Innovation policy and foresight in Japan

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The 3rd International Conference on Foresight

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National Institute of Science and Technology Policy (NISTEP)
Outline

- S&T policy development and history of foresight in Japan
- Contribution of the 8th foresight program to the discussion for the 3rd S&T basic plan
- Contribution of the 8th foresight program to the discussion for “Innovation 25”
- Grope for role and methodology of future foresight
Development of S&T Basic Plan in Japan

<table>
<thead>
<tr>
<th>Basic Plan</th>
<th>R&amp;D Investment</th>
<th>S&amp;T System</th>
<th>Administration</th>
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</thead>
<tbody>
<tr>
<td>1996</td>
<td>Expansion of total investment</td>
<td>17 T yen (17.6 T yen)</td>
<td>Reform of National Institutes and National Universities</td>
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<tr>
<td>2001</td>
<td>2nd</td>
<td>Prioritization by fields</td>
<td>Life Science, IT, Environment, Nano&amp;materials</td>
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<td>2005</td>
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<td>2006</td>
<td>3rd</td>
<td>Prioritization within fields</td>
<td>Key technology areas</td>
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<td>2010</td>
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Development of National Foresight in Japan

1970-80s: Catch up process
- Bottom-up decision making
- Consensus among sector

1990s: Transition phase
- Moderate link between S&T policy and foresight

2000-
- Strong prioritization
- Top-down decision making
- Link between S&T policy and foresight

Foresight
- 1971 The 1st Technology Foresight
- 1977 The 2nd Technology Foresight
- 1982 The 3rd Technology Foresight
- 1987 The 4th Technology Foresight
- 1992 The 5th Technology Foresight
- 1997 The 6th Technology Foresight
- 2001 The 7th Technology Foresight
- 2005 The 8th Foresight

S&T Basic Law
- 1995 The 1st S&T Basic Plan
- 1996-2000 The 2nd S&T Basic Plan
- 2001-2005 The 3rd S&T Basic Plan

Innovation 25
- Multi-methodology
- With Review Program
Linkage between foresight and policy making

Oct. 2002
Request for foresight

NISTEP
Survey design

May 2003
Budget allocated

May 2005
Foresight
Review
Additional survey

Oct. 2004
Input of intermediate results

Feb. 2007
Social vision toward 2025

Every three months
Reporting progress
Comments and requests

Final reports
Report

CSTP

MEXT

Council members meeting

Committees for 3rd Basic Plan

Innovation 25 Strategy Council

Cabinet Office
The 3rd Plan: Contents

Chap. 1 Basic Ideas

Chap. 2 Strategic priority setting
- basic research
- priority fields
- Strategic prioritized S&T

Chap. 3 S&T system reforms
- human resource development
- **creating scientific development and persistent innovation**
- reinforcement of foundation
- promotion of international activities

Chap. 4 S&T to be supported by society and the public

Chap. 5 Role of the CSTP
The 8th foresight program
Multi-methodology Foresight
with Review program

Two research projects conducted by NISTEP
(supported by Special Coordination Funds for Promoting S&T in FY 2003-2004)

Review of the past (during 1st & 2nd S&T Basic Plans)

S&T Indicators
Evaluation of achievements
Benchmarking
Impact study etc.

Multi-methodology foresight
Complementary 4 methods

Subjective Tailor 
Normative 
Objective 
Extrapolative

Bibliometric Analysis
Delphi Survey
Scenario Analysis
Socio-economic Needs Analysis

Science (Basic research) Technology (Application) Society (Impact)

More “political” message by coupling of review and foresight
The 8th foresight program

Improvements in Delphi survey

1. Structure of layers of Fields-Areas-Topics

Field 1

Area 1

Topics 1

Area 2

Topics 2

... 13

... 130

... 858

2. Two different stages of the realization time of each topic

- Technological realization
  - Time
  - Promoting measures

- Social realization
  - Time
  - Promoting measures

- When will the technology (topic) be technologically feasible?

- When will the technology have socioeconomic impact?
Contribution of the 8th Foresight results to the discussion for The 3rd Basic Plan

1. Enhancement of Intellectual assets
   a: Contribution to enhancement of Intellectual assets on the interested area itself
   b: Contribution to progress of other areas

2. Economic Effects
   c: Contribution to developments of existing industries
   d: Contribution to creations of new industries and businesses

3. Social Effects
   e: Contribution to securing safety and security
   f: Contribution to improvement of quality of life and social vitality

Measure for evaluation: “Large (10)”, “Largish (7.5)”, “Moderate (5)”, “Small (2.5)”, “Non” (0)

Definition of impacts

S&I impact → Max (a, b)
Economic Impact → Max (c, d)
Social Impact → Max (e, f)
Socio-economic Impact → { Max (c, d) + Max (e, f) } / 2
Total Impact → { Max (a, b)^2 + Max (c, d)^2 + Max (e, f)^2 }^{1/2}

Total impacts of Prioritized fields

*1: Impacts of each field are evaluated by average of areas which belong to the interested field.
*2: Radius of each circle shows the number of areas with top 1/3 total impacts in each field

Delphi Survey
Contribution of the 8th Foresight results to the discussion for The 3rd Basic Plan

Time Lag to Impact in Society

Time of Technological realization

- Information/communications
- Electronics
- Life science
- Health/medical care/welfare
- Agriculture/forestry/fisheries/foods
- Frontier
- Energy/resources
- Environment
- Nanotechnology/materials
- Manufacturing
- Industrial infrastructure
- Social infrastructure
- Social technology

Delphi Survey
Contribution of the 8th Foresight results to the discussion for The 3rd Basic Plan

International Competitiveness of R&D in each area

Compared with US

Compared with EU

Very large-scale information processing
High-productivity computing
Silicon electronics

Human and robot participation in manufacturing

Basic technology for space transportation and manned space activity
Planetary exploration technology
Earthlike life and extrasolar planetary exploration technology

Information/communications
Electronics
Life science
Health/medical care/welfare
Agriculture/forestry/fisheries/foods
Frontier
Energy
Environment
Nanotechnology/materials
Manufacturing
Industrial infrastructure
Social infrastructure
Social technology

Displays
Digital home appliances
Car electronics

Delphi Survey
Contribution of the 8th Foresight results to the discussion for The 3rd Basic Plan

Necessity of collaboration among fields

2005-2015

2015-2025

*1 Respondents chose at most three fields to cooperate.
*2 Black arrow indicates that 30% to 50% of respondents.
*3 Red arrow indicates that more than 50% of respondents.
Contribution of the 8th Foresight results to the discussion for The 3rd Basic Plan

Necessity of Inter-/Multi-disciplinary R&D for new areas

*1/3 of the rapidly-developing RAs are from Inter-/Multi-disciplinary areas.
Theme: Life support robotics

<Progressive scenario>
The development of lifestyle support robotics will be at Stage 1 from now until about 2015, with technology for “mechanical robots” and “communications robots” developing separately. Beginning about 2016, Stage 2 will likely see the development of integrated technology. Development during Stage 1 is likely to progress as follows.

Single-function household robots
→ Upgrading of functions through networks
→ Coordinated service by networked robots

Actions Japan should take:

- Strategy 1: Connecting various robots to network information and communications infrastructure is the top priority.
- Strategy 2: Power-assist technology should be given priority for advancement.
- Strategy 3: Take initiatives on social intelligence (communication with human beings) rather than on individual intelligence.
- In particular, Japan should establish initiatives to actively advance collaborative research in social science, cognitive science, brain science, and other research fields related to robot-human interaction (research on social intelligence-utilizing robots)

By Dr. Norihiro Hagita,
ATR Institute International
Innovation policy during the 3rd Plan period

「 Innovation 25 」

- Cabinet decision on Jun.1, 2007
- Long-term strategic guidelines up to 2025
- Integrated strategy for systemic renovation and technological renovation

Contents

- Japan 2025 through innovation
- Policy roadmap
- Strategies for social system reform
- Technology innovation strategies
The long-term strategic guidelines “Innovation 25”

- Process until Cabinet Decision (2007.6) -

Innovation 25 Strategy Council

Meetings (held once or twice a month)

Final report

Cabinet decision 2007.6

Agenda

Vision of Japanese society and required innovation toward 2025

End of Feb. 2007

Interim report

Strategic roadmaps

End of May 2007

Organizations that provide background information

Science Council of Japan, NISTEP, etc.

Council for Science and Technology Policy, etc.

Discussion based on the foresight results

Basic policies for economic and fiscal management and structural reform 2007
NISTEP’s approach for Innovation 25

Interim report
by Innovation 25 Strategy Council

- Vision of Japanese Society underpinned by technological feasibility
- Social systems that will bring desirable future
  - survey results
  - experts who have deep insights into technological developments and their future impacts on society

Duration: 4 months (Dec.2006 – Mar.2007) with 300 participants

The 8th foresight program conducted by NISTEP in 2003-2005

Around 2500 experts were involved.
Social Vision toward 2025
- Scenario Discussion based on S&T Foresight -

**(NISTEP Report No.101)**

**Steering committee**
- consisted of a chair and 15 members including social scientists;
- had two meetings;
- supervised the progress.

**Experts panels by theme**
Each panel
- consisted of a chair and around 10 members;
- had two meetings;
- looked toward the future of the relevant theme.

**Workshops by theme**
From 30 to 50 people joined each workshop. Participants were; S&T experts, social scientists, younger researchers, users, etc.

<table>
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<tr>
<th>Theme</th>
<th>Description</th>
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<td>Theme 1</td>
<td>Staying healthy throughout your life</td>
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<tr>
<td>Theme 2</td>
<td>Information and telecommunications infrastructure to improve quality of life: benefit of ubiquitous computing</td>
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<tr>
<td>Theme 3</td>
<td>Assistance for activities of daily life based on the development of brain science</td>
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<td>Theme 4</td>
<td>Safe and sustainable cities</td>
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<td>Theme 5</td>
<td>Keeping yourself vigorous and open-minded: career choices, child-raising and diversification in seniors’ lifestyles</td>
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<td>Theme 6</td>
<td>Efforts against global environmental issues and toward coexistence in the world</td>
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*Around 300 experts joined the discussion.*
Discussion at NISTEP : Results by theme

Theme 6: Efforts against global environmental issues and toward coexistence in the world

Systemization of elemental technologies and diffusion of systems to Asian countries
- environmental protection technologies
- water treatment technologies

Transmission of environmental information to the world
- earth observation data
- simulation data

Asian youths will tackle the establishment of economic systems that will bring about both economic and environmental effects with experiences in Japanese universities.

**Increased Japan’s presence in the world**

**Reduction of CO₂ emission by half**

**Sound water cycle**

**Contribution to the solution against global environmental problems**

**desirable society in 2025**

- Businesses that will produce economic and environmental effects
- Dissemination of environmental consciousness

**Visualization system of environmental information**

Impacts on environment of his/her daily activities will be shown to each citizen.
Discussion at NISTEP: Results by theme

Theme 2: Information and telecommunications infrastructure to improve quality of life

The most important agenda is infrastructure improvement related to ICT, that will bring innovation.

Infrastructure that enables digitalization of economic activities
All economic value information like stocks and bonds, intellectual property are circulated through networks. etc.

Infrastructure for:

- **value digitization**
- **ubiquitous identification**
- **rule digitization**
- **universal operation**

- live
- consume
- work
- raise
- heal
- enjoy
- learn
- interact

Infrastructure that unifies real world and cyber world
Getting information on every object and location in a moment, related services are provided. etc.

Infrastructure that enables automatic application of electronic rule systems
Cars drive automatically under electronic road traffic act. etc.

Infrastructure toward elimination of digital divide: assured equal accessibility to services
Operation procedures of IT devices are simply standardized and modified according to personal requests. etc.

Elemental technologies such as information security, reliability technology.
Grope for evolution in methodology

Multi-methodology

Approach at NISTEP for Innovation 25

Delphi Survey
Bibliometric Analysis
Socio-economic Needs Analysis
Scenario Analysis

Science (Basic research)
Technology (Application)
Society (Impact)

Objective
Extrapolative
Subjective
Normative

Complementary

Desirable Society

Scenario

Delphi results

A good experience/hint for NISTEP to think about the next generation of foresight

Convergence? Integration?
Japan-Finland collaborative research

A challenge for integrated multi-methodology foresight

Discussion on social needs on big social change

Theme selection A, B, C

Data for discussion (Statistical data, Indicators in R&D, · · ·)

Panel A
- Scenario writing
- Roadmap

Panel B
- Scenario writing
- Roadmap

Panel C
- Scenario writing
- Roadmap

Workshops

Delphi Survey

Execlutions in Finland/Japan, respectively

International comparison
# Foresight to the discussion for the 4th Basic Plan

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<tr>
<th>Basic Plan</th>
<th>S&amp;T policy Goal</th>
<th>Strategic priority setting</th>
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<tbody>
<tr>
<td>1st</td>
<td>General</td>
<td>—</td>
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<tr>
<td>2nd</td>
<td>General</td>
<td>Prioritization by Fields</td>
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<tr>
<td>3rd</td>
<td>General + Detailed</td>
<td>Prioritization within Fields by Key-tech areas</td>
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<tr>
<td>4th ?</td>
<td>Structured Goal ?</td>
<td>Prioritized Key-tech areas ?</td>
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<td></td>
<td>Goal A</td>
<td>Key-tech area(s)</td>
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<td>Goal B</td>
<td>Key-tech area(s)</td>
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<td>Goal C</td>
<td>Key-tech area(s)</td>
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Theme: Delphi, Scenario, Roadmap

Convergence ? Integration ?
Expected role of foresight

- Strong linkage with policy making

- S&T policy is increasingly innovation oriented.
  - Need for “outcome oriented” approaches

- Foresight should:
  - meet various policy making requirements
  - be outcome oriented

- Design of Foresight
  - Comprehensive Outlook with Multi-methodology
    - Convergence or Integration of Multi-methodology ?