

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



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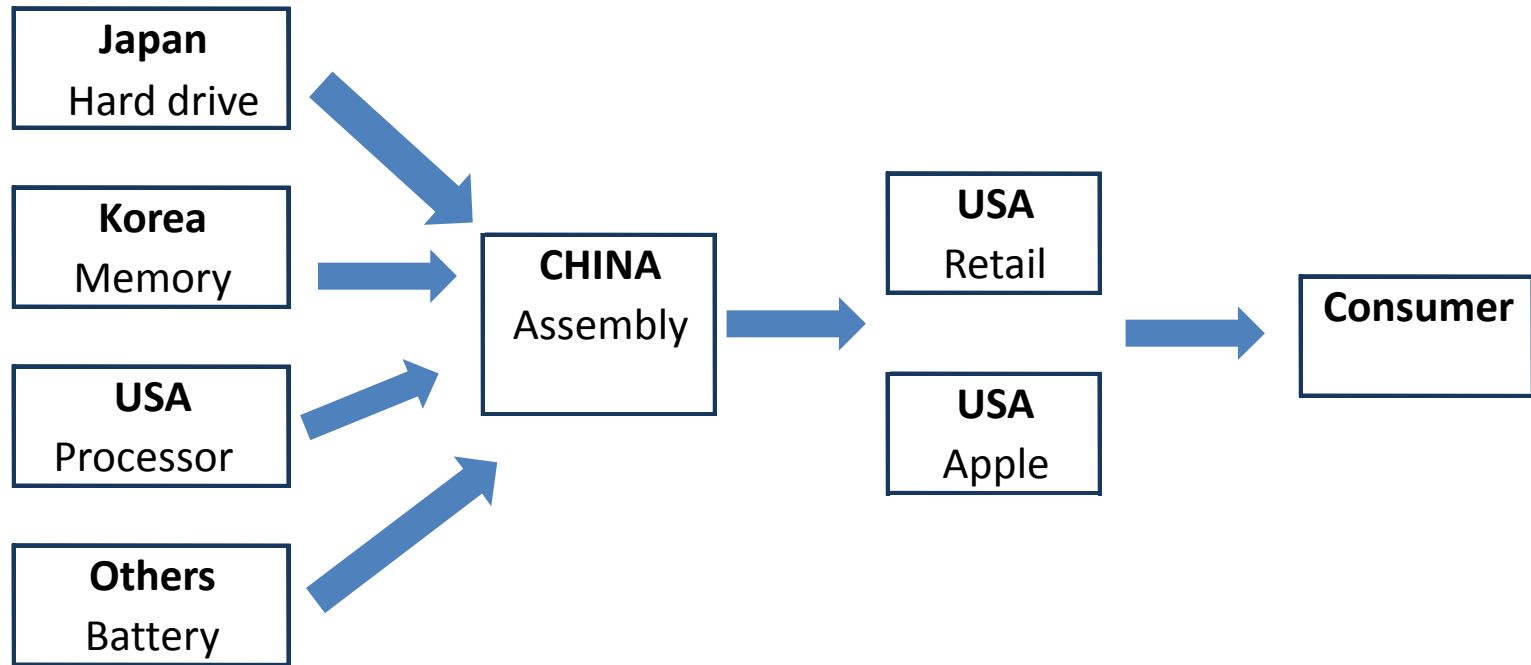
Based on work with  
Greg Linden, UC Berkeley and  
Kenneth L. Kraemer, UC Irvine

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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.?”**

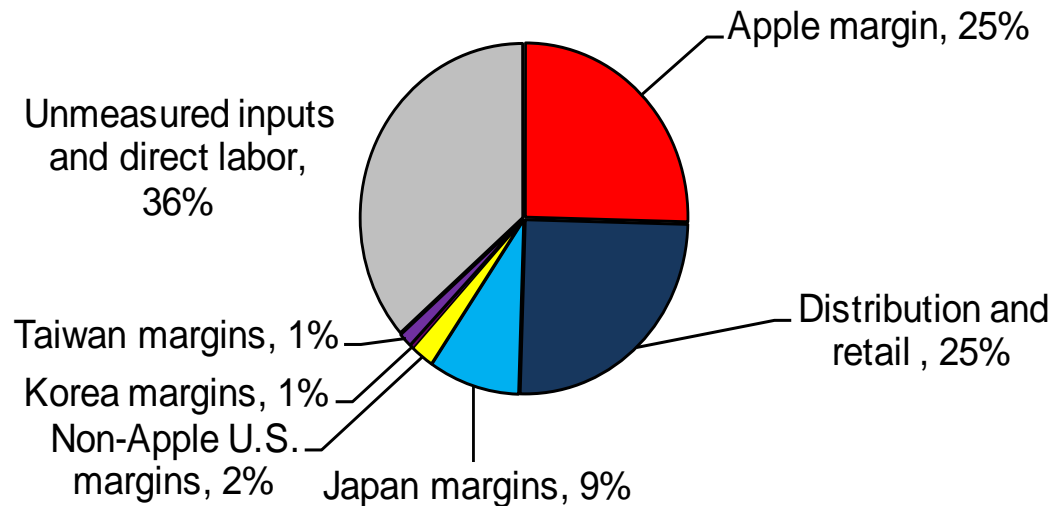
# Value capture in the 30GB Video iPod

Type	Input	Supplier	Supplier HQ Country	Estimated Input Price	Gross Profit Rate	Value Capture
Storage	Hard Drive	Toshiba	Japan	\$73.39	26.5%	\$19.45
Display	Display Assembly	Toshiba-Matsushita	Japan	\$23.27	28.7%	\$6.68
Processors	Video/Multimedia Processor	Broadcom	US	\$8.36	52.5%	\$4.39
Processors	Controller chip	PortalPlayer	US	\$4.94	44.8%	\$2.21
Battery	Battery Pack	Unknown	Japan*	\$2.89	30%*	\$0.87
Memory	Mobile SDRAM Memory - 32 MB	Samsung	Korea	\$2.37	28.2%	\$0.67
Memory	Mobile RAM - 8 MBytes	Elpida	Japan	\$1.85	24.0%	\$0.46
Memory	NOR Flash Memory - 1 MB	Spansion	US	\$0.84	10.0%	\$0.08
		8 key parts sub-total		\$117.91		
		433 other parts		\$22.79		
		Estimated assembly and test		\$3.86		\$3.86
		<b>Estimated factory cost</b>		<b>\$144.56</b>		<b>\$38.66</b>

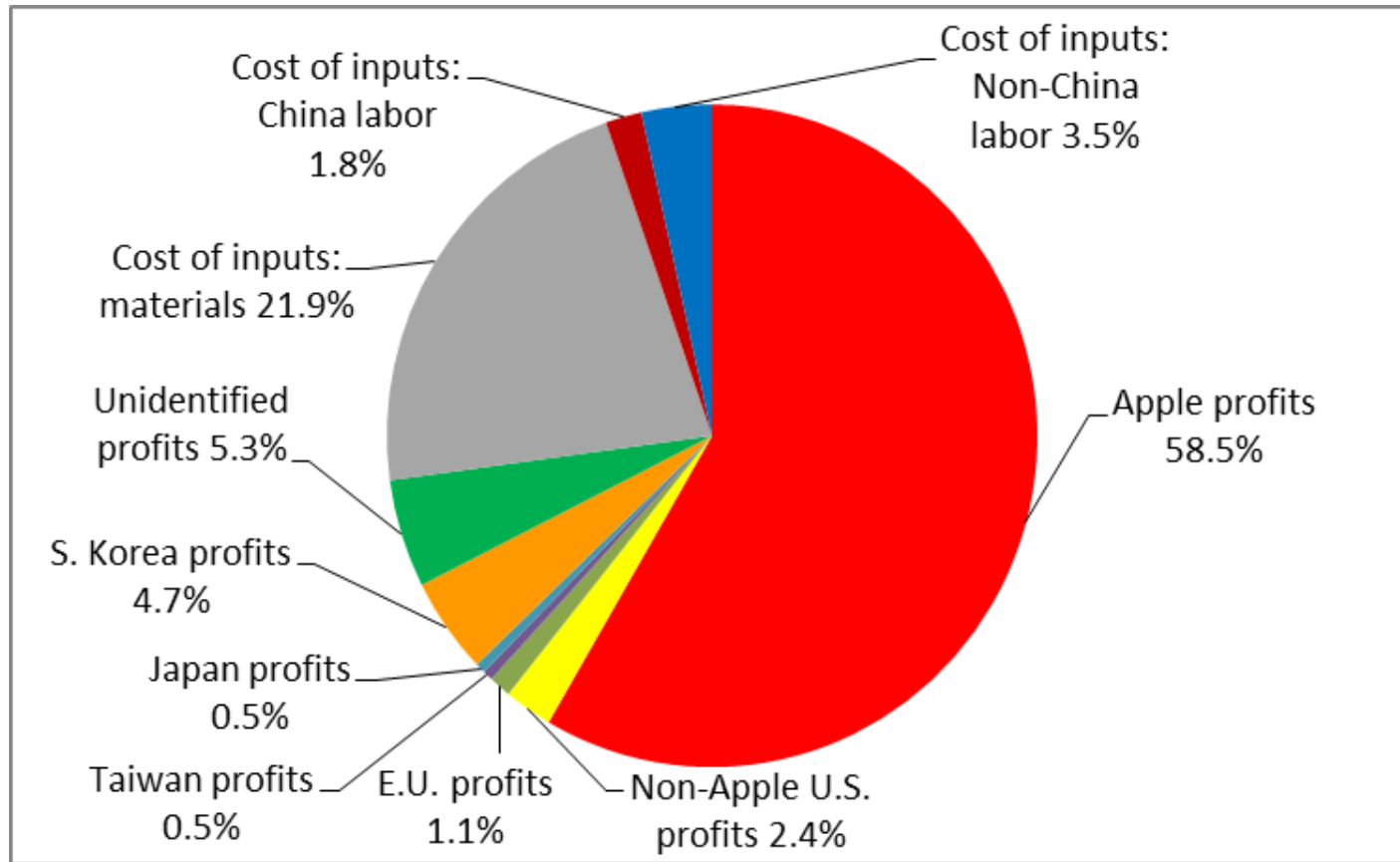
Source: Portelligent, Inc., 2006 and authors' calculations.

# Share of value captured: profits

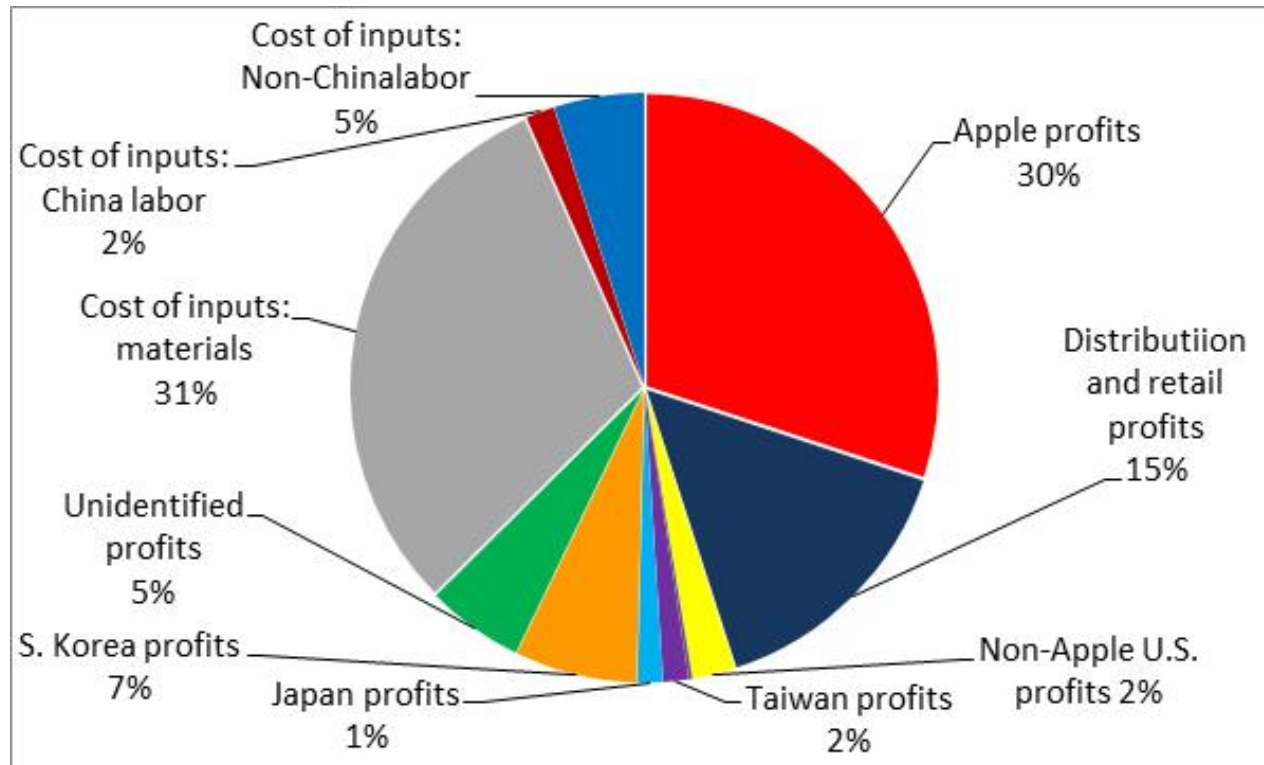
Share of value capture, \$299 iPod



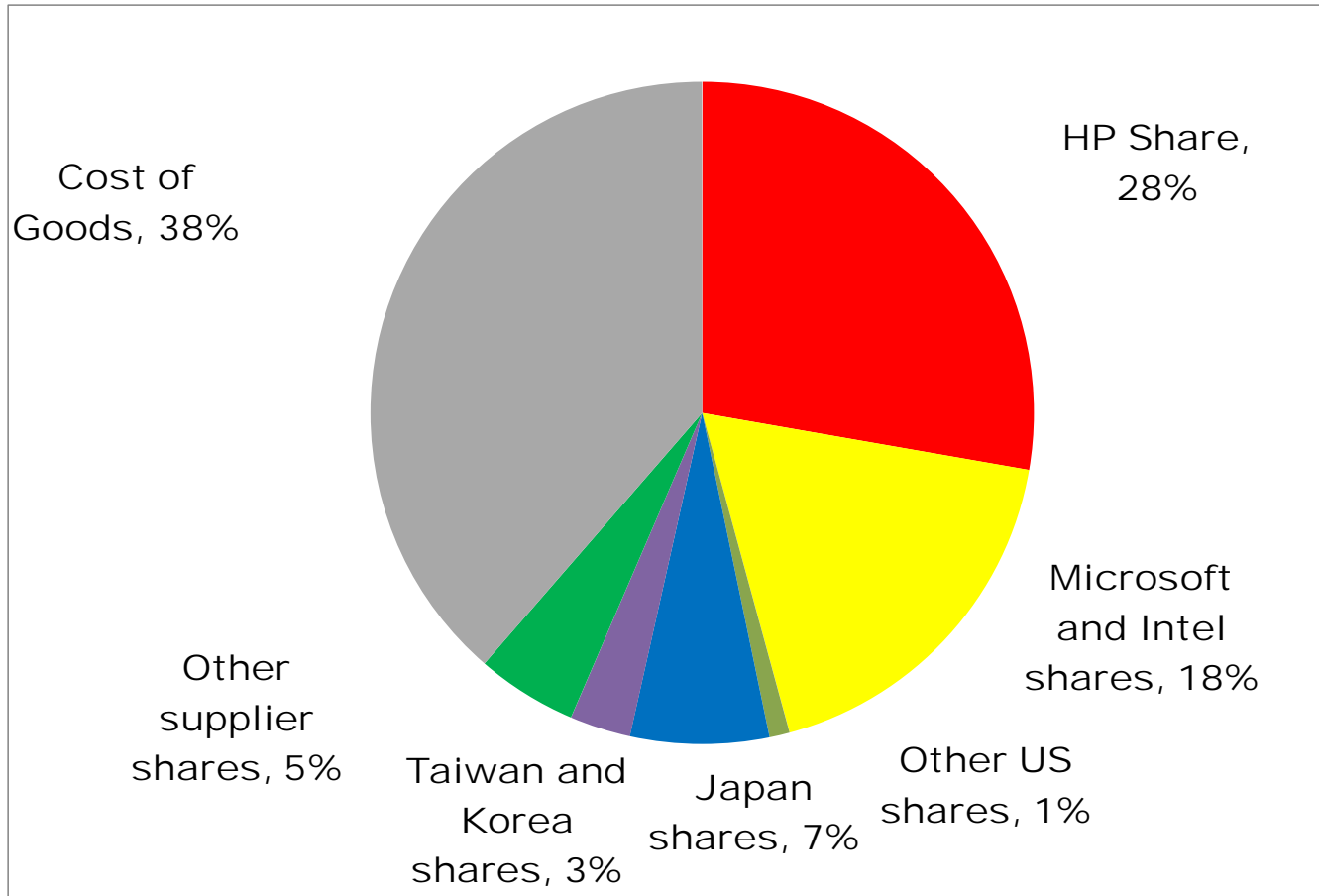
# iPhone value capture



# iPad value capture



# Is Apple Unique? (HP notebook)



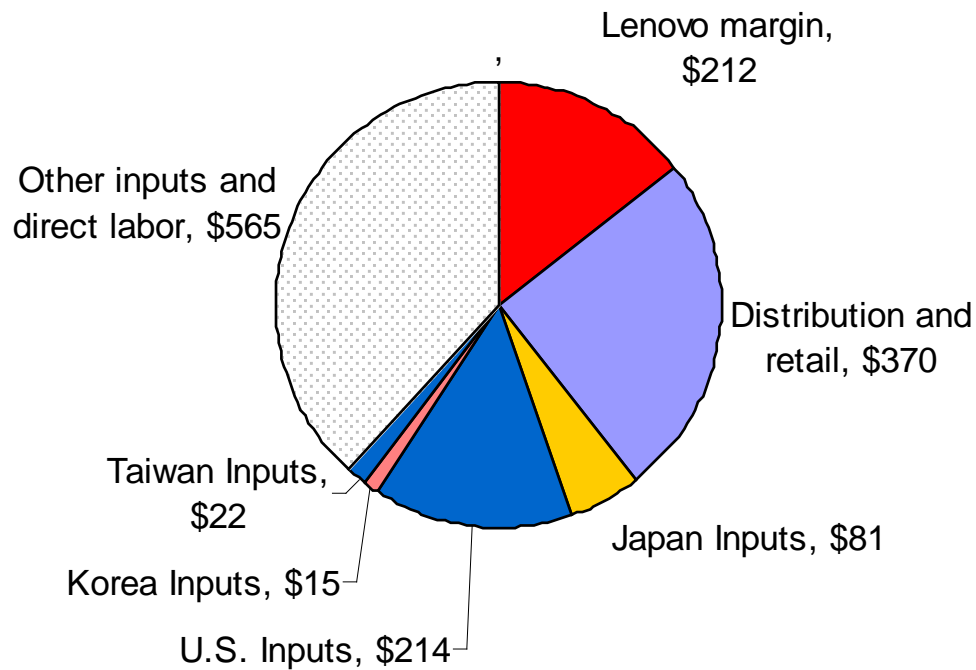


# Where's China?

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

# China capturing value: Lenovo

Value capture for \$1479 Lenovo notebook



# 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

	Production	Retail/non-professional	Engineering/professional	Total
U.S.	30	7,789	6,101	13,920
Non-U.S.	19,160	4,825	3,265	27,250

- U.S. has 1/3 of total jobs
- U.S. has 2/3 of professional jobs

# Wages

## Worldwide iPod-related compensation, 2006

	Production	Retail/non-professional	Engineering/professional	Total
U.S.	\$1,429,200	\$220,183,310	\$562,191,318	\$753,287,510
Non-U.S.	\$90,236,050	\$96,500,000	\$131,750,000	\$318,486,050

- 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

A typical wind turbine will contain up to 8,000 different components. This guide shows the main parts and their contribution in percentage terms to the overall cost. Figures are based on a REpower MM92 turbine with 45.3 metre length blades and a 100 metre tower.



### Tower 26.3%

Range in height from 40 metres up to more than 100 m. Usually manufactured in sections from rolled steel; a lattice structure or concrete are cheaper options.



### Rotor blades 22.2%

Varying in length up to more than 60 metres, blades are manufactured in specially designed moulds from composite materials, usually a combination of glass fibre and epoxy resin. Options include polyester instead of epoxy and the addition of carbon fibre to add strength and stiffness.



### Rotor hub 1.37%

Made from cast iron, the hub holds the blades in position as they turn.



### Rotor bearings 1.22%

Some of the many different bearings in a turbine, these have to withstand the varying forces and loads generated by the wind.



### Main shaft 1.91%

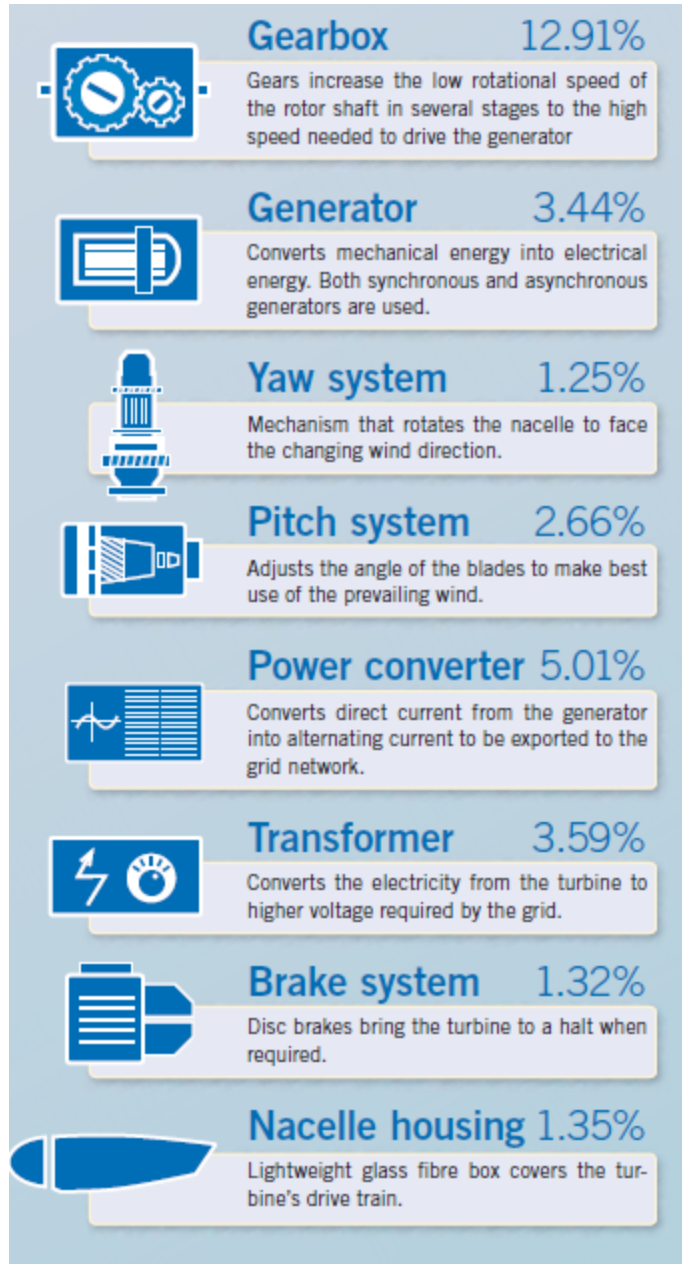
Transfers the rotational force of the rotor to the gearbox.



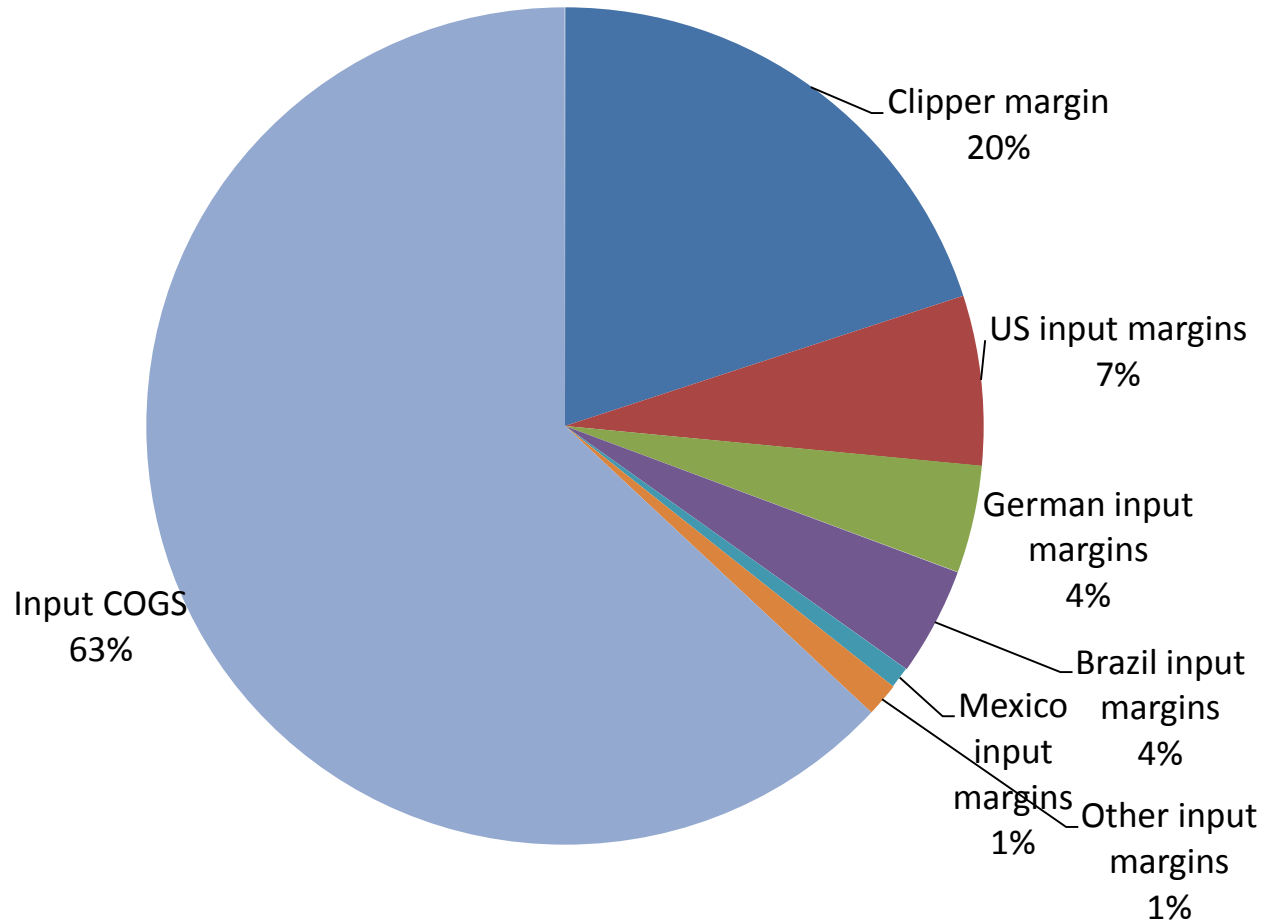
### Main frame 2.80%

Made from steel, must be strong enough to support the entire turbine drive train, but not too heavy.

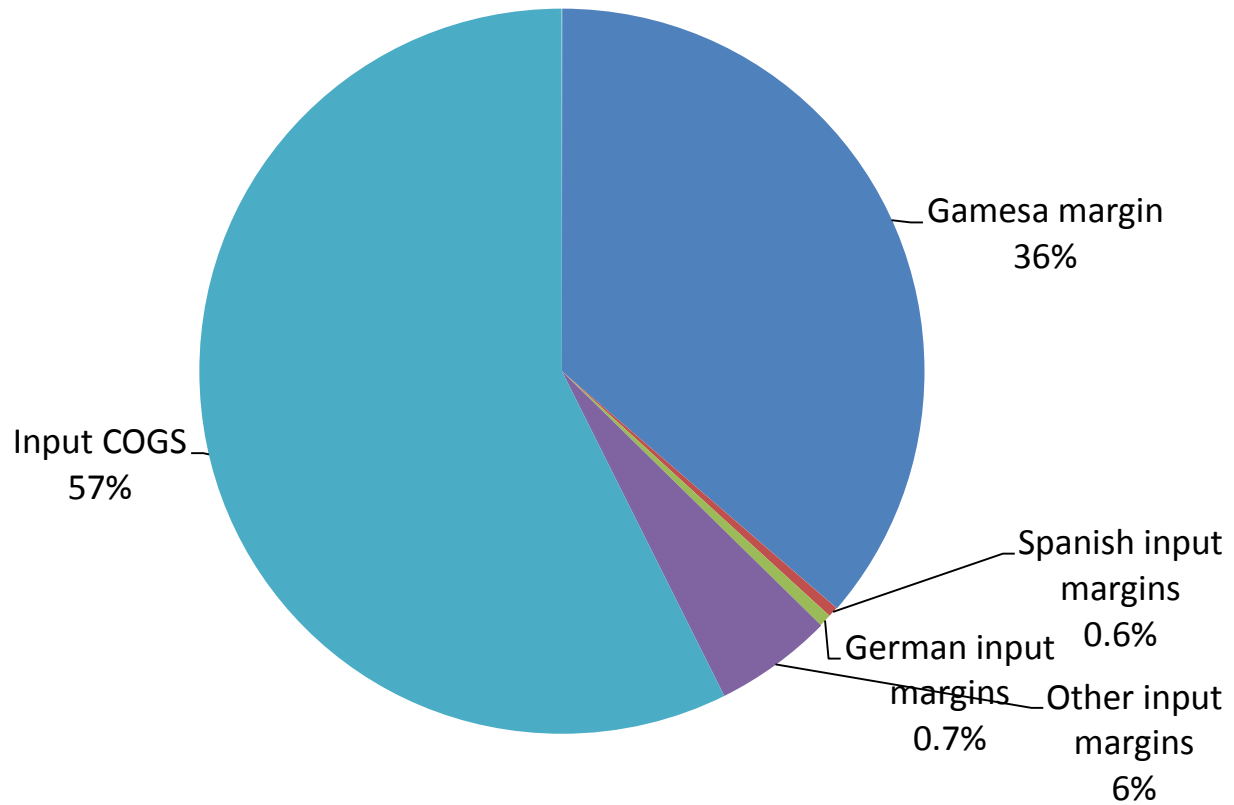
Source:  
Wind Directions, 2007



# Value capture in a 2.0 MW Clipper Liberty Turbine



# Value capture in 2.0MW Gamesa G8 turbine



# 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*,  
<http://pcic.merage.uci.edu/papers/2008/WhoCapturesValue.pdf>
- iPod and notebook PCs, *Industrial and Corporate Change*,  
<http://pcic.merage.uci.edu/papers/2008/WhoProfits.pdf>
- iPod jobs, *Journal of International Commerce and Economics*,  
<http://pcic.merage.uci.edu/papers/2011/InnovationJobCreationiPod.pdf>
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- iPhone and iPad profits,  
[http://pcic.merage.uci.edu/papers/2011/Value\\_iPad\\_iPhone.pdf](http://pcic.merage.uci.edu/papers/2011/Value_iPad_iPhone.pdf)

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