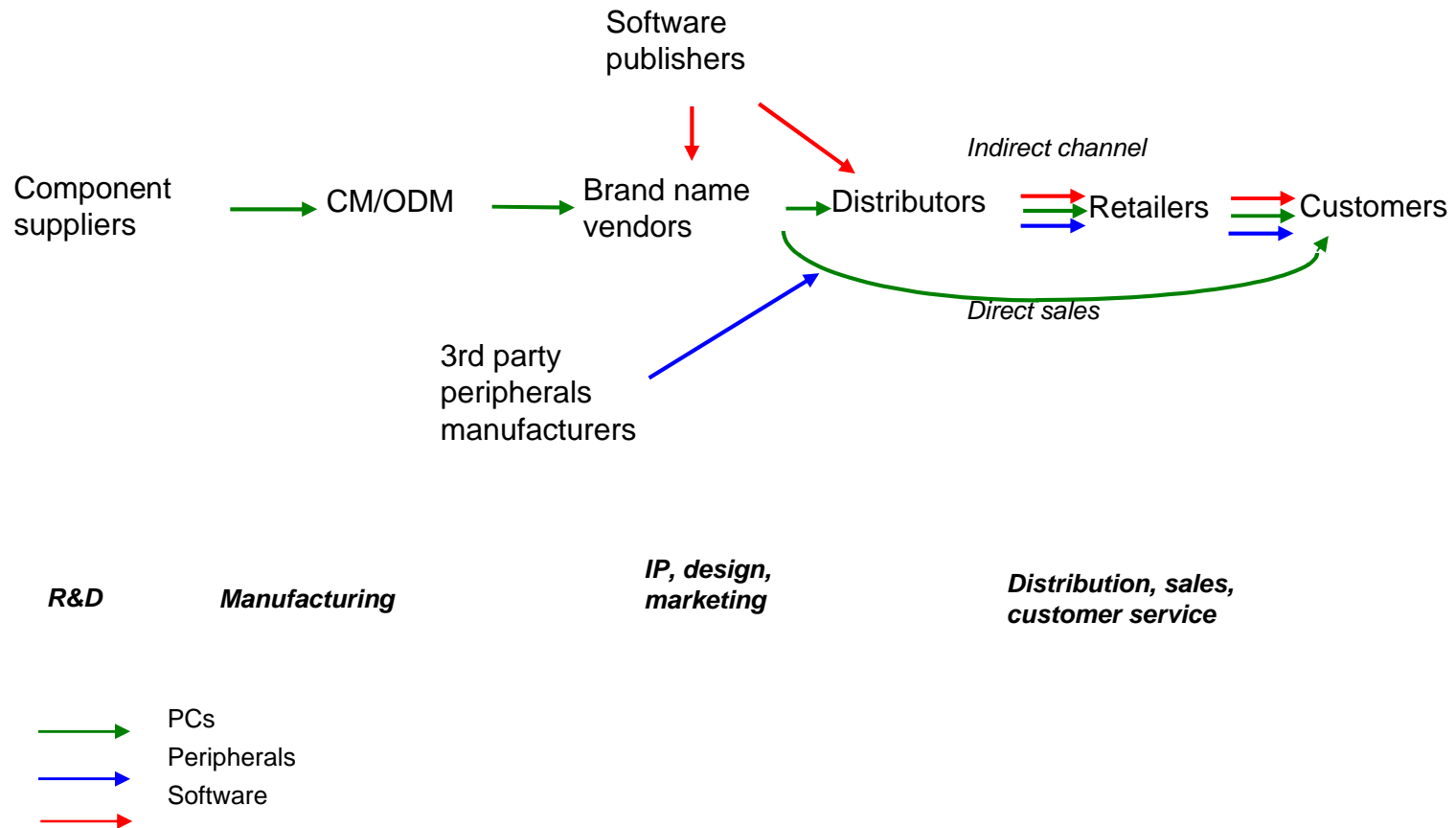
Case studies: iPods and notebooks

- Global innovation networks that incorporate these distinctions found in many industries
- We study two products built on a global supply and innovation network—iPods and notebook PCs
 - Similar technologies involved (chips, storage, software, displays), mostly the same suppliers
 - One is radical, one incremental
 - Do they tell similar or different stories about value capture?
- We focus on a few products in one industry to do a very detailed analysis of value capture in global networks

Incremental innovation in the PC industry

- PC a mature product with established dominant design
- Modular product architecture with defined interfaces. Allows innovation to proceed independently in all layers of the industry
- Microsoft and Intel define key standards and shape innovation decisions of component and system makers
- Branded PC makers decide which innovations to incorporate. Most innovations available to everyone

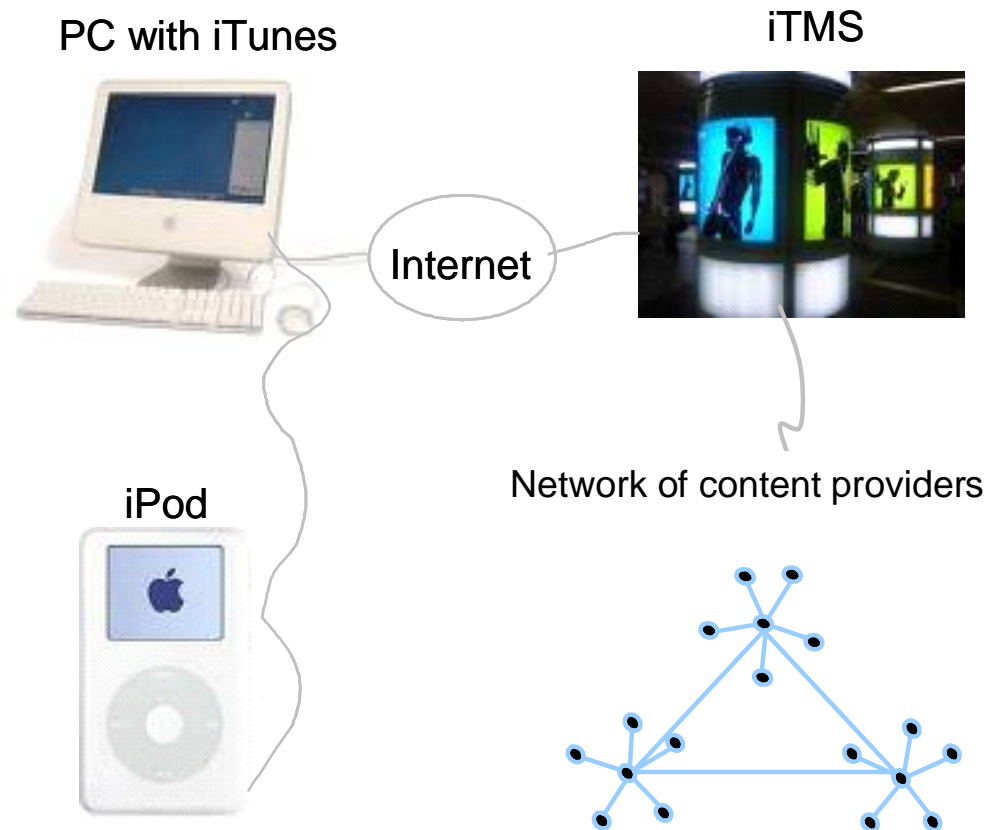
PC industry value network



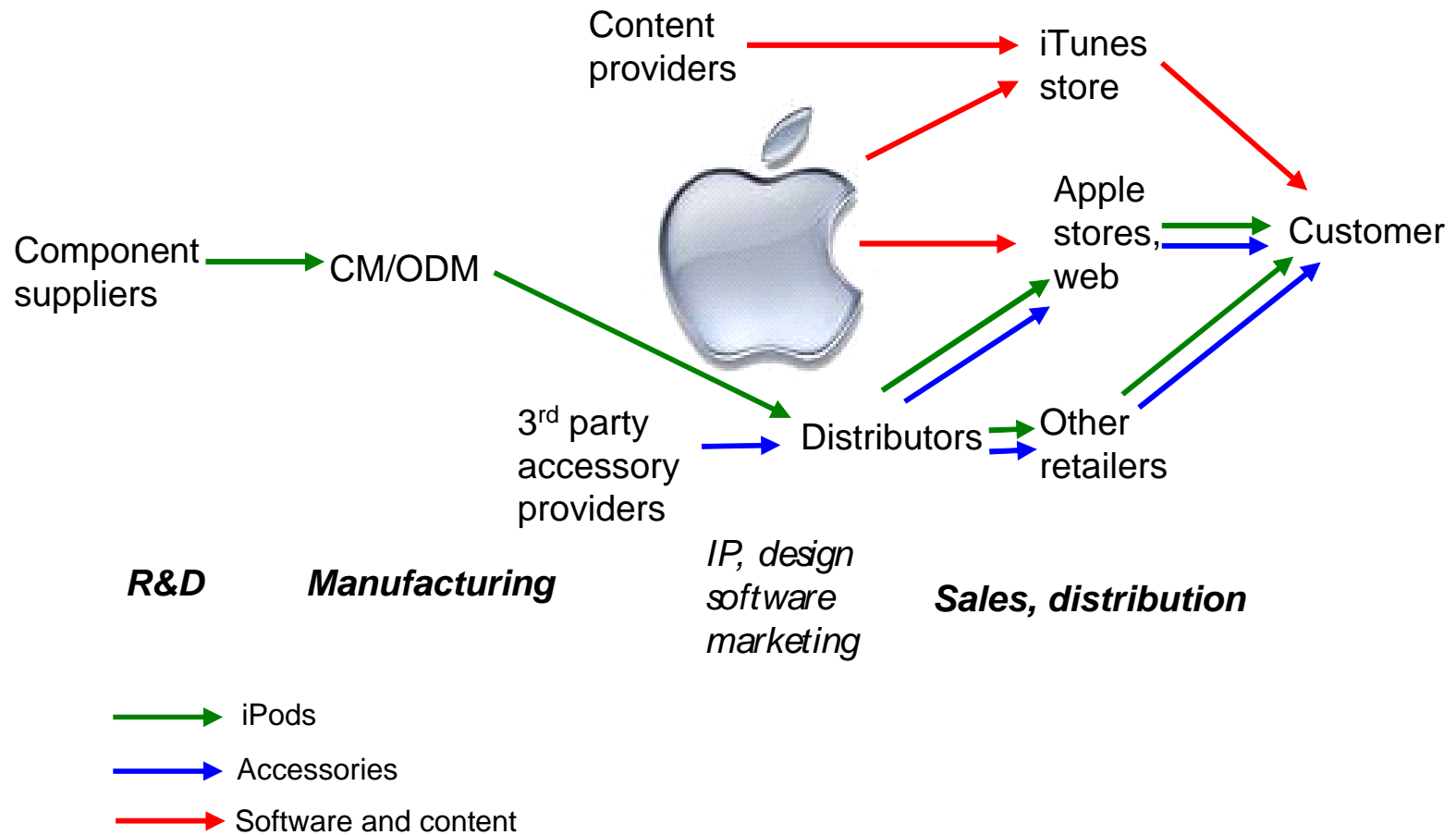
Radical innovation in the iPod

- Emerging product category, no dominant design
- Innovation aided by advances in core technologies: hard drive, flash memory, audio compression (MP3), batteries
- Apple created complete system of hardware, software, services.
 - Worked with suppliers to customize key components
 - Created an ecosystem that includes iPod, iTunes software for PCs, iTunes store, content
 - Success based on design, ease of use, integration of product and services to satisfy consumers

The iPod ecosystem



The iPod value network



Comparing iPods and notebooks

- Similarities
 - Components are supplied globally by mostly the same U.S. and Asia-Pacific firms
 - Assembly is in China
 - Distribution and retail is local or regional around the world.
- Differences
 - Whose brand is on the label: Apple vs. various U.S., Japanese, Taiwanese, Chinese notebook vendors
 - Who controls the standards: Apple vs. Microsoft and Intel

Who captures the value of innovation?

- Critical issue for companies and countries.
- Companies need to know
 - how much to invest and where to focus their own efforts
 - when and how to leverage global networks
 - where to retain control to capture value.
- U.S. needs to know
 - real facts about globalization
 - how to capture more value from participating in global networks
 - how to prepare their people to compete globally
 - how to create an environment for innovation

Research approach

- Need a framework to measure value creation and capture.
 - Use value chain analysis.
 - Identify who captures value along the supply chain
- Need a methodology to measure value at the firm and country level.
 - We break down individual products, identify who makes the major components, who assembles the product, who sells it
 - Estimate the value captured by each party.
 - Firm level data is then aggregated to country level

Accounting methodology

- Value added = sale price - purchased inputs = direct labor + gross profit
- Value capture = gross profit = value added - direct labor

Sales price	- purchased inputs			
	- direct labor	Value added		- cost of goods sold
	- SG&A		Gross profit	- SG&A
	- R&D	- R&D		
	- Depreciation	- Depreciation		
	- Net profit	- Net profit		

Product level estimation

- Obtained teardown data from Portelligent, Inc.
 - 30 GB iPod, 2003
 - 30 GB Video iPod, 2005
 - 8GB iPod Nano, 2005
 - HP nc6230 notebook, 2005
 - Lenovo T43 notebook, 2005
- Break down cost and identify manufacturers of major inputs
 - For each input, estimate gross margin using company and comparative data.
 - Multiply cost by margin to get value capture by firm
 - Direct labor costs are not broken out in firm financial reports, so we cannot measure value added. Possible future research.

Key Inputs in the 30GB 5th-Generation iPod (Video iPod), 2005

Type	Input	Supplier	Supplier HQ Country	Estimated Input Price	Price as % of Factory Cost	Supplier Gross Profit Rate	Est'd. Value Capture
Storage	Hard Drive	Toshiba	Japan	\$73.39	50%	26.50%	\$19.45
Display	Display Assembly	Toshiba-Matsushita	Japan	\$23.27	16%	28.70%	\$6.68
Processors	Video/Multimedia Processor	Broadcom	US	\$8.36	6%	52.5%	\$4.39
Processors	Controller chip	PortalPlayer	US	\$4.94	3%	44.8%	\$2.21
Battery	Battery Pack	Unknown	Japan*	\$2.89	2%	30.0%*	\$0.87
Memory	Mobile SDRAM Memory - 32 MB	Samsung	Korea	\$2.37	2%	28.2%	\$0.67
Memory	Mobile RAM - 8 MBytes	Elpida	Japan	\$1.85	1%	24.0%	\$0.46
Memory	NOR Flash Memory - 1 MB	Spansion	US	\$0.84	1%	10.0%	\$0.08
			Sub-Total	\$117.91	80%		
			Other parts	\$22.79	15%		
			Estimated assembly and test	\$7.40	5%		\$3.70
			Estimated factory cost	\$148.10	100%		\$38.50

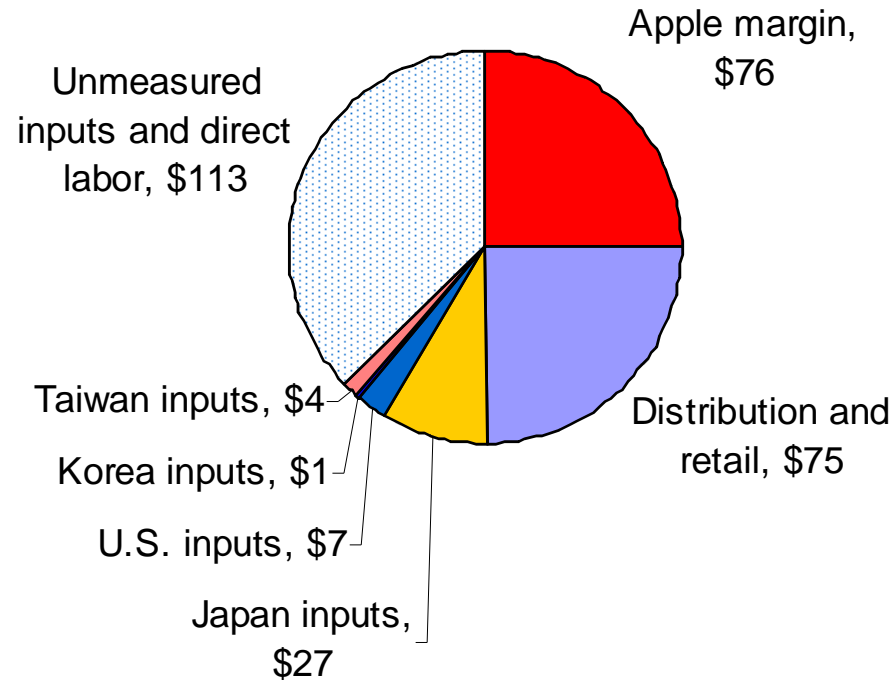
iPod and notebook PC input values

Purchased inputs as percentage of factory cost

	Video iPod	HP nc6230 notebook
Software	Developed inhouse	11%
Storage	50%	12%
Display	16%	16%
Processors	9%	27%
Assembly	5%	5%
Battery	2%	5%
Memory	2%	4%
PCBs	2%	2%
Enclosure	2%	1%
Input Device(s)	1%	2%
	89%	85%
Total Parts	451	2,196

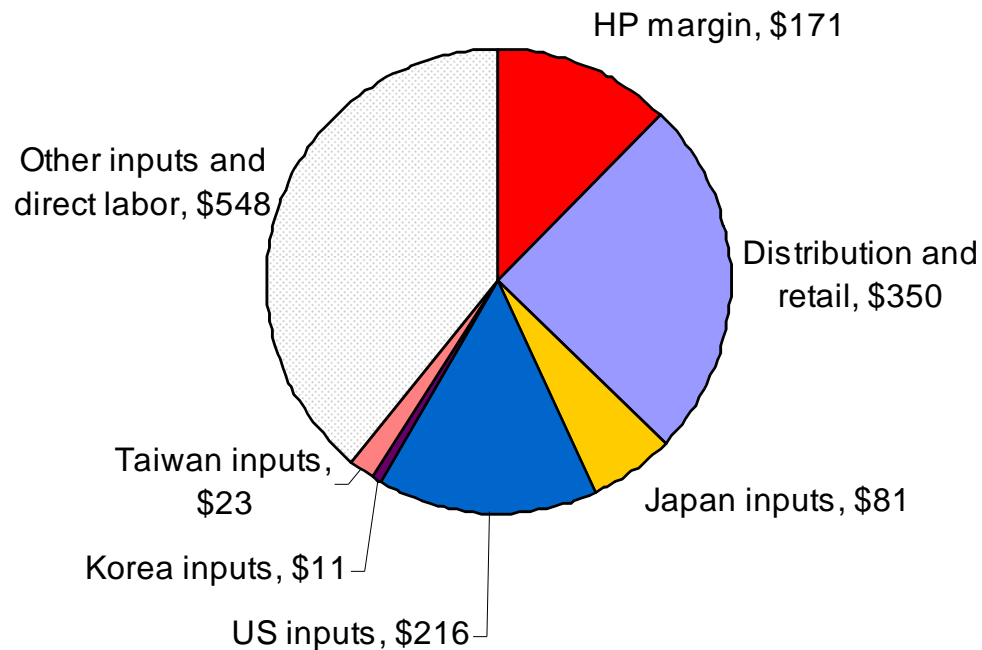
Distribution of value capture: iPod

Value capture for \$299 iPod



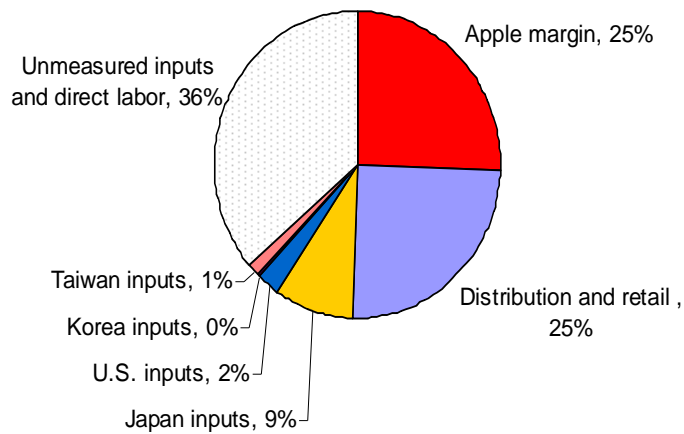
Distribution of value capture: notebook PC

Value capture for \$1400 HP notebook

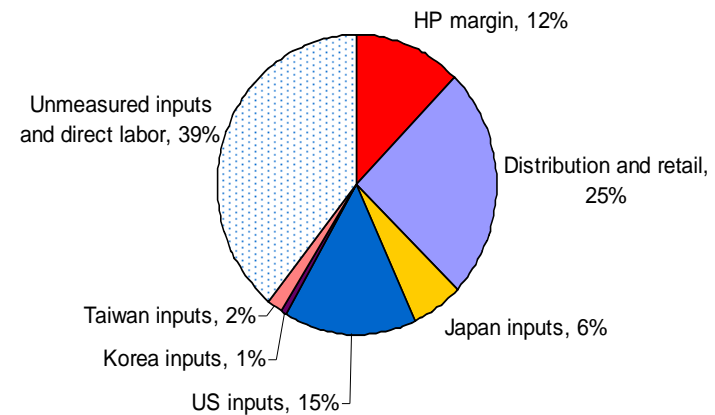


Comparison of value capture

Share of value capture, \$299 iPod



Share of value capture, \$1400 HP notebook

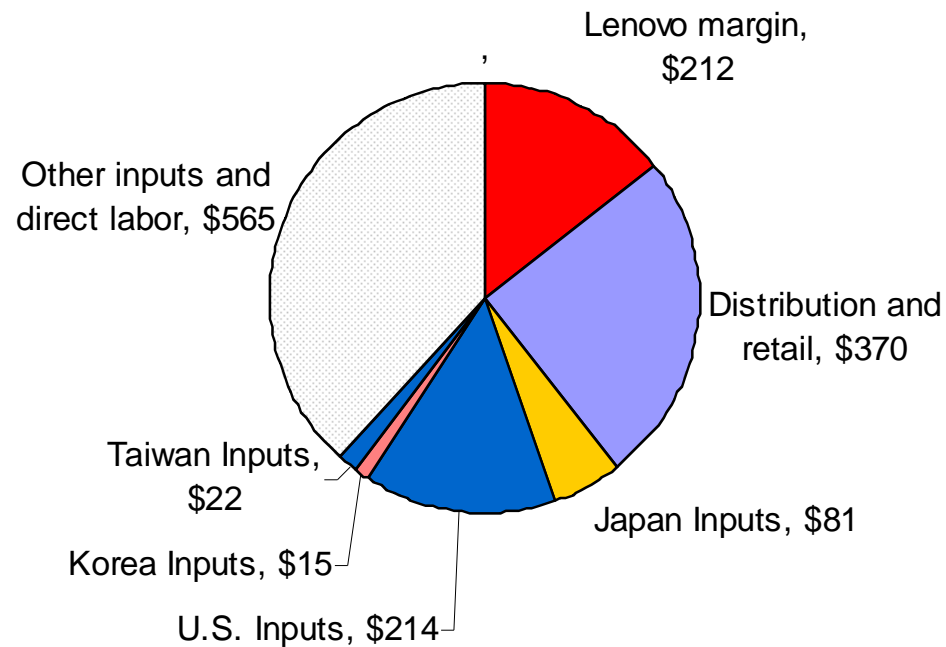


Where's China?

- 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
- For Lenovo laptop, China's share is bigger

China capturing value: Lenovo

Value capture for \$1479 Lenovo notebook



Innovation and competition

- Key distinction in who captures value is not between radical and incremental innovation. It's who defines the market and controls standards
 - Apple for iPod
 - Microsoft and Intel for PCs
- “Wintel” is not the model for the rest of the electronics industry.
 - Even Microsoft doesn't use it outside of PCs (XBox and Zune)
 - Lead firms in other segments don't want suppliers to capture most of the value.

Value of innovation to the U.S.

- Value captured by countries depends mostly on success of domestically-owned firms
 - Electronics industry dominated by U.S. and Japanese brands
 - U.S. continues to generate new innovations and set standards
- Innovation by domestic companies creates value for shareholders, who are mostly in the U.S.
- Creates employment in the U.S. in management, R&D, design, sales, marketing, accounting etc.
- As technologies mature, activities move offshore. Constant innovation creates new opportunities.

Value capture matches innovation

Top 50 U.S. Patent Grantees By Country, 2005

Country or Region	Number of Grantees	Number of Patents
United States	25	18,310
Japan	16	14,710
Europe	5	3,359
Korea	3	2,490
Taiwan	1	441

Source: Calculated from data in "IFI Issues List Of 2005's Top Patent Companies," IFI Patent Intelligence Press Release, January 10 2006.

U.S. competitiveness

- The U.S. has strong assets to capture value in a global innovation environment.
 - Brand name companies
 - Core technologies
 - Sophisticated markets
- But those advantages can be lost
 - When technologies shift or market conditions change
 - When domestic market is slow to adopt new technologies
- The U.S. is falling behind in key growth markets, especially wireless.
- Global competition now affecting U.S. knowledge workers as well as production workers

Trade data are misleading

- Bilateral trade statistics can be misleading
 - Bilateral U.S./China trade deficit increases by the factory cost of imported iPod or notebook
 - Yet most valuable inputs are made elsewhere and shipped to China for final assembly.
- Example
 - Intel chips fabricated in U.S., assembled in Malaysia, shipped to China for final assembly and exported to U.S.
 - Increases U.S. surplus with Malaysia and deficit with China
 - But most of the value from Intel was created and consumed in the U.S.

Policy issues

- Focus on bilateral trade deficit is misguided.
 - As China cost rises, production will move, but not to the U.S.
 - Raising tariffs or revaluing of RMB will only shift the trade deficit somewhere else.
- U.S. should focus on value creation and capture via innovation.
 - Promote dynamic domestic markets
 - Sustain favorable environment for entrepreneurs
- U.S. knowledge workers need to adapt rapidly
 - Cross-disciplinary skills (e.g., hardware and software)
 - Business and industry knowledge
 - Cross cultural management
- Bad news: Production jobs probably gone for good

Thank you.

- For the iPod-notebooks comparison paper, see:
- <http://pcic.merage.uci.edu/papers/2007/CapturingValue.pdf>.
- For the methodology paper, see:
- <http://www.pcic.merage.uci.edu/papers/2007/MappingTheValue.pdf>
- For the iPod paper, see:
- <http://pcic.merage.uci.edu/papers/2007/AppleiPod.pdf>

- COMMENTS, QUESTIONS???

Geography of value capture

The Geography of Value Capture for Five Products

	Retail Price	Distribution	Retail	Lead Firm Gross Margin	U.S. Inputs	Japan Inputs	Korea Inputs	Taiwan Inputs	Total
30GB iPod, 2003	\$399	\$40	\$60	\$114	\$4	\$32	\$2	\$5	\$257
30GB Video iPod	\$299	\$30	\$45	\$76	\$7	\$27	\$1	\$4	\$190
4GB iPod Nano, 2005	\$249	\$25	\$37	\$30	\$3	\$4	\$32	\$3	\$134
HP nc6230, 2005	\$1399	\$140	\$210	\$171	\$216	\$81	\$11	\$23	\$852
Lenovo T43, 2005	\$1479	\$148	\$222	\$212	\$214	\$81	\$15	\$22	\$914

Source: Authors' calculations