Ex Ante Evaluation Methodologies used in Korea for Public Research Resource Allocation

Byeongwon Park

Technology Foresight Center
Korea Institute of S&T Evaluation and Planning
Korea’s S&T has achieved remarkable growth during the last half century.
Past and Present of Korea’s S&T

World 8th Power in S&T by 2025

Rapid Progress all the area in S&T related activity

- Technological Competitiveness
  2nd (IMD, 2005)
  7th (WEF, 2005)

- # of Researcher
  156,220 FTE
  44% ↑ (since 2000)

- Corporate Research Institutes
  10,270 (2004)
  44% ↑ (since 2000)

- New S&T Administration
  Since 2004

- SCI Paper
  19,279 (2004)
  55% ↑ (since 2000)

- US Patents
  4,428
  34% ↑ (since 2000)

- R&D Budget
  28.774 (milliion US$ PPP)
  56% ↑ (since 2000)
World of R&D (2005)

Share of Total R&D (2007)
- US: 36.8%
- China: 14.8%
- Japan: 12.5%
- Korea: 2.8%
## R&D Spending in Private Sectors

### Amount

<table>
<thead>
<tr>
<th>Rank</th>
<th>Company</th>
<th>Sector</th>
<th>Country</th>
<th>Rank 2005</th>
<th>Rank 2003</th>
<th>2005/06 R&amp;D £bn</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Ford Motor</td>
<td>A</td>
<td>USA</td>
<td>3</td>
<td>1</td>
<td>4.66</td>
</tr>
<tr>
<td>2</td>
<td>Pfizer</td>
<td>P</td>
<td>USA</td>
<td>2</td>
<td>5</td>
<td>4.33</td>
</tr>
<tr>
<td>3</td>
<td>General Motors</td>
<td>A</td>
<td>USA</td>
<td>6</td>
<td>4</td>
<td>3.9</td>
</tr>
<tr>
<td>4</td>
<td>Daimler Chrysler</td>
<td>A</td>
<td>Germany</td>
<td>1</td>
<td>2</td>
<td>3.88</td>
</tr>
<tr>
<td>5</td>
<td>Microsoft</td>
<td>S</td>
<td>USA</td>
<td>7</td>
<td>11</td>
<td>3.64</td>
</tr>
<tr>
<td>6</td>
<td>Toyota Motor</td>
<td>A</td>
<td>Japan</td>
<td>4</td>
<td>6</td>
<td>3.73</td>
</tr>
<tr>
<td>7</td>
<td>Johnson &amp; Johnson</td>
<td>P</td>
<td>USA</td>
<td>14</td>
<td>13</td>
<td>3.68</td>
</tr>
<tr>
<td>8</td>
<td>Siemens</td>
<td>E</td>
<td>Germany</td>
<td>5</td>
<td>3</td>
<td>3.64</td>
</tr>
<tr>
<td>9</td>
<td>Samsung Electronics</td>
<td>E</td>
<td>S.Korea</td>
<td>17</td>
<td>33</td>
<td>3.17</td>
</tr>
<tr>
<td>43</td>
<td>Hyundai Motor</td>
<td>A</td>
<td>S.Korea</td>
<td>56</td>
<td>89</td>
<td>1.36</td>
</tr>
</tbody>
</table>

### Growth Rate

<table>
<thead>
<tr>
<th>Rank</th>
<th>Company</th>
<th>Country</th>
<th>Growth of R&amp;D 1 yr</th>
<th>Growth of R&amp;D 4 yr</th>
<th>R&amp;D £bn</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>BAE Systems</td>
<td>UK</td>
<td>31%</td>
<td>41%</td>
<td>1.45</td>
</tr>
<tr>
<td>2</td>
<td>Oracle</td>
<td>USA</td>
<td>25%</td>
<td>49%</td>
<td>1.09</td>
</tr>
<tr>
<td>3</td>
<td>Hyundai Motor</td>
<td>S. Korea</td>
<td>22%</td>
<td>110%</td>
<td>1.36</td>
</tr>
<tr>
<td>4</td>
<td>Johnson &amp; Johnson</td>
<td>USA</td>
<td>21%</td>
<td>45%</td>
<td>3.68</td>
</tr>
<tr>
<td>5</td>
<td>Motorola</td>
<td>USA</td>
<td>20%</td>
<td>-1%</td>
<td>2.14</td>
</tr>
<tr>
<td>12</td>
<td>LG Electronics</td>
<td>S. Korea</td>
<td>15%</td>
<td>50%</td>
<td>1.02</td>
</tr>
</tbody>
</table>
How can Korea find the best way to allocate Public R&D Budget?

Various Forms of ex ante Evaluation

Technology Foresight
Technology Assessment
Technology Roadmapping
Technology Foresight
Foresight is booming everywhere

- Increasing interest in thinking about the future of S&T
  - in order to strengthen the ability to anticipate future S&T related issues
  - In order to formulate new strategy for S&T policy

- Nowadays technology foresight (TF) is practiced in many countries and private firms.
  - Because TF can make a unique strategic contribution to the policy maker and firm manager as well as social stakeholders.
  - Especially in the science and technology related area.

- The need for priorities in science and technology
  - No one country can afford vast amount of R&D spending

- This Seville Seminar is a premier example that shows the current emerging issues in Foresight activities.
<table>
<thead>
<tr>
<th>Type</th>
<th>Sponsoring Ministry</th>
<th>Facilitating organization</th>
<th>Thematic Area or Project Title</th>
<th>Time Horizon</th>
<th>Methodology</th>
</tr>
</thead>
<tbody>
<tr>
<td>TF (2006)</td>
<td>Ministry of Environment</td>
<td>KIEST (Korea Institute of Environmental Science and Technology)</td>
<td>Future Trends in Environmental Technology</td>
<td>+15 yrs</td>
<td>Environmental Scanning Delphi</td>
</tr>
<tr>
<td>F</td>
<td>The Presidential Office</td>
<td>Presidential Committee on Education Innovation</td>
<td>Future of Education in Korea -What we do right now?</td>
<td>+15 yrs</td>
<td>Panel</td>
</tr>
<tr>
<td>ST (2006)</td>
<td>Ministry of Planning and Budget</td>
<td>Co-Work with KDI(Korea Development Institute)</td>
<td>Vision 2030 - Layout for government Budget Spending up to 2030</td>
<td>-2030</td>
<td>Panel</td>
</tr>
</tbody>
</table>
Overview of the 3rd Korean Technology Foresight

- S&T basic Law: Article 13 (enacted in 2001)
- Every 5 years (carried out by KISTEP)
- Provide the vision and direction of emerging S&T area – identify new technology that may have high potential for growth of national wealth and betterment of quality of human life
- Has to implement in S&T basic plan (every 5 year, 2nd Plan for 2008-2012))

* 1st TF (1993-1994) and 2nd TF (1997-1998) were Lab-Directed Research Projects carried out by STEPI * and KISTEP

* STEPI (Science and Technology Policy Institute)

* 3rd TF was carried out in 2003-2004 by KISTEP and it is the first TF after enactment of S&T basic Law.
• Consideration of socio-economic needs and issues in future Korea and enlargement of participation of the stakeholders
• Application of Delphi methods for emerging technology that may solve the future needs and issue
• Scenario writing for future society
  · Future prospect, needs/issues and technology
  · Internal consistency
  · Increase awareness the role of S&T in the knowledge-based society
• Offering of policy alternatives to promote knowledge-based innovative society

Time Horizon : up to year 2030  
TYPE OF EXERCISE ADDRESSED: National – covering all S&T fields and the entire territory of Korea
3rd Korean TF: Procedures

1st phase

Future perspectives
Needs and Issues of society
(4 actors-15 categories-43 subcategories
(Dec. 2003)

2nd Phase

Future Technology Subjects and Delphi Survey Analysis
(Aug. 2004)

3rd Phase

Future Social Systems Scenario Building
(Dec. 2004)
Korean TF : Results

- Technology Foresight with socio-economic consideration (3rd Generation Foresight)
  - Future perspectives, assessment of future needs & issues
  - Scenario writing on future social systems (education, labor, healthcare, safety)

- Identify 761 future technology subjects
  - 61% of them will realize between 2011-2015
  - Korea is still lagging all future technology area
  - Korea has the strong competitiveness in IT area
  - Space and earth is most lagging area (7-10 years)

- Strong emphasis on dissemination to the general public
  - Book, Comics, Movie in addition to formal report

- Government took follow-up action quickly
  - Future Strategic Technology
Future Strategic Technology Initiative

• Government launches new project to identify emerging generic technologies at the national level based on 3rd Korean foresight results

• Critical attributes of national strategic technology
  Emerging
  Disruptive
  Converging
  Strategic area where government should be involved
Priority Setting Procedure

3rd Technology Foresight  
Survey from Industrial & R&D Inst.  
Overseas DB  

Future Tech. Candidate DB (KISTEP)  
1st Screening (Expert Panel)  
Survey & 2nd Screening  

Future Strategic Tech.
Future Strategic Technology 21

- Global observing system
- Climate/weather forecasting
- Marine territory management
- Digital convergence
- Smart computing
- Nano and functional material
- Cognitive science and humanoid robot
- Culture contents
- Digital convergence
- Smart computing
- Nano and functional material
- Information security
- Super efficient transportation
- Bio-resource
- Satellite
- Fusion
- Ubiquitous civil infrastructure
- Hazard, disaster forecast
- Next generation nuclear energy and safety
- Clean and renewable energy
- Global observing system
- Climate/weather forecasting
- Marine territory management
- Bio-safety & defense
- Drug discovery & personalized medicine
- Bio-diversity and natural resources conservation
- Ubiquitous civil infrastructure
- Hazard, disaster forecast
- Next generation nuclear energy and safety
- Clean and renewable energy
- Economic Impact
- Quality of Life
- Public Need
- Regenerative medicine
Technology Assessment in Korea
Technology Assessment in Korea (TAK)

- TAK starts 20~30 years behind OTA and Europe’s PTAs
  - 2003: NBIT converging technology
  - 2005: nanotechnology, RFID
  - 2006: currently working on 3 subjects (nanomaterials, stem cell, UCT)
- According to the Basic Law of Korea S&T in Article 14 Clause 1
  - “Government should evaluate the effect of new S&T developments in the areas of society, economics, culture, ethics, and environment, etc and apply the assessment results to policy”
- More efforts are needed to settle Korean version of TA
  - Enhance the public involvement to reach out for stakeholders and laypersons → citizens forum
Structure of TAK organization

National S&T Committee (NSTC) [review TA results]

MOST [Gateway]

Other Government Departments

Subjects selection committee

KISTEP [TA planning & operations]

TA committee [evaluating TA results]

Citizens forum

Monitoring, Exchange of opinions

Technology analysis subcommittee

Technology assessment subcommittee

Tech A Expert Panel

Tech B Expert Panel
**TAK Procedure**

1. **Selection of subjects**
   - Proposals can be put to the committee from S&T community, NGOs, government departments, etc.
   - The committee decide the priority of subjects to be tackled.

2. **Main TA studies**
   - Prediction of future technology development
   - Analysis and evaluation of consequences
   - Analysis of political options, etc.

   - Public involvement (citizens forum)

3. **Draft document**
   - Expert & stakeholder review
     - (public hearing, etc)

4. **Final document**
   - Reported to National S&T Committee
Main TA studies

1st step
- problem definition
- description of the technology
- prediction of future technology development

2nd step
- description of society and persons affected
- prediction of social developments identification
- analysis and evaluation of consequences

3rd step
- analysis of political options
- communication of the results in a generally accessible form
TA in 2006
Organization of the committee

TA committee
[evaluation of TA results]

- Nanomaterials Expert Panel
  - Technology Analysis subcommittee
  - Technology Assessment subcommittee

- Stem cell Expert Panel
  - Technology Analysis subcommittee

- UCT Expert Panel
  - Technology Analysis subcommittee
  - Technology Assessment subcommittee
Technology Roadmapping
Brief History of TRM in Korea

• Public Sector
  – MOCIE
    • Industrial Technology Roadmap
      – Annually try the new industry area (product) and update old ones.
  – MOST
    • National Technology Roadmap(2002)
  – MIC
    • u-IT839 (8 service, 3 infrastructure, 9 products)

• Private Sector
  – Samsung Electronics
    • Customized TRM based on SRI-framework
NTRM : Approach

Analysis of Industrial Need → 5 visions → 13 Directions → 99 Key Technologies → NTRM

- Incorporate existing TRMs into NTRM with necessary modifications
- Handle basic S&T separately from NTRM based on bottom-up approach

- NTRM include Macro Roadmaps for strategic product/functions and detailed TRM for chosen key technologies
NTRM by 5 Visions

1. Building an information-knowledge-intelligence society
2. Aiming at Bio-Healthtopia
3. Advancing the $E^2$ Frontier
4. Upgrading the Value of Major Industries of Korea Today
5. Improving National Safety and Prestige
Building an Information-Knowledge-Intelligence Society

Meeting a variety of human needs in all areas of life by making IT service more intelligent, mobile, and user-friendly

Anytime, Anywhere, Any-device Communication

Innovation in Contents & Service

Ambient Intelligence
High-speed Wireless Multimedia/ 4G Mobile Communication

Technology
- narrowband CDMA modem
- wideband CDMA modem
- Power control, Smart antenna, Interference, SDR
- Fixed ATM/IP
- Wireless IP core tech. (QoS, Handoff, Resource management)
- Network interworking (GW)
- DO/GPRS
- DO/DV/GPRS enhancements
- ALL-IP core network
- Adhoc, Bluetooth
- PAN

Product
- 2G cellular system
- 4G mobile comm.
- HMI/Hot Spot system
- W-CDMA system/ HSDPA
- Cdma20001x EV-DO/ EV-DV
- Cdma20001x EV system

Competitiveness of domestic technology
- High
- Medium
- Low

Importance
- high
- low

R&D strategy
- basic research
- international collaboration
- applied research
- Outsourcing
Due to legislation, it seems to be quite favorable situation to run TF/TA/TRM in nation-wide in Korea.

But there are several things to be addressed.

- Capability to run TF/TA/TRM (Facilitating)
  - Not many
  - Not enough experiences
- Methodological Competence?
  - What is the best combination of methods
- Impact on Policy making
  - Some, but not Clear yet
Thank you