China’s Economy: Growth and Global Connections

Case Study: State Sector Reforms and Evolution in the Semiconductor Industry
China’s electronics and semiconductor industry, circa 1985, was enmeshed in a complex hierarchy

PRC President Jiang Zemin (served 1993-2003) in 1997:

“In reality, ...[history] shows that if a country has several group companies it will be assured of maintaining a certain market share and position in the international economic order. America, for example, relies on General Motors, Boeing, DuPont and a batch of other multinational companies. Japan relies on six large enterprise groups, and South Korea relies on ten large commercial groupings. ...Our nation’s position in the international economic order will be to a large extent determined by the position of our nation’s large enterprises and groups.”

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抓大放小

“Grasp the Large, Let Go of the Small”
Profits of PRC’s 12 largest global 500 companies; all are SOEs

- Sinopec Group
- China National Petroleum
- State Grid
- Industrial & Commercial Bank of China
- Agricultural Bank of China
- China Construction Bank
- China State Construction Engineering
- Bank of China
- China Mobile Communications
- SAIC Motor
- China Railway Engineering
- China National Offshore Oil

SOURCE: FACTSET RESEARCH SYSTEMS

CHART: STACY JONES
SOE Reforms: Case Study in Semiconductor Industry

PKU Globex
How did China move from central planning and state ownership to a mixed ownership and global integration?

- Specific industries are illustrative of industry changes
  - 5YP by industry
  - Take-off by industry
  - One industry may help us understand groups of industries

- Main findings: interplay of SLD and “enterprise-led development” in the 1990s
  - Initially one-off efforts, then enterprise-based learning, then industry-wide policies
  - Different than general SOE reforms
  - Results were significant, but behind the vanguard, incremental, and organizational (vs tech)

Diagram:
- One-off State Investments
- 1990s
- Enterprise-based Learning (in selected state-invested enterprises)
- 2000s
- New Industry-wide Policies for ALL firms
China’s electronics and semiconductor industry, circa 1985, was enmeshed in a complex hierarchy

*Simon notes that in 1985, the Ministry of the Electronics Industry oversaw some 2600 production units and 130 research institutes. In 1988, the State Machine Building Commission and the Ministry of the Electronics Industry merged to form the Ministry of Machine Building and Electronics Industry.

Importantly, in parallel with general SOE reforms, a new leading group made plans to invest in specific electronics industry projects

- 1982, new leading group, strategy of “Control Fragmentation, Control Chaos (治散, 治乱)”
  - Funds for 33 sites for new equip, but little success

- 1983, strategy of “Build 2 Bases and 1 Point”

- 1985, new guidelines
  - Focus on applications, foreign tech, and whole industry chain, with mfg emphasis
  - Use markets/competition, use national projects for large investments
  - Get funding through competitive bids and foreign capital

- 1986, “divestiture” of production & research units

- 1989,
  - Allocated RMB5b for 2 bases, 5 key enterprises
  - The #742 Factory selected to anchor the South Base, pursue 1 micron production, and (hopefully) be China’s “1st world-class IDM”

Officials hoped that one functioning IDM would attract a full industry chain, including both domestic and foreign firms
An overview of China’s major semiconductor projects and enterprises in the 1990s (now #2, #8, and #9)

- **Project 908**
  - Huajing, Inst 24 w/ ATT and CSMC SOE (>JV)
  - IDM
  - Wuxi, est 1989

- **Project 909**
  - Huahong-NEC JV with Japan
  - IDM
  - Shanghai, est 1994

- **SMIC**
  - WFOE, but “Chinese” w/ Taiwanese Mgmt
  - Foundry
  - Shanghai, est 1999

3 Other Sino-Foreign JVs (w/ Alcatel, Philips, NEC)

Electronics OEMs and ODMs increase in China

Foreign Firms bring Pak-Assy-Test to China

While ramping up semiconductor production, China’s market for semiconductors was growing
An overview of the semiconductor and electronics industry

- Semiconductor companies used to be “IDMs” (integrated device mfg, e.g., Intel, Samsung, etc.)
- But vertical integration gave way to sectors by late 1990s, e.g., Freescale came out of Motorola for design
- IC industry sectors:

  - Design
  - Manufacturing: (“Fabrication” in a “Foundry”)
  - P.A.T.: (Packaging, Assembly, Test)

- Semiconductors in the broader electronics supply chain

  - Semiconductor Cos. (ICs or discreet devices)
  - EMS (ECM) or ODM (often in China)
  - OEM (global brands, e.g., Apple)
Project 908 at Huajing remained unfunded for over 5 years

**Obstacles, 1989-1996**

- Funding
- Timing
- Technology and organization
- Foreign challengers
- Management

Lacking funding, equipment, and production, Project 908 was called a failure, and locals protested the once renowned Huajing.
Ultimately, Huajing’s managers made major operational changes

**Enterprise Solutions at Huajing, 1997-2002**

- From old management to new
- From enterprise to individual accounting units
- Using Taiwanese managers and tech (via JV) and the foundry model
- From vertical integration to sectoral businesses
- From central to municipal control, from debt to stock
- From Huajing to China Resources

The lessons and changes at Huajing informed Project 909 and previewed transitions in the industry
Huajing’s revenues increased significantly from 1995, and it remains one of China’s largest semiconductor companies.

Estimates of Huajing-affiliated Organizations’ Revenues in US$ millions

These estimates are based on ratios of revenues among Huajing-affiliated organizations. Since 2008, Huajing-affiliated organizations have combined financial statements under CRM, but previous years are estimated based on Huajing data from earlier years.

Sources include:
CRM (China Resources Microelectronics) annual reports.
Chinese leaders instigated Project 909 in 1995

**Why a capital-intensive project in a rapidly advancing, competitive industry?**
- Existing enterprises need to upgrade production, growing market, use shop-floor to catch-up, no firms with necessary capital nor capital markets
- Not due to the performance of state firms nor import-substitution nor foreign exclusion

**Approval, funding, timing**
- Leaders: Premier Li Peng, President Jiang Zemin, Minister Hu (MEI), and Mayor Xu
- US$2b, ~7% of 1995 military budget, initially US$500m
- MEI got money from Premier’s Fund, didn’t need multiple approvals
- In 4 months, State Council and National Planning Committee approved/funded 909

**Lessons from 908 (with over 30 Huajing staff):**
- Can’t merely import production lines, need expertise, maintenance, training, etc.
- Don’t pursue leading edge tech, it changes too fast, and China’s market is low/med
- Funding is not enough, need international talent and capital, need talent and designs from start, “bring in any willing foreign partners for participation”

908 was production focused, but 909 would be production, design, talent, and market focused
Yet, 909 leaders had difficulty attracting a foreign partner

**Goals:**
- A functioning IDM would attract full industry chain, includes domestic & foreign firms
- Serve China’s market, revenue for virtuous cycle of upgrading, market-led vs tech-led

**Potential partners:**
- Contacted 30-40 potential foreign partners
- Response: no business plan, no revenues, investment is loans, 908 “failed,” no mgmt team, 20 yrs behind global tech, make mostly discrete devices, tough policy environment
- 909 recruited from Huajing, across China, and CAS; offered large comp to foreigners

**Breakthrough:**
- Connect negotiations & market: offer partners newly state controlled IC card market
- 5 firms negotiate for over a year, resulting in NEC as partner in 1997

**NEC JV:**
- would supply the GM, run sales & marketing, provide tech and market
  - Producing in 1999, claimed profits in 2000
  - Adopted the foundry model (90% in ’03), developed IP with foreign partners

909 was more successful than 908, but China’s (1990s) policy environment was a problem during negotiations and operations
These enterprise-based experiences in ‘90s ultimately led to industry-wide policy changes via “Document 18” in mid 2000

- Enterprise obstacles in 1990s:
  - Multi-step approval processes
  - Inconsistent and high importation costs and tax policies
  - Large black market for smuggled electronic components
  - Limited access to foreign capital

- “One-offs”: Enterprises got “one-off” preferential tax and tariff exemptions, subsidies, etc., but making such arrangements was not transparent nor predictable

  - Easing firm and branch formation
  - Clarifying and decreasing taxation
  - Encouraging foreign investment and trade
  - Increasing capital sources and availability
  - Protecting IP (?)

WTO agreements further improved policies by 2005, but production had been ramping up from 1995 and ongoing Chinese enterprises were established
2016: China is 59% of global semiconductor market & 16% of production, with design being the fastest growing sector

Sources:
2) Wang Yangyuan and Wang Yongwen, Wo Guo Jichengdianlu Chanye Fazhan Zhilu: cong Xiaofei Daguo Zouxiang Chanye Qiangguo 我国集成电路产业发展之路：从消费大国走向产业强国 (China’s Integrated Circuit Industry Development Path: From a Big, Consuming Nation to a Strong, Industrial Nation), Kexue Chubanshe 科学出版社 (Science Press), 2008, page 123, per CSIA
China’s semiconductor production (blue) and market (red)

This graph is constructed from the following sources:
2) Wang Yangyuan and Wang Yongwen 王阳元 and 王永文, Wo Guo Jichengdianlu Chanye Fazhan Zhilu: cong Xiaofei Daguo Zouxiang Chanye Qiangguo 我国集成电路产业发展之路：从消费大国走向产业强国 (China’s Integrated Circuit Industry Development Path: From a Big, Consuming Nation to a Strong, Industrial Nation), Kexue Chubanshe 科学出版社 (Science Press), 2008, page 123, per CSIA.

Note: The PWC analyses uses data from CSIA and CCID, both associated with China's Ministry of the Information Industries. The data includes all enterprises operating in China, including foreign enterprises, not just Chinese owned or state owned enterprises.
Industry growth and global integration resulted in thousands of Chinese personnel gaining valuable experience.

By 2005, 18 of 25 of the world’s largest semiconductor firms had design groups in China.
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From 2000, the industry in China also moved up the value chain as more activity was concentrated in the design sector.

### Production Revenues in China, by Sector (RMB100 million), excluding Discrete Devices

<table>
<thead>
<tr>
<th>Year</th>
<th>2000</th>
<th>2001</th>
<th>2002</th>
<th>2003</th>
<th>2004</th>
<th>2005</th>
</tr>
</thead>
<tbody>
<tr>
<td>Design</td>
<td>9.8</td>
<td>14.8</td>
<td>21.6</td>
<td>44.9</td>
<td>81.8</td>
<td>124.3</td>
</tr>
<tr>
<td>1. Percent of industry</td>
<td>5</td>
<td>7</td>
<td>7</td>
<td>13</td>
<td>15</td>
<td>18</td>
</tr>
<tr>
<td>Fabrication (manufacturing)</td>
<td>48</td>
<td>27.7</td>
<td>33.6</td>
<td>60.5</td>
<td>180</td>
<td>232.9</td>
</tr>
<tr>
<td>2. Percent of industry</td>
<td>26</td>
<td>14</td>
<td>14</td>
<td>17</td>
<td>33</td>
<td>33</td>
</tr>
<tr>
<td>Packaging, Assembly, Testing (P.A.T.)</td>
<td>128.4</td>
<td>161.1</td>
<td>213.3</td>
<td>246</td>
<td>283.5</td>
<td>344.9</td>
</tr>
<tr>
<td>3. Percent of industry</td>
<td>69</td>
<td>79</td>
<td>79</td>
<td>70</td>
<td>52</td>
<td>49</td>
</tr>
<tr>
<td>Total</td>
<td>186.2</td>
<td>203.6</td>
<td>268.5</td>
<td>351.4</td>
<td>545.3</td>
<td>702.1</td>
</tr>
</tbody>
</table>


By 2000, China was home to 2.5% of global semiconductor revenues and by 2010, 10.8%.