R&D investment and R&D support for SMEs in Korea

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Total R&D Investment increase trends ('99~'17)

- Ratio of total R&D investment is 4.55% of GDP ('17): 1st among OECD countries
- 4.55% is composed of private sector (3.43%) and government (1.12%)

Source: MSIT, KISTEP (2018)
Increase of government R&D budget of Korea

When government R&D budget amounts to 20 trillion Won (’19), performance against investment became rising issue

Korea government R&D budget trends

Government R&D budget (100 million Won)  Variation over last year (%)
Major countries’ total R&D budget is gradually increasing (’99~’16)

→ Average Annual Increasing Rate: China (21.4%), Korea (7.7%), USA (4.9%), UK (3.5%)
The rate of increase of private sector in R&D investment is higher than that of government. Korea follows this trend.

Major countries’ private and government investment trends

Source: MSIT, KISTEP (2018)
Major countries’ government R&D budget is gradually increasing (’99~’16)

→ Average Annual Increasing Rate: Korea(11.1%), USA(4.0%), German(3.3%)

Source: MSIT, KISTEP (2018)
The role of government R&D investment

The role of developing countries’ government is more important

Advanced countries (7)
USA, Japan, France etc

The role of government
No significance ($p<0.515$)

Developing countries (33)
Korea, China, Mexico etc

The role of government
(+) Significance verification ($p<0.057$)

Increase of R&D efficiency of NIS

Source: KISTEP internal research (2018)
Korea government has ranked 1st since 2010. 1.12% (’17)

Major countries’ government R&D intensity of GDP trends

R&D investment stock (‘91~‘16년): Korea: 1.0; USA: 12.3; Japan: 2.4; German: 2.3

Comparison of major countries’ government R&D budget stock

The ratio of government R&D budget over whole budget was highest in 2014 as 5.0%

The ratio of government R&D budget trends

Source: KISTEP (2019)
Government R&D investment ratio (22.5%, ’17) is second lowest level among major countries

→ The highest ratio was 28.7% (’09) and the ratio is getting lower

Government and private R&D budget ratio

<table>
<thead>
<tr>
<th>Country</th>
<th>Government, public source</th>
<th>Private source</th>
<th>Abroad source</th>
<th>etc</th>
</tr>
</thead>
<tbody>
<tr>
<td>Korea(2017)</td>
<td>22.5%</td>
<td>76.2%</td>
<td>1.3%</td>
<td></td>
</tr>
<tr>
<td>USA(2016)</td>
<td>32.5%</td>
<td>62.3%</td>
<td>5.2%</td>
<td></td>
</tr>
<tr>
<td>Japan(2016)</td>
<td>21.2%</td>
<td>78.1%</td>
<td>0.7%</td>
<td></td>
</tr>
<tr>
<td>German(2016)</td>
<td>28.8%</td>
<td>65.2%</td>
<td>5.9%</td>
<td></td>
</tr>
<tr>
<td>France(2015)</td>
<td>38.3%</td>
<td>54%</td>
<td>7.6%</td>
<td></td>
</tr>
<tr>
<td>UK(2015)</td>
<td>33.9%</td>
<td>49%</td>
<td>17.1%</td>
<td></td>
</tr>
<tr>
<td>China(2016)</td>
<td>20%</td>
<td>76%</td>
<td>0.7%</td>
<td></td>
</tr>
</tbody>
</table>

Source: MSIT, KISTEP (2018)
The ratio of main parts of government R&D budget: 70% (2019)

- Public infrastructure (24.9%), Basic research (20.0%), Innovation eco-system (18.7%)
- Innovation eco-system includes region, commercialization, HR and SMEs

Ratio of Government R&D budget parts

- Major industry (15.2%)
- New industry (13.9%)
- Public-infrastructure (24.9%)
- Quality of life (7.4%)
- Basic research (20%)
- Innovation eco-system (18.7%)
Government R&D investment: Korea case_6

Budget in public infrastructure, quality of life and basic research is increasing
- While budget for region is decreasing, support of SMEs is increasing

Composition of government R&D budget trends

Source: PACST (2019.2.14)
The government R&D budget for SMEs: 3.2 trillion Won (2018)

- Ministry of SMEs and Startups (33.8%), KOSBIR (66.2%)
  * KOSBIR: Korea Small Business Innovation Research Program
- Research budget per project is decreasing from 240 (2016) to 190 million Won (2018)
  * Big company: 1,440 million Won (2018)

<table>
<thead>
<tr>
<th>Classification</th>
<th>2013</th>
<th>2014</th>
<th>2015</th>
<th>2016</th>
<th>2017</th>
<th>2018</th>
</tr>
</thead>
<tbody>
<tr>
<td>Government</td>
<td>168,771</td>
<td>177,428</td>
<td>189,231</td>
<td>190,942</td>
<td>194,615</td>
<td>196,681</td>
</tr>
<tr>
<td>Ministry of SMEs and Startups</td>
<td>8,587</td>
<td>8,850</td>
<td>9,835</td>
<td>9,563</td>
<td>11,172</td>
<td>10,917</td>
</tr>
<tr>
<td>KOSBIR</td>
<td>17,282</td>
<td>17,377</td>
<td>19,367</td>
<td>20,703</td>
<td>22,093</td>
<td>21,390</td>
</tr>
<tr>
<td>Sum (Ratio)</td>
<td>25,869</td>
<td>26,227</td>
<td>29,202</td>
<td>30,266</td>
<td>33,265</td>
<td>32,307</td>
</tr>
<tr>
<td></td>
<td>(15.3%)</td>
<td>(14.8%)</td>
<td>(15.4%)</td>
<td>(15.9%)</td>
<td>(17.1%)</td>
<td>(16.4%)</td>
</tr>
</tbody>
</table>
### Performance of R&D investment for SMEs

The effectiveness of R&D investment in terms of financial performance:
- It depends on the used data and methodology.
- Positive performance in input additionality and employment performance.

### Performance of R&D budget for SMEs

<table>
<thead>
<tr>
<th>Research</th>
<th>Data</th>
<th>Methodology</th>
<th>Input additionality</th>
<th>Output additionality</th>
</tr>
</thead>
<tbody>
<tr>
<td>Case A(2016)</td>
<td>NTIS</td>
<td>PSM</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Case B(2017)</td>
<td>KOSBIR &amp; MSS</td>
<td>PSM &amp; DID</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Case C(2018)</td>
<td>NTIS</td>
<td>Matching &amp; DID, Machine learning</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Case D(2018)</td>
<td>NTIS</td>
<td>Matching &amp; DID, Machine learning</td>
<td>○</td>
<td>×</td>
</tr>
<tr>
<td>Case E(2019)</td>
<td>KOSBIR &amp; MSS</td>
<td>Matching &amp; DID</td>
<td>○</td>
<td>○</td>
</tr>
</tbody>
</table>

○: positive effect, ×: negative effect, △: no correlation

STEPI, 2019
Challenges of R&D investment

Accountability of R&D investment

- The limitation of R&D investment increase
- Low quality of performance compared to quantity of performance
  - Dramatic increase in terms of quantitative performance vs. Qualitative level is not satisfactory

Size of R&D investment vs. Direction of investment

- Economic growth through inclusive innovation
- Social problem resolving R&D and participation of people
Challenges of R&D support for SMEs

Performance of R&D subsidiary

- The volume of R&D subsidiary for SMEs increases and positive performance
- Technology level stands still (around 75%) and productivity is below 50% (manufacture, 2015) of big company
  - Shortage of technical professionals

Contribution to national economic growth

- The number of SMEs: 99.9%, Employees: 82.2%
  - The volume of manufacture: 49% (2016)
- Combination of subsidiary (investments and loans) and tax supports
Thank you for your attention

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Quantitative performance

It shows the dramatic increase in terms of quantitative performance in Korea.

**Paper**

- **No. of paper (SCI)**
  - '13: 49,897
  - '14: 52,194
  - '15: 54,691

**Patent**

- **No. of patent (PCT)**
  - '13: 12,381
  - '14: 13,117
  - '15: 14,626

**R&D center**

- **No. of corporate R&D centers (private sector)**
  - '06: 13,324
  - '07: 14,975
  - '08: 16,719
  - '09: 18,772
  - '10: 21,785
  - '11: 24,291
  - '12: 25,860
  - '13: 28,771
  - '14: 32,169
  - '15: 35,288
Qualitative performance

Qualitative level is not satisfactory from a viewpoint of productivity and impact.

**Paper**
- Cited number per paper (ave.): 2006-2010 - 3.88, 2011-2015 - 5.09
- Korea (ave.) - 5.13, OECD (ave.) - 5.53

**Knowledge**
- Index of global innovation (2017)
  - Knowledge Creation: 2th
  - Knowledge Effect: 38th
  - Knowledge Diffusion: 13th

※ Total 127 country
※ KC (no. of paper, patent), KE (commercialization etc.), KD (export of computer, communication service, etc.)
Korea has achieved compressed economic growth in line with the investment to R&D.
Meanwhile, the quality of life issues were given less priority in the process.

South Korea GDP(PPP) Evolution (1911-1990)
(Unit: USD)

OECD ‘A Better Life Index’
Covers 34 OECD members as of 2015 and Brazil, Russia

<table>
<thead>
<tr>
<th>Factors</th>
<th>Ranking</th>
<th>Index</th>
</tr>
</thead>
<tbody>
<tr>
<td>Living</td>
<td>20</td>
<td>5.7</td>
</tr>
<tr>
<td>Income</td>
<td>24</td>
<td>2.2</td>
</tr>
<tr>
<td>Occupation</td>
<td>16</td>
<td>7.3</td>
</tr>
<tr>
<td>Social linkage</td>
<td>36</td>
<td>0.0</td>
</tr>
<tr>
<td>Education</td>
<td>4</td>
<td>7.9</td>
</tr>
<tr>
<td>Environment</td>
<td>30</td>
<td>4.8</td>
</tr>
<tr>
<td>Social participation</td>
<td>4</td>
<td>7.4</td>
</tr>
<tr>
<td>Health</td>
<td>31</td>
<td>4.7</td>
</tr>
<tr>
<td>Satisfaction in life</td>
<td>29</td>
<td>3.8</td>
</tr>
<tr>
<td>Safety</td>
<td>6</td>
<td>9.5</td>
</tr>
<tr>
<td>Work-life balance</td>
<td>33</td>
<td>5.0</td>
</tr>
</tbody>
</table>

※Scores nearing 10 means higher levels

Resources / OECD

yonhapnews
Innovative SMEs

It shows the number of innovative SMEs is gradually increasing.
Research budget per project is small compared to big company
Technology level of SMEs stands still

<table>
<thead>
<tr>
<th>Classification</th>
<th>2003</th>
<th>2005</th>
<th>2007</th>
<th>2009</th>
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<th>2013</th>
<th>2015</th>
<th>2017</th>
<th>2018</th>
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</thead>
<tbody>
<tr>
<td>TL trends</td>
<td>73.6</td>
<td>75.8</td>
<td>74.6</td>
<td>74.7</td>
<td>74.8</td>
<td>77.5</td>
<td>77.6</td>
<td>75.6</td>
<td>77.6</td>
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