Outline

1. Political Backgrounds of S&T
2. Review of Past Foresight
3. STFC of NISTEP
4. Future project
S&T Budget

- Education Ministry: 43.2%
- STA: 24.4%
- METI: 16.3%
- Defense Agency: 4.8%
- Agriculture Ministry: 3.4%
- Health & Welfare Ministry: 3.1%
- Telecommunication: 2.0%
- Construction Ministry: 1.3%
- Others: 1.3%

3.0 trillion yen (1998)

3.5 trillion yen (2002)
Political Structure

- STC
- CSTP
- Coordination Planning
- Implementation Ministries
- Prioritization National Policy

Bottom up Top down
Government’s Share of R&D Expenditure

[Graph showing the share of R&D expenditure by government for Japan, USA, Germany, France, and UK from 1981 to 2000.]
R&D Expenditure by Fields (2001)
Japanese Technology Foresight in 1970s and 1980s

• Japan was on the catch up process

• To form common vision/consensus on future priority and perspective

• To lead industry through “long term visions”

• Moderate link to government’s S&T policy
  – Indirect effects to R&D resources allocation
Structure of National Foresight

- **Holistic**
  - DELPHI
  - NISTEP

- **Macro-level**
  - Ministries

- **Meso-level**
  - Groups of companies

- **Micro-level**
  - Individual companies and research institutes

Terutaka Kuwahara (NISTEP)
<table>
<thead>
<tr>
<th>NO.</th>
<th>Survey Year</th>
<th>Fields</th>
<th>Topics</th>
<th>Experts</th>
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<td>1</td>
<td>1970-1971</td>
<td>5</td>
<td>644</td>
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<td>800</td>
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<td>4</td>
<td>1986</td>
<td>17</td>
<td>1071</td>
<td>2007</td>
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<td>5</td>
<td>1991</td>
<td>16</td>
<td>1149</td>
<td>2385</td>
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<td>1996</td>
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<td>7</td>
<td>2000</td>
<td>16</td>
<td>1065</td>
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Evaluation of First Survey (1971)

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<td>Social Development</td>
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<td>18</td>
<td>40</td>
<td>42</td>
<td>34</td>
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<td>All</td>
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<td>36</td>
<td>36</td>
<td>34</td>
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- Fully
- Partially
- Not
Japanese and German Time of Realization (Japanese 92 & German 93)
# Examples of Delphi Topics

<table>
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<tr>
<th>Topics</th>
<th>Number of respondents</th>
<th>Importance Index</th>
<th>2001</th>
<th>2006</th>
<th>2011</th>
<th>2016</th>
<th>2021</th>
<th>2026</th>
<th>Never</th>
<th>Don't know</th>
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<td>Elucidation of carcinogenic mutation mechanisms.</td>
<td>113</td>
<td>88</td>
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<td>2</td>
<td>6</td>
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<tr>
<td>Development of drugs capable of preventing the occurrence of certain types of cancer.</td>
<td>212</td>
<td>87</td>
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<td>5</td>
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<td>Development of technology capable of forecasting the occurrence of major earthquakes (magnitude 7 or above) several days in advance.</td>
<td>102</td>
<td>92</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>29</td>
<td>14</td>
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<tr>
<td>Practical use of a highly secure next-generation internet that allows the transmission of real-time information, leading to the implementation of internet-based telephone services and motion video broadcasts.</td>
<td>232</td>
<td>92</td>
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<tr>
<td>Practical use of large-area amorphous silicon solar cells with a conversion efficiency of more than 20%.</td>
<td>144</td>
<td>91</td>
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<td>7</td>
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<td>Widespread use of non-fossil energy sources (wind, geothermal, solar (photovoltaic/solar thermal) and waste heat) in all areas of life including household, industry and transportation.</td>
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<td>94</td>
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<td>10</td>
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<tr>
<td>Year</td>
<td>Genome Science</td>
<td>Regenerative Medical Treatment</td>
<td>Brain Science</td>
<td>Bioinformatics</td>
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<tr>
<td>2005</td>
<td>Development of methods for surmising new functions of proteins from DNA base sequence data.(2009)</td>
<td>It becomes possible to determine the entire base sequences of an individual including genetic structure and SNP (single nucleotide polymorphism) promptly and cheaply, leading to widespread use of such methods for diagnosis and tailor-made treatment.(2012)</td>
<td>Development of food capable of supporting a healthy aging society from a nutritional perspective by preventing a decline in antioxidants, brain and chewing functions.(2012)</td>
<td>Development of bioinformatics capable of prospecting the risk of carcinogenesis from genetic background etc.(2013)</td>
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<td>2010</td>
<td>Establishment of technologies for predicting bioactivity and functional domain of proteins from their higher-order structures.(2012)</td>
<td>Identification and classification by the molecular etiology of the genes related to diabetes, hypertension, and arteriosclerosis, which are typical lifestyle diseases that exhibit multiple-factor hereditary traits.(2013)</td>
<td>Development of gene therapy for diabetes.(2016)</td>
<td>Progress in bioinformatics enables integration and mutual utilization of massive amounts of data, leading to widespread practice of life science research in virtual laboratories established on networks.(2015)</td>
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<tr>
<td>2020</td>
<td>Practical use of technology that utilizes a computer to monitor motor-related activity of the brain, and enable direct and voluntary control of artificial limbs without the spinal cord or peripheral nerves.(2023)</td>
<td>Widespread use of regenerative treatment technology for damaged organs using embryonic stem cells.(2020)</td>
<td>Practical use of a treatment method that promotes recovery from motor paralysis through nerve stem cell transplantation.(2020)</td>
<td>Elucidation of brain mechanisms for logical reasoning.(2028)</td>
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<tr>
<td>2025</td>
<td></td>
<td></td>
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<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>2030</td>
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</table>
Important fields in "coming 10 years" and "after 2010"

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<tbody>
<tr>
<td>Field of Respondents</td>
<td>Information</td>
<td>Life</td>
<td>Environment</td>
<td>Material</td>
<td>Manufacturing</td>
<td>Infrastructure</td>
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<tr>
<td>&lt;Field of Respondents&gt;</td>
<td>94%</td>
<td>53%</td>
<td>75%</td>
<td>91%</td>
<td>72%</td>
<td>92%</td>
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### Categorization of the most Important 100 topics

<table>
<thead>
<tr>
<th>Category</th>
<th>7th survey</th>
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<th>5th survey</th>
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<tbody>
<tr>
<td>Environment</td>
<td>27</td>
<td>25</td>
<td>28</td>
</tr>
<tr>
<td>Information</td>
<td>19</td>
<td>24</td>
<td>10</td>
</tr>
<tr>
<td>Life Science</td>
<td>28</td>
<td>17</td>
<td>37</td>
</tr>
<tr>
<td>Natural Disaster</td>
<td>8</td>
<td>11</td>
<td>9</td>
</tr>
<tr>
<td>New Energy</td>
<td>9</td>
<td>11</td>
<td>6</td>
</tr>
<tr>
<td>Others</td>
<td>9</td>
<td>12</td>
<td>10</td>
</tr>
</tbody>
</table>
Trends in National R&D Investment by Area
Trends in the Delphi Index by Area
Information

Delphi index (%)

Share of R&D expenditure (%)


Delphi index  Share of R&D expenditure
Life Science

![Graph showing Delphi index and Share of R&D expenditure over time (1970-2005).](image)

- **Delphi index (%)**
- **Share of R&D expenditure (%)**
Energy
Science and Technology Foresight Center (STFC)

- **Mission**
  - To support decision makers in government

- **Structure**
  - STFC Researchers
    - Various backgrounds
    - From ministry, university and industry
  - Affiliated Fellow
  - STF Network members
    - Various fields and sectors
STFC: Expert Network
Science & Technology Trends (J & E)

Science & Technology Trends Quarterly Review

No. 5
JANUARY 2003

Life Sciences
- Recent Trend of Cancer Research
- Molecular Target Therapy and Translational Research
- Trends in Organic Synthesis Chemistry Research
- Trends in Nanomaterials Research

Information and Communication Technologies
- Trends in Nanostructured Development of Information and Communication Systems
- Digital Content Distribution and Copyright Management Technology in the Broadband Age

Environmental Sciences
- Trends in the Development of Measures Against Global Warming Derived on CO2, Underground Storage

Nanotechnology and Materials
- Trends in Nanotechnology
- Trends and Problems of High-Level Radioactive Waste Disposal Projects — Technical and Social Aspects
- Trends in Distributed Power Sources

Infrastructure
- Trends in Disaster Simulation Technologies

Science and Technology Policy
- Latest Trends in US Science and Technology Policy
- Status Report on 2003 AAS Annual Conference
- Outline of Drafting up the FY2002 budget for Science and Technology
Requirements for Next Foresight

• Positive inputs to S&T top-down prioritization
  – Penetration / Consensus
  – Normative View
  – Outlook of S&T and in-depth study of key areas

• Linkage to political process
  – Participatory approach
  – Mission analysis
  – Synchronization to political process
Structure of the Foresight Program

- Societal Needs Analysis
- Bibliometric Analysis
- Scenario Analysis
- Delphi

Comprehensive Outlook of S&T for Basic Plan

Consensus
Long-term Perspective

Individual
Normative
In-depth

Social Stakeholders
Mission of S&T

\(\text{FUTUR}\)
Emerging area
Concluding Remarks

- Accumulation of experiences for 30 years
- Assessed effectiveness and limits of Delphi approach
- Change of S&T backgrounds
- Foresight program to meet political and socioeconomic requirements