

PR11:

**Emerging Fields in Science and Technology for the 4th
Science and Technology Basic Plan**

Study Research for Follow-up on Third Science and Technology Basic Plan (PR11)

Emerging Fields in Science and Technology for the Fourth Science and Technology Basic Plan

Report (Summary)

March 2009



National Institute of Science and Technology Policy (NISTEP),
Ministry of Education, Culture, Sports, Science and Technology

Overview

PR11 Emerging Fields in Science and Technology for the Fourth S&T Basic Plan

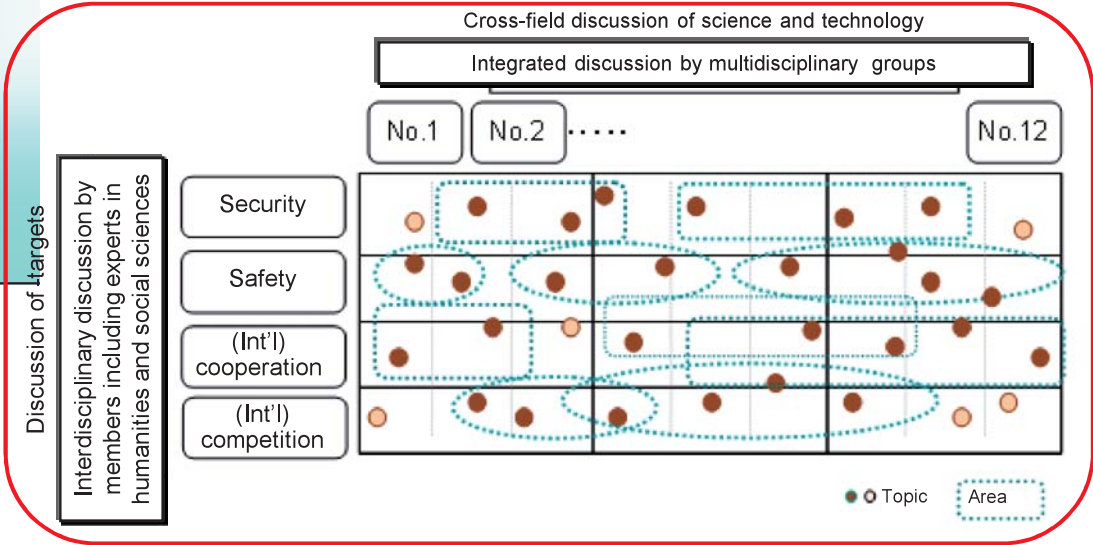
To extract new science and technology which should be the focus of the 4th Science and Technology Basic Plan, not limited to existing fields.

FY2008

“Areas which should be focus in discussions of Science and Technology Basic Plan.”
 “Science and technology topics considered necessary in the future society.”

Method :
 Discover focal areas and topics through exchanging views from two different types of discussion.

Discussions by two types of interdisciplinary panels.
 * 4 panels for discussion of targets for S&T
 * 12 panels for cross-field discussion of science and technology



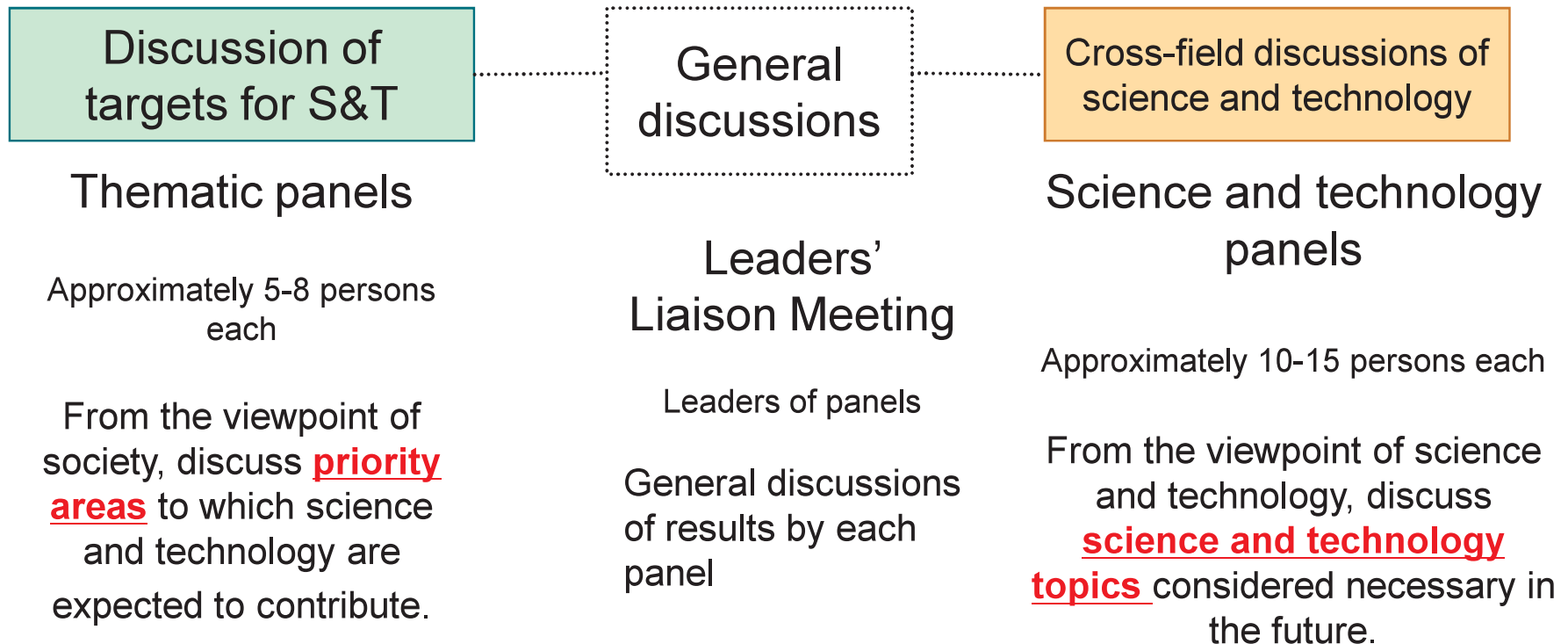
FY2009

9th S&T Foresight (planned)

Priority areas /Science and technology topics

<Implementation Structure for FY2008>

○ Panels : 4 thematic panels + 12 science and technology panels = 163 experts



Thematic Panels

- Task of panels
 - To extract approximately 30 **priority areas** in which problems can be solved or are expected to be solved mainly by science and technology.

- Basic concept of forming panels
 - Four panels are set up to discuss the following themes, in which science and technology are expected to contribute to solving problems.

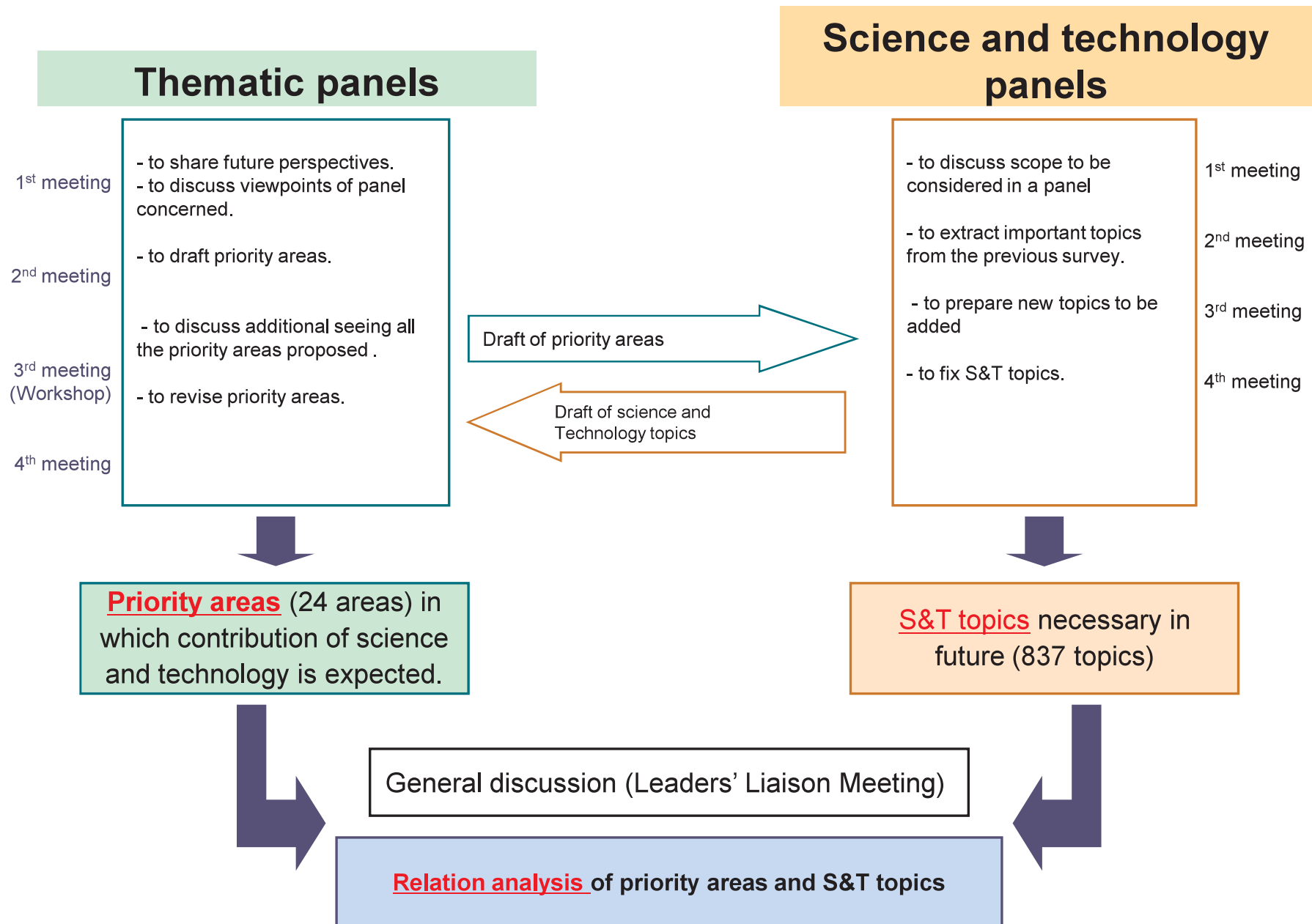
| Panel (theme) | Viewpoint | Content (initial proposal) |
|------------------------|---|---|
| Security | Keywords demanded for giving a true feeling of “affluent life of citizens.” | Lifestyles with a feeling of security and fullness. Examples: Improvement of quality of life (QOL); mental and physical health; medical services; support for child care and the elderly; etc. |
| Safety | | Maintaining a safe society. Examples: Construction, maintenance, and management of social infrastructure; disaster prevention; measures against crime and terrorism; information security; etc. |
| Co-operation | Viewpoints which are indispensable for considering “Japan in the world.” | Japan’s contribution to solving global issues. Examples: Global warming countermeasures; reduction of environmental loads; securing and effective utilization of resources; countermeasures for infectious diseases; etc. |
| Competitiveness | | Improvement of Japan’s international competitiveness and presence. Examples: Improvement of Japan’s international reputation by making new discoveries, constructing new fields, and creating new businesses; improvement of industrial competitiveness and GDP; science and technology inspiring dreams of the next generation, etc. |

Science and technology panels

- Task of panels
 - To extract approximately 800 science and technology topics which will be necessary in the future, with a time-frame of 30 years from the present.
- Basic concept of forming panels
 - In order to promote integrated discussions, each panel s are called by numbers. The panels themselves define the range of discussion, based on the following viewpoints.

| | Viewpoint (initial proposal) |
|--------------|---|
| No.1 | Utilization of electronics, communication technology, and nanotechnology in a ubiquitous society. |
| No.2 | Information technology including media and contents. |
| No.3 | Biotechnology and nanotechnology to contribute to humankind. |
| No.4 | Medical technology to contribute to healthy lifestyles using IT, etc. |
| No.5 | Technologies for observation and prediction of the state of the planet. |
| No.6 | Promotion of diverse energy technology innovations. |
| No.7 | Necessary resources, including water, food, minerals. |
| No.8 | Technologies for improving environmental indicators. |
| No.9 | Fundamental technologies, including substances, materials, nanosystems, processing, measurement, etc. |
| No.10 | Technologies for manufacturing/ constructing infrastructure. |
| No.11 | Strengthening of management led/required by advancement of science and technology. |
| No.12 | Infrastructure technologies supporting daily life and industry. |

<Flow of Study>



<Results 1: Priority areas>

Priority areas

| Panel | Priority areas | Examples of content |
|-----------------|--|--|
| Security | <ul style="list-style-type: none"> ◆ Construction of dependable public systems ◆ Understandability of systems ◆ Securing high quality health ◆ Realization of an age-free society for independence of the elderly ◆ Realization of sustainable lifestyles ◆ Realization of permanent peace | <p>System construction ; system optimization; system integration</p> <p>Visibility; security engineering; control technology</p> <p>Quantification of quality of health; comprehensive medical systems</p> <p>Self-help; mutual assistance; public assistance; QOL</p> <p>Food; resources; energy</p> <p>Defense; soft power</p> |
| Safety | <ul style="list-style-type: none"> ◆ Interaction , integration, and supply of data and knowledge related to safety ◆ Construction of systems for social safety as a whole ◆ Securing safety of individuals ◆ Assignment of responsibility for safety (responsibilities of individuals, responsibilities of national government) ◆ Safety culture/safety education ◆ Securing safety of artifacts (artificial products; includes information systems, etc.) ◆ Human safety ◆ Safety from environment and disaster | <p>Understanding of human behavior; high safety knowledge systems</p> <p>Defense; lifeline; medical care</p> <p>Technology for interaction between humans and computers</p> <p>Legal system; safe industry</p> <p>View of safety; analysis of defect modes in human behavior</p> <p>Discovery, evaluation, analysis, and response techniques for danger</p> <p>Crime prevention; investigation (manhunt) support; prevention of human accidents</p> <p>Danger prediction; discovery, rescue, escape, and evacuation techniques</p> |
| Cooperation | <ul style="list-style-type: none"> ◆ Exploration, development, and securing of undiscovered/unused resources and energy ◆ Monitoring and control of human activities on a global scale ◆ Realization of health throughout human life around the world ◆ Industrialization of Japanese-originated science and technology ◆ Development and use of educational functions ◆ Developing methodologies for solving international problems | <p>Assembling Data; exploitation of unused resources; rules for resource management</p> <p>Disaster prediction and countermeasures; regional response to global scale problems</p> <p>Health risk management; countermeasures for infectious diseases; design of living space</p> <p>High quality manufacturing; biotechnology and nanotechnology</p> <p>Training of international human resources; global-scale development of Japanese educational method</p> <p>Science and technology diplomacy; consensus-building techniques</p> |
| Competitiveness | <ul style="list-style-type: none"> ◆ Developing world-class intelligence and toughness ◆ Shared recognition ◆ Present methodologies based on Japanese sense ◆ Technology transfer as a donation for discovery of future demand | <p>Intellectual production capabilities; communication skills</p> <p>Sharing of history and culture; diverse recognition</p> <p>New sustainability science; harmony; regeneration and recovery</p> <p>Technology transfer (donation); humanity</p> |

<Results 2: Science and Technology Topics>

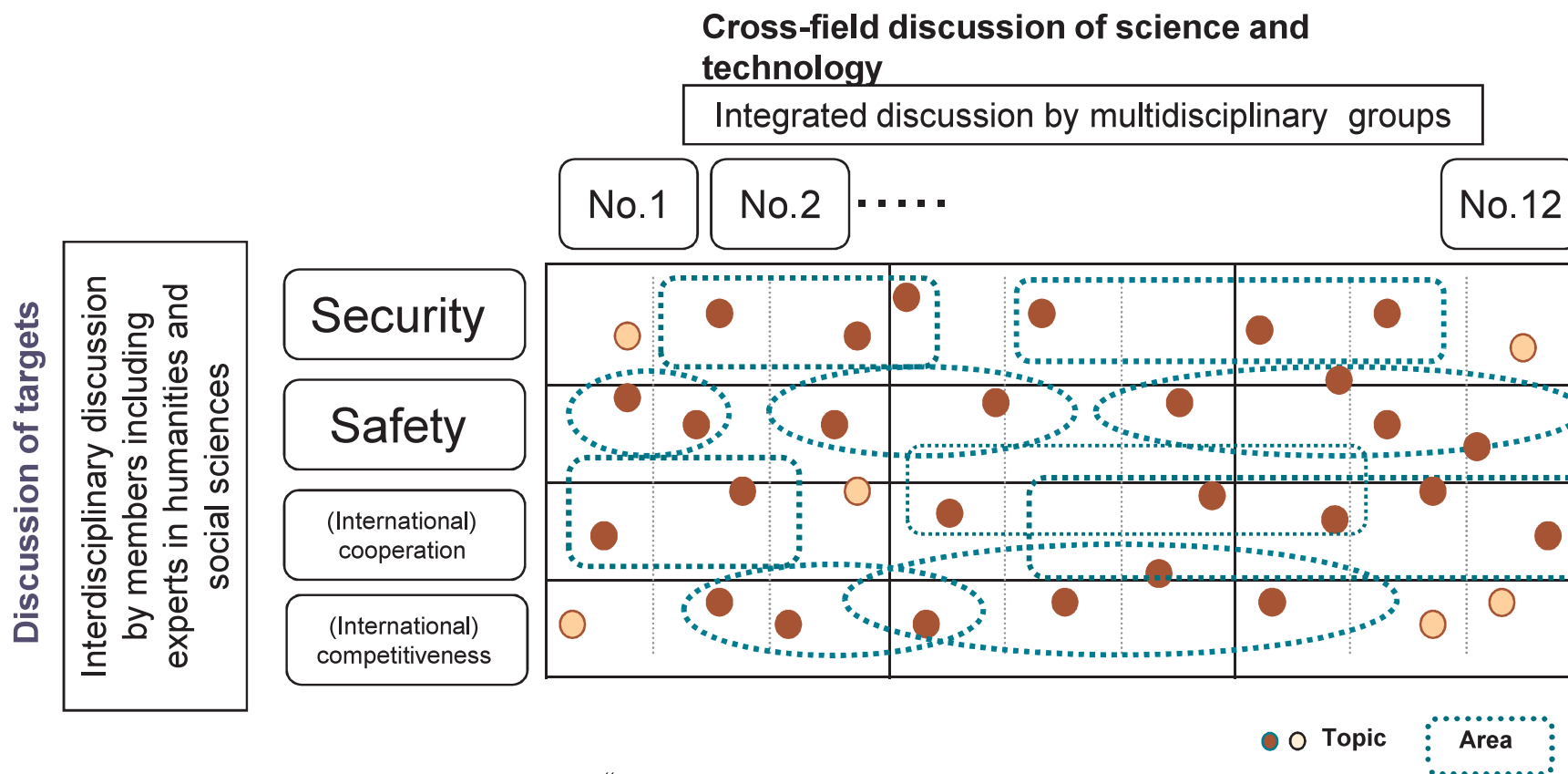
Setting of science and technology topics

- For example,
- Dramatic progress in particle accelerator technology, leading to breakthroughs in humankind's fundamental knowledge of the natural world.
 - Elucidation of the mechanism of metastasis of cancer.
 - Subterranean carbon dioxide sequestration techniques accompanied by long-term monitoring techniques for subterranean sequestration.
 - Systems enabling implementation of disaster mitigation measures in cooperation with the government, based on recognition and understanding of disaster risk potential by residents.
 - Establishment of independent Japanese medical standardization system.

| Panel | Viewpoint | Number of issues |
|--------------|---|------------------|
| No.1 | Utilization of electronics, communication, and nanotechnology in a ubiquitous society. | 71 |
| No.2 | Information technology including media and contents. | 78 |
| No.3 | Biotechnology and nanotechnology to contribute to humankind. | 63 |
| No.4 | Medical technology to contribute to healthy lifestyles of the nation's people using IT, etc. | 85 |
| No.5 | Understanding of dynamics of space, earth, and life, and science and technology which expand the region of human activity | 67 |
| No.6 | Promotion of diverse energy technology innovations. | 72 |
| No.7 | Necessary resources, including water, food, minerals. | 60 |
| No.8 | Technologies for protecting environment and forming sustainable society | 68 |
| No.9 | Fundamental technologies, including substances, materials, nanosystems, processing, measurement, etc. | 83 |
| No.10 | Manufacturing technologies which totally support development of industry, society, and science and technology | 76 |
| No.11 | Strengthening of management led/required by advancement of science and technology. | 59 |
| No.12 | Infrastructure technologies supporting daily life base and industrial base. | 55 |
| Total | | 837 |

<Relation Analysis of “Priority Areas” and “Science and Technology Topics”>

Matching of “priority areas presented by thematic panels” and “science and technology topics presented by science and technology panels”



- “Priority areas” were proposed from discussions of targets.
 - “Science and technology topics” were proposed from cross-field discussions of science and technology.
- “Science and technology topics” include topics (●) which contribute to the development of the “priority areas” identified in discussions of target, and topics (○) which fall outside these priority areas.