Knowledge generation within Korea’s bipolarized national system of innovation

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1. Introduction

- Korea as a mixture of advanced country and developing country features: catching up country
  - Advanced large manufacturing firms
  - Laggard small manufacturing and service firms
- Changes and pressure from globalization
2. Main Trends: History of NSI

- Japanese colonial rule 1910-45; US military rule 45-48; Korean War 50-53; Restructuring 53-60
- 5-Year Plans 1960s on; Export policy
- Chaebol group firms
- Gov’t Research Institutes (GRIs) and other S&T infrastructure: 1970s-1980s
- Liberalization of economic system: from 1980s
- Post-1997 Asian Financial Crisis; Reform
2. Main Trends: History of NSI
3. Propensity to Innovate

- Lower propensity to innovate as compared to European countries
- Large firms in manufacturing sector most innovative
- Dominant pattern: imitative innovation through reliance on foreign technology
Figure 1. Share of innovative firms in Korea

Note: 1 ‘small’ firms: firms with 10-49 employees in Europe. 10-99 in Korea
2 ‘medium’ firms: firms with 50-249 employees in Europe. 100-299 in Korea
3 ‘large’ firms: firms with more than 250 employees in Europe, more than 300 in Korea

4.1. Knowledge inputs to innovation

4.1.1. R&D Activities

- High R&D intensity; specializing in ICTs
- R&D activity headed by domestic firms: large firms
- Public sector org in R&D
  - GRIs (mainly applied research): relatively large sector
  - National testing labs and R&D institutes
- Weak university R&D
- R&D by FDI firms not active
Figure 3. R&D as a fraction of GDP
Figure 4. Changing relationship between royalty payments and R&D

Figure 5. Patenting trend of Korea in the US

Figure 6. South Korea’s revealed technological advantage

4.1.2. Competence Building

- Rapid expansion of education system.
- Training provided by Korean education system not meeting demands of domestic firms.
- Key actor in investment in training for competence building = firms: large firms.
Figure 7. Share of the population with at least an upper-secondary qualification—Percentage in 2001
4.2. Demand-Side Factors
4.2.1. Formation of new markets
- Government policies
  - Expansion of demand for broadband internet service by encouraging diffusion of broadband internet network
  - Encourage utilization of IT by small firms
  - Set industry standards, i.e. CDMA
4.2.2. Demand Articulation of Quality Requirements
- Large firms
- Standards and regulation by government
4.3. Provision of Constituents

4.3.1. Generation of Organizations.

- Spate of new venture businesses, post-1997
  - Government driven
  - Neglecting market mechanism
- ‘Internal ventures’ and spin offs by firms of Chaebol group.

4.3.2. Networking, Interactive Learning and Knowledge Creation

- Occurring recently b/w large firms and GRIs
- Funding incentives from the government
  - Exploitation by firms
- NTBFs as a new partner for Large firms
  - little technological gap in specialty area: traditionally big technology gap between large firms and subcontracting small firms
### Table 1. Spin-offs from the firms in the Chaebols

<table>
<thead>
<tr>
<th></th>
<th>No. of mother co.</th>
<th>1997</th>
<th>1998</th>
<th>1999</th>
<th>2000</th>
<th>2001</th>
<th>Total</th>
<th>No of employees</th>
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<td>Samsung</td>
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<td>0</td>
<td>115</td>
<td>29</td>
<td>5</td>
<td>12</td>
<td>161</td>
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<td>36</td>
<td>27</td>
<td>18</td>
<td>8</td>
<td>9</td>
<td>98</td>
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<td>LG</td>
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<td>5</td>
<td>18</td>
<td>51</td>
<td>14</td>
<td>6</td>
<td>94</td>
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<td>SK</td>
<td>11</td>
<td>3</td>
<td>11</td>
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<td>4</td>
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<td>1</td>
<td>40</td>
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<td>0</td>
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<td>1</td>
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<td>103</td>
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<tr>
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<td>5</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>9</td>
<td>144</td>
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<tr>
<td>Dongyang</td>
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<td>2</td>
<td>1</td>
<td>0</td>
<td>3</td>
<td>227</td>
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<tr>
<td>Hyosung</td>
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<td>0</td>
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<td>0</td>
<td>2</td>
<td>52</td>
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<tr>
<td>CJ</td>
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<td>0</td>
<td>1</td>
<td>4</td>
<td>6</td>
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<td>0</td>
<td>3</td>
<td>0</td>
<td>3</td>
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</tr>
<tr>
<td>Hyundai Dept</td>
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<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>658</td>
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<tr>
<td>Daewoo E.</td>
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<td>0</td>
<td>0</td>
<td>4</td>
<td>0</td>
<td>4</td>
<td>60</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>76</strong></td>
<td><strong>47</strong></td>
<td>178</td>
<td>124</td>
<td>53</td>
<td>40</td>
<td>442</td>
<td><strong>67,863</strong></td>
</tr>
</tbody>
</table>

**Notes:**
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Figure 8. Trends of co-invented patents

Source: Korea Institute of Patent Information
4.3.2. Networking, Interactive Learning, Knowledge Creation (cont)

4.3.3. Provision of Institutions

- Government as main actor 1960s, 1970s → Market mechanisms
  1980-2000 → Government as main actor, post-Asian Financial Crisis

- Government as the driver of economic reform after the financial crisis: corporate governance, the financial system, labour relations, government sector

- Big change: large firms as a target for reform, end of life time employment, deregulation, fully opened economy
4.4. Support Services

4.4.1. Incubating Activities
- Incubators under the government initiative

4.4.2. Financing
- Predominance of banking system: moving from mortgage based loan system to credit based loan system, under the new supervisory framework in imitation of the US system

4.4.3. Consultancy Services
- Poorly developed
4.5. Summary of Main Activities in NSI

- Private sector as the leading sector
  - Large firms (and their networks)
- Rise in FDI inflow: FDI firms as emerging actors but still weak in their position
- GRIs major actors in public R&D sector
- Not much cooperation b/w universities-industry-GRIs, however recent rise in cooperation
- Education system rapid expansion, slow upgrading of the quality: laggard to meeting demand from advanced large firms

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## 5. Consequences of Innovation

### Table 2. The Korean NSI with high R&D intensity and low performance

<table>
<thead>
<tr>
<th>I/O</th>
<th>Criteria</th>
<th>Compared to OECD</th>
<th>Compared to EU</th>
<th>Compared to Asian tigers</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Input</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>R&amp;D intensities: R&amp;D per GDP</td>
<td>Highest level</td>
<td>Highest level</td>
<td>Highest</td>
<td></td>
</tr>
<tr>
<td><strong>Output</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Innovativeness: innovation survey</td>
<td>n.a.</td>
<td>Manuf: lower with 10.7% gap</td>
<td>n.a.</td>
<td></td>
</tr>
<tr>
<td>Innovativeness: Patenting per population</td>
<td>Low</td>
<td>Low</td>
<td>n.a.</td>
<td></td>
</tr>
<tr>
<td>Productivity</td>
<td>n.a.</td>
<td>Lowest</td>
<td>Lowest</td>
<td></td>
</tr>
<tr>
<td>GDP per capita$^1$</td>
<td>n.a.</td>
<td>Low-middle in terms of GNI per capita (OECD 2005)</td>
<td>Low</td>
<td>Lowest</td>
</tr>
</tbody>
</table>
6. Globalization and the NSI

- Korean firms rely on foreign sources: for marketing and for knowledge intensive R&D activities which they are lack of
- Well connected within global production network, less well connected in R&D network
- Major institutional changes and innovation pattern after external shock from globalization
  - mismanagement of liberalization process => financial crisis => IMF pressure => 4 major economic reform, fully opened market
  - Expansion of inward FDI investment => increased role of FDI
  - Leading innovation pattern: agile commercialization of emerging technology abroad
  - Top large firms emerge as the leading global players in product development

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6. Globalization and the NSI

Figure 9. Increase in foreign direct investment

Note: Based on notified figures 2001*: January to June
Source: Ministry of Commerce, Industry and Energy
6. Globalization and FDI
6.2. Expansion of FDI and multinational firms

- the importance of FDI in Korean NSI increased.
  - The share of patents filed between 1998 - 2004 by FDI firms (equity more than 50%):
    - rose to 3.7% of all the patents from 0.4% between 1990-1997
6.2. Expansion of FDI and multinational firms

- Enhancement of FDI firms’ R&D activities after the crisis?

Figure 10. Patents filed in Korea by FDI (>50% F. Share) : 1990-2005
7. Strengths and Weaknesses of the System and Policies

- Strengths:
  - large firms
  - strong manufacturing base
  - IT investment and diffusion
  - GRIs
  - highly educated population
7. Strengths and Weaknesses of the System and Policies

- Weaknesses
  - poor knowledge infrastructure for small firms (dual structure)
  - weak competence of small firms
  - weak science base
  - Fragmented nature of economic, industrial and S&T policies
8. Future Innovation Policy

- 2004’s policy move towards national systems of innovation
  - Enhance innovation capability, increase R&D expenditure, develop strategic technology, reinforce cooperation, coordinate policies
  - Governmental body for coordinating S&T policies
  - S&T policy agenda as the national agenda: from peripheral agenda
  - New ideas confined to the narrow sense of science and technology policy
- NSI with FDIs: attracting and integrating
8. Future Innovation Policy

- Bi polarized NSI: weak small firm innovation
  - More small firms get innovative: not strong enough to support large firms’ competitiveness
  - Innovation through large firm-small firm linkage
  - Public R&D organizations for small firms
  - Consulting organizations for small firms: marketing, outsourcing.
  - System for supporting small firms’ export drive

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8. Future Innovation Policy

- Mismatches and strategic dissonances
  - Institutions and policy conflicts
  - Strategic dissonances
    - Mismatch between policy objectives and measures: high impact
    - The policy on the assumptions on the complex innovation systems: not supported by empirical data, high impact