Labor from a Managerial Point of View

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Outline

• US automotive manufacturing is not dead yet
• But, underinvestment in human and organizational capital hurts firms’ ability to meet future challenges
  – Offshoring
  – Energy
US automotive manufacturing remains important

• 873,000 direct jobs in motor vehicle and supplier industries
• 4.5 million jobs in indirect and expenditure-generated employment

– Source: cargroup.org, 2007
Average percentage of auto parts made in the U.S. and Canada for cars sold in North America

Source: wsj, 4/2006
Why are there still so many auto jobs here?

• A big return to skill, integrated problem-solving, and proximity
  – These returns could be increased
• What does an auto worker do?
  – Boron operator
  – Operators who don’t operate
  – Gear carrier assembly
• Manufacturing processes can be designed to take advantage of broad-based skills
  – Toyota production system
  – Fast ramp-up of breakthrough innovations
Offshoring to low-wage countries

• Doesn’t necessarily mean low costs, particularly on a life-cycle basis
• Evidence from
  – 40 First-tier suppliers (CAR report)
  – Second-tier suppliers (2006 survey I conducted with Michigan Manufacturing Technology Center)
Large suppliers: Offshoring has mixed results

Figure 8
Outsourcing Benefit Comparison

- Information Technology: 3.5
- Engineering: 3.3
- Manufacturing: 3.2
- Outsourced overseas for financial savings: 3.2
- Human Resources: 2.5
- Launch management: 1.9
- Sales: 1.4

Not at all Beneficial | Somewhat Beneficial | Very Beneficial

Question: Please rate the benefit to your firm of outsourcing the following
The U.S. Component Manufacturing Industry

• Manufactures metal, plaster, and rubber components for final consumer products.
• Approximately one quarter are solely suppliers to auto industry.
• Many small firms, often squeezed between larger suppliers of raw materials and larger producers of consumer products.
• More tied to region than its customers, but increasingly dispersing out of cities.
• Facing a sudden surge in international competition.
• Represents 10.6% of U.S. manufacturing jobs, up from 8.8% in 1980.
Data

- **Benchmarking Questionnaire**
  - 615 plants responded to survey conducted by Michigan Manufacturing Technology Center in spring 2003
    - Highly detailed survey asks about revenues, costs, operations
    - Respondents are presidents, CFOs, plant managers
    - Low response rate (~10%), but no bias in size, productivity
      - Michigan is overrepresented; South is underrepresented

- **Relationship Questionnaire**
  - Survey sent to plants who answered benchmarking questionnaire
  - Asked about sources of ideas; relationships with customers, suppliers, rivals
    - 65% response rate

Customers are offshoring

<table>
<thead>
<tr>
<th>They are relocating more of their manufacturing to regions where wages are lower:</th>
<th>Applies to our largest single KCL--2006</th>
<th>Applies to our largest single KCL--2003</th>
</tr>
</thead>
<tbody>
<tr>
<td>In the US and/or Canada</td>
<td>22.3</td>
<td>25.5%</td>
</tr>
<tr>
<td>In Mexico or in Central or South America</td>
<td>36.4</td>
<td>41.2%</td>
</tr>
<tr>
<td>In Eastern Europe</td>
<td>24.9</td>
<td>15.6%</td>
</tr>
<tr>
<td>In Asia</td>
<td>42.9</td>
<td>27.4%</td>
</tr>
</tbody>
</table>
Small suppliers are experimenting

Mean percent of work for each step performed by plants that off-shore some work to China

- % China/Asia- Product Tryout/Test
- % China/Asia- Finishing & Oth Secondary
- % China/Asia- Part/Component Assy
- % China/Asia- Parts Manufacturing
- % China/Asia- Tooling Tryout/Test
- % China/Asia- Tooling Build
  Tooling Build/Test
- % China/Asia- Tooling Design
- % China/Asia- Process Design incl Cad/Cam
- % China/Asia- Product Design

Mean
Results are mixed

<table>
<thead>
<tr>
<th>How well have your expectations been met by your offshore sources, in terms of:</th>
<th>Frequency of Positive Responses</th>
<th>Frequency of Negative Responses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quality</td>
<td>39.1%</td>
<td>21.7%</td>
</tr>
<tr>
<td>Completeness</td>
<td>47.8%</td>
<td>13.0%</td>
</tr>
<tr>
<td>Timeliness</td>
<td>28.3%</td>
<td>37.0%</td>
</tr>
<tr>
<td>Cost</td>
<td>67.4%</td>
<td>19.6%</td>
</tr>
</tbody>
</table>
## Worrisome impacts on capability

Across all of sales - not just one important contract or product line - how (if at all) has company’s use of offshore resources affected ability to:

<table>
<thead>
<tr>
<th></th>
<th>Frequency of Positive Responses</th>
<th>Frequency of Negative Responses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Introduce new products quickly?</td>
<td>23.4%</td>
<td>25.5%</td>
</tr>
<tr>
<td>Address quality issues as they arise?</td>
<td>23.4%</td>
<td>38.3%</td>
</tr>
<tr>
<td>Implement any required engineering changes?</td>
<td>27.7%</td>
<td>31.9%</td>
</tr>
<tr>
<td>Make changes to business processes?</td>
<td>32.6%</td>
<td>23.9%</td>
</tr>
</tbody>
</table>
Not all US Manufacturers Doomed by Low-Wage-Country Firms’ Lower Landed Cost

U.S. Mfrs within striking distance of “China” median

Lowest-Cost

Lowest-Cost U.S.: better than “China” median

© 2006 MMTC Performance Benchmarking Service
Value-added / FTE is highly skewed:
The top 10% are more than twice as productive as the median shop.

Source: Performance Benchmarking Service: metalworking respondents
Look at the variance among tool & die shops serving automotive!

<table>
<thead>
<tr>
<th>Measures</th>
<th>Low Volume Machining</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Top 10%</td>
</tr>
<tr>
<td>Average Hourly Wage, Shop Employees</td>
<td>$21.75</td>
</tr>
<tr>
<td>Employee Turnover Rate</td>
<td>100.0%</td>
</tr>
<tr>
<td>Design Employees as a Percent of Total Employees</td>
<td>17.6%</td>
</tr>
<tr>
<td>Dollar Value of Machinery per FTE</td>
<td>$164,759</td>
</tr>
<tr>
<td>Percent of Machines More than 20 Years Old &amp; Not Upgraded</td>
<td>75.7%</td>
</tr>
<tr>
<td>Percent of Employees Using a Computer at Least Once a Week</td>
<td>100.0%</td>
</tr>
<tr>
<td>Customers Who Received Advise on Products/Materials as a Percentage of Total Sales</td>
<td>100.0%</td>
</tr>
<tr>
<td>Average Hours per Machine Setup</td>
<td>0.2</td>
</tr>
<tr>
<td>Running Hours as a Percentage of Available Hours</td>
<td>91.1%</td>
</tr>
<tr>
<td>Percent of Units Scrapped Due to Errors</td>
<td>0.1%</td>
</tr>
<tr>
<td>Percent of Deliveries Made by Original Ship Date</td>
<td>100.0%</td>
</tr>
<tr>
<td>Inventory Turns (Cost-of-Goods-Sold / Total Inventory)</td>
<td>55.1</td>
</tr>
<tr>
<td>Hours Shop is Open as a Percent of Total Hours in a Year</td>
<td>71.9%</td>
</tr>
</tbody>
</table>

Note machine age and turnover data reversed
Thinking About Offshore Competition … Comparing a US gray iron foundry to a low-wage offshore competitor

<table>
<thead>
<tr>
<th>Cost of Goods Sold (COGS)</th>
<th>US</th>
<th>Assumption About Offshore</th>
<th>Offshore</th>
</tr>
</thead>
<tbody>
<tr>
<td>FTE Employees</td>
<td>70.0</td>
<td>1/4 as productive</td>
<td>324.3</td>
</tr>
<tr>
<td>Annual Payroll per FTE</td>
<td>$32,422</td>
<td>1/10 as expensive</td>
<td>$3,242</td>
</tr>
<tr>
<td>Annual Fringes per FTE</td>
<td>$5,721</td>
<td>1/20 as expensive</td>
<td>$286</td>
</tr>
<tr>
<td>COGS Labor</td>
<td>$2,670,000</td>
<td></td>
<td>$1,144,083</td>
</tr>
<tr>
<td>Purchased Material &amp; Svcs</td>
<td>$3,910,000</td>
<td>10% cheaper per unit</td>
<td>$3,831,800</td>
</tr>
<tr>
<td>Utilities</td>
<td>$400,000</td>
<td>10% cheaper per MMBTU</td>
<td>$416,910</td>
</tr>
<tr>
<td>Plant &amp; Eqpt Expense</td>
<td>$520,000</td>
<td>25% lower</td>
<td>$390,000</td>
</tr>
<tr>
<td><strong>Total COGS</strong></td>
<td><strong>$7,500,000</strong></td>
<td></td>
<td><strong>$5,782,793</strong></td>
</tr>
</tbody>
</table>
### Payoff to US Initiatives

<table>
<thead>
<tr>
<th>Initiative</th>
<th>Impact of Initiative</th>
<th>Landed Cost Index</th>
<th>Value</th>
<th>Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Memo: Baseline</td>
<td></td>
<td></td>
<td>116.95</td>
<td></td>
</tr>
<tr>
<td>Reduce Waste 10%</td>
<td>Cuts labor, capital, &amp; material cost</td>
<td></td>
<td>116.70</td>
<td>-0.25</td>
</tr>
<tr>
<td>Reduce Material Cost 10%</td>
<td>Cuts material cost (and maybe weight)</td>
<td></td>
<td>112.63</td>
<td>-4.32</td>
</tr>
<tr>
<td>Reduce Pay 10%</td>
<td>Cuts labor costs</td>
<td></td>
<td>113.12</td>
<td>-3.83</td>
</tr>
<tr>
<td>Reduce Fringes 10%</td>
<td>(but may increase turnover)</td>
<td></td>
<td>116.27</td>
<td>-0.67</td>
</tr>
<tr>
<td>Increase Productivity 10%</td>
<td>Cuts FTE heads from 70 to 73</td>
<td></td>
<td>112.44</td>
<td>-4.50</td>
</tr>
<tr>
<td>Devalue US Dollar 10%</td>
<td>Raises offshore costs</td>
<td></td>
<td>106.54</td>
<td>-10.41</td>
</tr>
</tbody>
</table>

- Thinking About Offshore Competition …
Costs & benefits often forecast incorrectly

• Accounting is wrong
  • Over-emphasis on direct labor.
  • OEMs misunderstand costs and require unproductive moves overseas.
    – Many important costs are not in the standard spreadsheet:
      • distraction of top management (lost focus on innovation at home)
      • Increased risk from long supply chain, esp. with JIT
    – Increased “handoff costs” between US and foreign operations
      • Products must be more clearly specified
      • Quality problems may be harder to solve due to geographic and cultural distance
      • More difficult communication among product design, engineering, and production hinders serendipitous discovery of new products and processes
      • Reduced quality, increased time-to-market

⇒ Long term less innovation
How can this be?

• Debate over impacts of offshoring is stalled because carried out at high level of abstraction—even inside firms

• Managers don’t always understand the process that employees actually use
  – If they underestimate interface complexity, may underinvest in proximity or governance
  – Cost projections explicitly assume that overseas plants will equal US productivity
“Learning Lean” vs. “Lean Standardization” model

- **Lean standardization model** Achieves significant performance improvements by focusing solely on the technical elements of lean production without modifying HR practices & culture change to encourage worker involvement.

- **Learning lean model** Combines low-waste manufacturing practices (lean) with an involved, empowered, & prepared workforce focused on innovation, quality & organizational flexibility (learning).
“Learning Lean" model generates better performance because

• Continuous innovation is needed because plants must handle more variety & falling average order sizes as highest-volume orders are most likely to be lost

• Routine self-management is needed to reduce costly supervisory overhead

• Continuous improvement requires knowledge that only direct workers have
Example: Delphi Kokomo Printed Circuit Boards

• Delphi Kokomo brought back work from Singapore
  – Increased capacity utilization on existing machines
    • Quality improvement
    • Earlier inspection
  – More broadly trained skilled workers

• Highly paid workers stay a long time—develop deep knowledge

• Knowledge-sharing requires trust between labor and management
  – Union can be a vehicle for negotiating and enforcing agreements about who benefits from productivity improvements
Off-shoring: local or global optimum?

- Off-shoring has benefits given current US automotive product development system (saves money)
- But, distance can drive interfaces (as well as vice versa)!
  - US vs Japan product design strategy
    - US OEM tolerates lower, slower interaction to achieve lower measured cost of off-shored design
    - Japanese emphasize understanding of context: employees need to understand not just their own job, but the context within which they do their job
      - Indian designer makes mistake because not continually reminded of the function of his design
  - Choice of organization will affect evolution of interfaces
  - Is off-shoring hindering evolution of US industry to a more efficient product development process?
Developing Capabilities for Clean Cars
Not much progress recently...

Source: http://www.epa.gov/otaq/cert/mpg/fetrends/420s06003.pdf
Big increases in auto energy efficiency will require major effort

• Invention and innovation
  – Fuel cells, hydrogen

• Ramping up to mass production
  – Regenerative braking

• Incremental improvement using existing technology
  – Can be the source of significant gains
  • Tenneco diesel—cut NOx emissions by 90%
  • Debug production process for recyclable seats
  – Second-tier suppliers a weak link
    • Tooling sector is in trouble
    • Other second tier suppliers
      – Weak product development capabilities
      – Much room for reducing energy use in production
But capabilities for this effort are lacking

• Shortage of skilled workers
  – Auto industry buyouts
    • ¾ of Delphi employees
    • 38,000 GM, 35,000 Ford, 11,000 Chrysler employees
  – National Association of Mfrs study
    • 90% of manufacturers report moderate to severe shortage of skilled production employees
    • 65% report moderate-to-severe shortage of scientists and engineers
  – Yet firms are proposing wage cuts

• Employee involvement programs are atrophying
Conclusions

• US automotive manufacturing is not dead yet
• But, underinvestment in human and organizational capital hurts firms’ ability to meet future challenges
  – Offshoring
  – Energy