AUTOMOTIVE CLUSTER IN JAPAN: THE AICHI REGION

Masatsugu Tsuji

OSIPP (Osaka School of International Public Policy)
Osaka University

DIJ-EU-IIC, Tokyo 2004
OUTLINE

• Structure of automobile production
• Toyota vs. GM
• Economic foundation of hierarchical structure
• IT and Toyota production system
• Globalization and Toyota
Figure 1: Hierarchical Structure of Automobile Industry

(i) primary parts manufacturers (primary subcontractors)

- related parts manufacturers
  - tire bearing

(b) specialized parts manufacturers

- primary parts (complete)
  - piston, clutch, brake
  - transmission case
  - instrument panel

(c) subcontractors

- casting
- forging
- machine work
- plating
- simple parts

(ii) secondary parts manufacturers (secondary subcontractors)

- subcontracting work
  - casting
  - forging
  - press
  - machine work
  - plating

- simple parts
  - clutch, cylinder, radiator
  - brake lining, thermostat

(iii) tertiary parts manufacturers (tertiary subcontractors)

- subcontracting work
  - casting, forging, press
  - machine work, plating

- general parts
  - screw, cloth
  - cogwheel
  - spring
Production Structure: Toyota vs. GM I

- Hierarchical
  - Toyota Group
    - Primary parts suppliers: 168
    - Secondary parts suppliers: 5,437
    - Tertiary parts suppliers: 41,703
    - Long-run contract relationship: 36,000

- Non-hierarchical
  - GM
    - Parts suppliers: 12,000
    - Short-run competitive
## Toyota vs. GM: II

<table>
<thead>
<tr>
<th>Toyota</th>
<th>GM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low domestic production: 20-25%</td>
<td>High: 40-50%</td>
</tr>
<tr>
<td>400 trade partners</td>
<td>Many more</td>
</tr>
<tr>
<td>Toyota dominates</td>
<td>Equal partner</td>
</tr>
<tr>
<td>Long-term commitment to quality and price</td>
<td>Market-based relationship</td>
</tr>
<tr>
<td>Parts suppliers invest in specific equipment</td>
<td>General equipment</td>
</tr>
</tbody>
</table>
Centralization of Toyota Plants

11 plants are located in the Nishi-Mikawa region.
## Concentration of Toyota and its Parts Suppliers I

<table>
<thead>
<tr>
<th></th>
<th>Aichi Pref.</th>
<th>Gifu Pref.</th>
<th>Mie Pref.</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>Owari</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hishi-Mikawa</td>
<td>11</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Higashi-Mikawa</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Toyota</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Toyota Group</td>
<td>11</td>
<td>34</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Kyohokai</td>
<td>33</td>
<td>80</td>
<td>3</td>
<td>10</td>
</tr>
<tr>
<td>%</td>
<td>22.6</td>
<td>54.8</td>
<td>3.4</td>
<td>6.8</td>
</tr>
</tbody>
</table>

Other Mie Pref. = 3

Other Pref. = 20

Other Gifu Pref. = 13.71

Other Owari Pref. = 3.7
# Concentration of Parts Suppliers II

<table>
<thead>
<tr>
<th></th>
<th>Aichi Pref.</th>
<th>Gifu Pref.</th>
<th>Mie Pref.</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Owari</td>
<td>Hishi-Mikawa</td>
<td>Higashi-Mikawa</td>
<td></td>
</tr>
<tr>
<td>Denso</td>
<td>22</td>
<td>32</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>Toyota Gosei</td>
<td>54</td>
<td>4</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>Toyota Shatai</td>
<td>34</td>
<td>33</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Aichi Seiko</td>
<td>38</td>
<td>4</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Reasons for Concentration

Coase=Williamson:

Save costs of transportation and information

Economies of scale

Synergy effect

Classical theory can apply
Economic Foundations

• GM vs. Toyota

GM

services

Inefficiency of large organization

Toyota

Parts s.

services

Principal

agent

Saving of transaction and information costs
Principal-Agent Model

Basic Assumptions

(1) Monitoring
   Quality
   Price

(2) Incentive mechanism
   Profit sharing
   Risk sharing
Why do parts suppliers stay in the hierarchical structure?

• Costs of delivery
• Quality management
• Forced collaboration with Toyota

Hypothesis: Growth Sharing
### Table 3-7: Up-Grading of Primary Parts Manufacturers of Toyota Motor Co.

<table>
<thead>
<tr>
<th>Employee Capital 10 Thous Yen</th>
<th>1974</th>
<th>1988</th>
</tr>
</thead>
<tbody>
<tr>
<td>over 1,000</td>
<td>over 100,000</td>
<td></td>
</tr>
<tr>
<td>over 1,000 ~ 999</td>
<td>over 99,999</td>
<td></td>
</tr>
<tr>
<td>300 ~ 499</td>
<td>5,000 ~ 9,999</td>
<td></td>
</tr>
<tr>
<td>201 ~ 299</td>
<td>2,001 ~ 4,999</td>
<td></td>
</tr>
<tr>
<td>101 ~ 200</td>
<td>1,001 ~ 2,000</td>
<td></td>
</tr>
<tr>
<td>51 ~ 100</td>
<td>1,000 ~ 501</td>
<td></td>
</tr>
<tr>
<td>50 ~ 21</td>
<td>101 ~ 500</td>
<td></td>
</tr>
<tr>
<td>1 ~ 20</td>
<td>less than 100</td>
<td></td>
</tr>
</tbody>
</table>

Source: Aichi Keizaijih, No. 120 and Shiomi [1985] for 1974 
Realty of Toyota Group 1988, for 1988
Transformation of the Japanese Economy

• Information Society (IT)

• Globalization

How do these affect the Toyota production structure and the location of Toyota and its parts suppliers?
Revival of U.S. Automobile Industry I

• Concurrent Engineering

Chrysler “Neon” in 1993

2000cc engine, $10,000

Comparison of development period and costs

Neon  31 months  US$ 130,000
Saturn (GM)  7 years,  $ 350,000
Escort (Ford)  4 years  $ 200,000

Cf. Toyota was 37 months
Revival of U.S. Automobile Industry II

- ANX (American Automotive Network Exchange)

  e-marketplace

- GM
- Ford
- Chrysler
IT and Toyota Production System

- Kanban Method → e-Kanban Method

Lead time: 2 hours
Globalization and Toyota I

Manufacturing Plants in North America

② TMMC (1988: 166,131)
④ NUMMI (1984: 305,691)
⑦ TMMK (1988: 446,199)
⑧ TMMI (1998: 170,442)
Globalization and Toyota II

Manufacturing Plants in Europe

① TMMF (2001: 61,904)
③ Portugal (1968: 4086)
④ UK (1992: 153,415)
Manufacturing Plants in Asia

⑦ Indonesia (1970: 0,083)  
⑧ Malaysia (1968: 22,115)  
⑪ Philippines (1989: 15,873)  
⑫ Taiwan (1986: 67,495)  
⑮ Thailand (1964: 90,708)  
⑰ Vietnam (1996: 5,760)
Toyota’s Overseas Production

The chart shows the overseas production of Toyota from 1992 to 2001, categorized by regions: North America, Latin America & the Caribbean, Europe, Africa, Asia, Oceania, and Middle East & Southwest Asia. The production numbers are indicated on the y-axis, ranging from 0 to 1200, and the years from 1992 to 2001 are marked on the x-axis.

- **North America** shows a steady increase, reaching its peak in the late 1990s.
- **Latin America & the Caribbean** has a more fluctuating trend, with a notable decline around 1998.
- **Europe** exhibits a consistent growth pattern, particularly noticeable in the latter half of the period.
- **Africa** maintains a relatively low production level throughout the years.
- **Asia** shows a steady increase with a slight dip in the early 2000s.
- **Oceania** remains at a low level, similar to Africa.
- **Middle East & Southwest Asia** also shows a steady increase, with a slight decrease in 1998.
Toyota’s Overseas Sales
# Plants of Toyota Parts Suppliers

<table>
<thead>
<tr>
<th>Toyota Group</th>
<th>Calif.</th>
<th>IN</th>
<th>KY</th>
<th>MI</th>
<th>OH</th>
<th>IL</th>
<th>TN</th>
<th>CA/Canada</th>
<th>Others</th>
</tr>
</thead>
<tbody>
<tr>
<td>Toyota Group</td>
<td>5</td>
<td>3</td>
<td>6</td>
<td>3</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>Kyohokai</td>
<td>1</td>
<td>2</td>
<td>6</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>
Conclusion

Toyota’s Strengths

*Jidoka* (automation)
*Kanban* Method (Just-in-time)
QM and TQM (labor participation)

Dispersion due to globalization

Negative and positive aspects

Toyota is behind in the IT revolution

Above strengths still larger