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The 9th Science and Technology Foresight
-Contribution of Science and Technology to Future Society-

The 9th Delphi Survey

(Summary)

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Science and Technology Foresight Center

National Institute of Science and Technology Policy

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Chapter 1: Design of the 9th S&T Foresight

The National Institute of Science and Technology Policy — an organization affiliated with MEXT (Ministry of Education, Culture, Sports, Science and Technology) — conducted a survey titled “The 9th Science and Technology Foresight” under grants-in-aid from the Special Coordination Funds for Promoting Science and Technology (FY2009). The objective of the survey was to clarify the policies to be taken in the fields of science, technology, and innovation in view of coping with future challenges. For this purpose, extensive discussions were held on an out-of-the-box basis while considering the direction to take for the future, whereby the focus is placed on the sciences and technologies that contribute to solving the global and national challenges. The mission-oriented approach (specifically aiming at solving the global and national challenges) and the interdisciplinary approach (out-of-the-box discussion crossing the boundaries of existing disciplines) characterize the methodology employed in this survey.

Considering the current global trends and situation in Japan, the survey narrowed down the course of actions, in terms of scientific and technological challenges, into the following four directions (grand challenges).

- ✧ Central player in the scientific and technological arena
- ✧ Sustainable growth through green innovation.
- ✧ Successful model for healthy-aging society.
- ✧ Secure life.

Subsequently, an interdisciplinary, out-of-the-box discussion was held from the viewpoint of constructing the framework for knowledge integration and paths to be taken, aiming at providing solutions to the grand challenges. In specific terms, the survey employed a combination of the following methods: Delphi survey based on interdisciplinary considerations with the targets in the future society clearly in mind; scenario writing using several methods in view of paths to be taken toward the desired future; region-based discussions for the realization of sustainable regional societies (Figure 1).

The results of the discussions are summarized in the following three reports:

[Delphi survey]

The 9th Delphi Survey（NISTEP REPORT No. 140）
http://www.nistep.go.jp/achiev/ftx/jpn/rep140j/idx140j.html

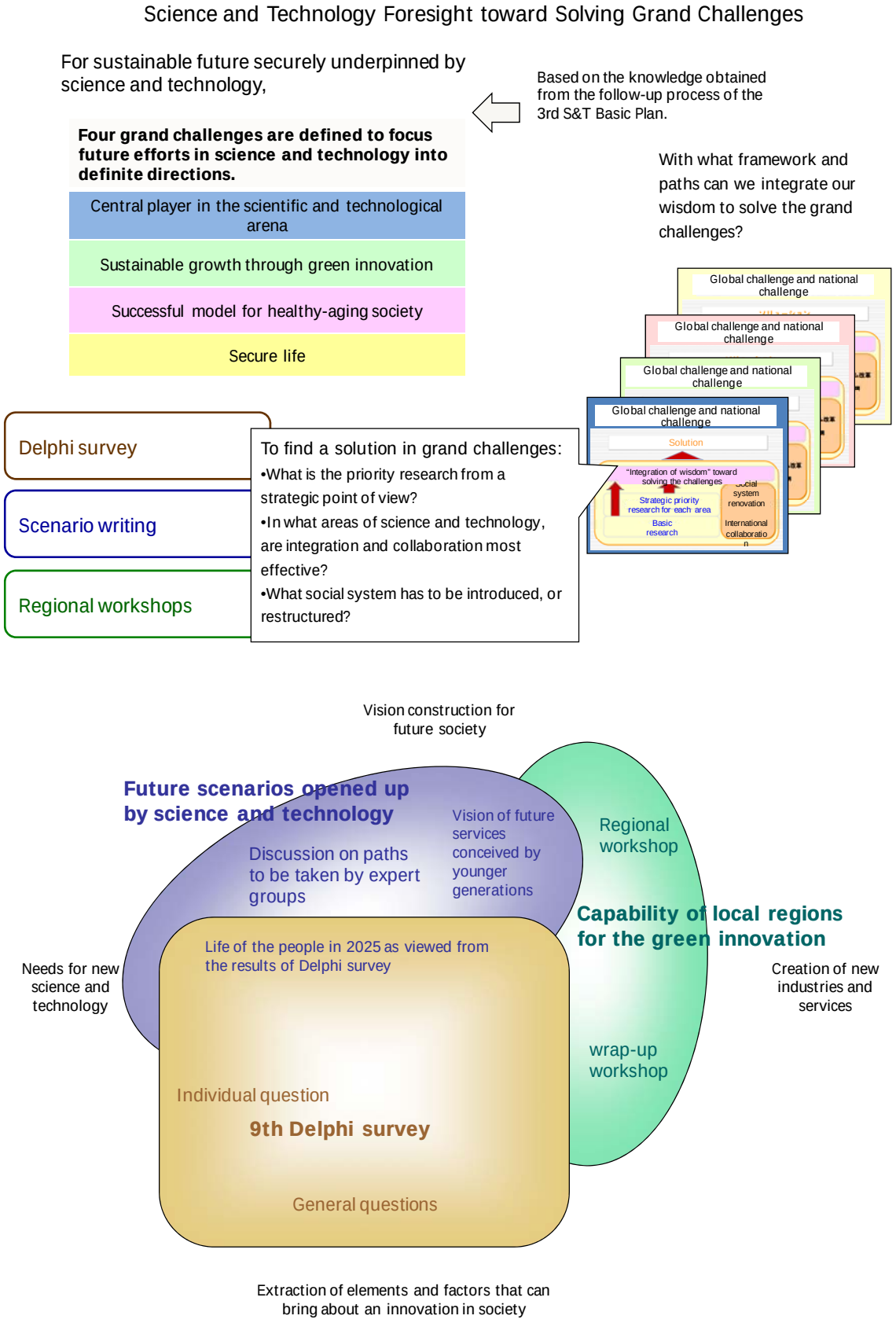
[Scenario writing]

Future Scenarios Opened up by Science and Technology (NISTEP REPORT No. 141)
http://www.nistep.go.jp/achiev/ftx/jpn/rep141j/idx141j.html

[Regional Green Innovation]

Capability of Local Regions for the Green Innovation (NISTEP REPORT No. 142)
http://www.nistep.go.jp/achiev/ftx/jpn/rep142j/idx142j.html

Figure 1: General overview of the survey



Chapter 2: Overview of the 9th Delphi Survey

Japan has a 40-year history of foresight activities in science and technology. This is the 9th round of the series of successive Delphi[*1] surveys since the first survey conducted in 1971.

In the survey this time, an attempt was made to outline the future prospect of evolutions in major areas of science and technology, whereby the relevant areas were extracted irrespective of the existing disciplines. The guiding viewpoint here was to define "what we should do from now onward" to attain future goals and resolve the global and national challenges. For this reason, cross-sectional panels were established across scientific and technological frontiers — in contrast to those organized on a section-by-section basis in the previous surveys — and they were designated by numbers. Through interdisciplinary discussions, the panels defined the survey topics and question items, and analyzed the results.

*1: The Delphi method iterates two or more rounds of the same questionnaire to the same respondents, until the answers converge to some specific way of thinking. In the second and subsequent questionnaire, the respondents are allowed to change their answers based on the summarized information (i.e. general trend of thinking) of the previous round. Some of the respondents change their opinions, allowing the overall opinions to converge.

2-1. Flow of the survey

Four preliminary panels were established and designated as "Security," "Safety," "International Collaboration," and "International Competitiveness." They involved the experts from the humanities and social sciences, as well as natural sciences, in discussion on future targets that science and technology can contribute to attain, and on global and national challenges to be resolved. Through extensive discussions, the targets and challenges were clarified and summarized into 24 "critical issues".

Twelve interdisciplinary panels (see Table 1), consisting of 135 experts in total from the humanities, social sciences and natural sciences (from universities, industrial sectors, and research organizations), held discussions to finally configure the topics[*2] and areas[*3] for the survey. Through the discussions, a selection was made with primary focus on the sciences and technologies that can contribute to resolving the global and national challenges, and with due consideration given to relationships with the critical issues. To avoid discussion limited by existing disciplines, names of disciplines or technological fields are intentionally left out of the panel designations. The scope and central theme of the discussion was determined by each panel.

A general deliberation was conducted on setting up the framework of subsequent discussions, and it pointed out the importance of paths through which future science and technology will be assimilated into society as a "system compatible with society," and thus the need for the following:

a) systematic research and development involving the inter-related areas of science and technology, b) a point of view that grasps multiple areas of inter-related areas of science and technology as a unified system, c) research into the methodology for implementation in a society, and d) an overhead view that perceives the social system as a inseparable part of science and technology.

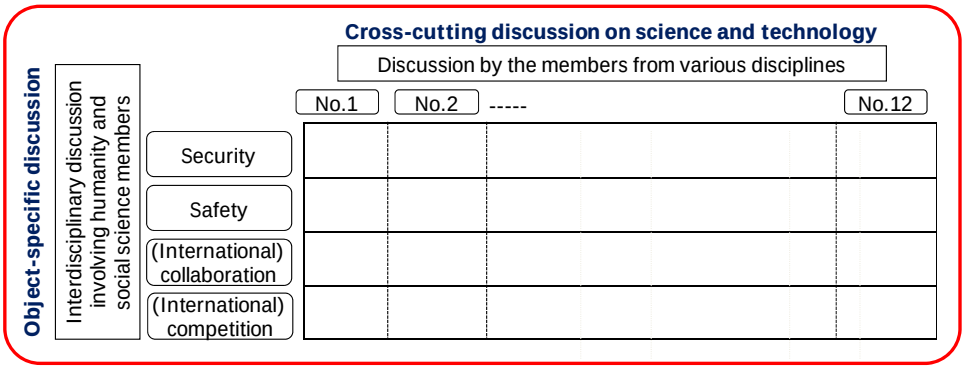
*2: A topic represents a description of such entities as future science, technology, and social system.
*3: An area represents a group of inter-related topics.

Table 1: Panel structure

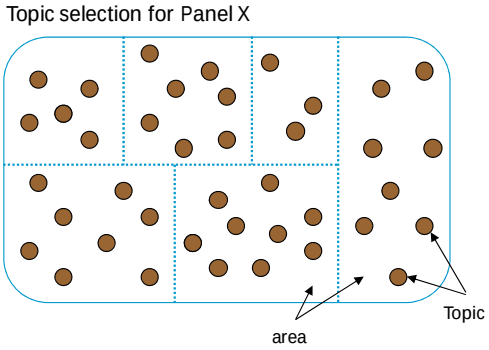
Panel	Viewpoint (defined by each panel)	Number of areas	Number of topics
No. 1	Utilization of electronics, communication, and nanotechnology in a ubiquitous society	6	70
No. 2	Information technology including media and contents	12	76
No. 3	Biotechnology and nanotechnology to contribute to humankind	8	58
No. 4	Medical technology to contribute to healthy lifestyles of the nation's people using IT, etc.	5	85
No. 5	Understanding of dynamics of space, earth, and life, and science and technology which expand the region of human activity	7	64
No. 6	Promotion of diverse energy technology innovations	13	72
No. 7	Necessary resources, including water, food, minerals	7	59
No. 8	Technologies for protecting environment and forming sustainable society	10	68
No. 9	Fundamental technologies, including substances, materials, nanosystems, processing, measurement, etc.	5	84
No. 10	Manufacturing technologies which totally support development of industry, society, and science and technology	8	76
No. 11	Strengthening of management led/required by advancement of science and technology	8	58
No. 12	Infrastructure technologies supporting daily life base and industrial base	5	62
Total		94	832

Figure 2: Method of setting topics

Relationship with twelve interdisciplinary panels and four object-specific panels



Method of setting topics



Setting topics:
1) Selection of keywords that most typically represent issues to be focused.
2) Definition of areas by grouping relevant keywords (the area definition was reviewed after the topics were set)
3) Definition of topics for each area
* More than one conceptually similar topic exists within an area.

Two rounds of the questionnaire were conducted — the first in November 2009 and the second in February 2010 — about the future perspective of the topics (832 in all) from the viewpoint of a time span of 30 years until 2040, and a total of 2900 experts responded (Figure 3). An analysis

was carried out based on the final results from the second round (Table 2, Figure 4). Note that, in the first round, additional questions were designed by each panel to inquire about Japan's desirable approach to resolving global and national challenges.

Figure 3: Classification of respondents

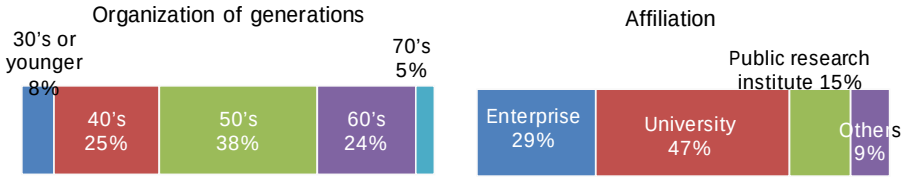


Table 2: Question items

Question items regarding each topic	Question items regarding Japan's approach for solving global / national challenges
◆ Importance ◆ Forecasted time of technological/social realization ◆ Sectors that will pave the way to tecchnological/ social realization Technological realization: Sufficient implementation of technological environment Social realization: Availability as tangible commodities and services	◆ Items of key importance for the resolution of global and national challenges ◆ R&D required for the resolution of the challenges ◆ International strategy in R&D ◆ Priority items that the government should address ◆ R&D needed for simultaneous pursuit of environmental preservation and sustainable development.

Figure 4: An example of a questionnaire summary

Area	Topic number	Topic	Importance				Forecasted time of technological realization (to be realized somewhere in the world)								Sectors that will pave the way to technological realization					Forecasted time of social realization (to become applicable/widely used in Japan)							Sectors that will pave the way to social realization						
			Important for Japan and the rest of the world (%)	Especially important for Japan	Especially important for the world	Low importance/priority	Already realized	2011–2015	2016–2020	2021–2030	2031–2040	2041 and later	Will not be realized (%)	Don't know	University (%)	Public research organization	Private enterprise (including NPO)	Collaboration of multiple sectors	Others (International organizations, etc.)	2011–2015	2016–2020	2021–2030	2031–2040	2041 and later	Will not be realized (%)	Don't know	University (%)	Public research organization	Private enterprise (including NPO)	Government (including local public agency)	Collaboration of multiple sectors	Others (International organizations, etc.)
	26	A Green ICTS system that reduces the energy necessary for the transmission and storage of information to one-millionth of that in 2010	95	2	0	3							12	11	55	47	48	18	3						14	12	26	33	64	17	19	3
	52	Smart grid technology that can improve power efficiency and reduce the total Japanese power needs by 20%	72	27	1	0							2	2	23	47	66	52	2						2	2	10	26	71	41	50	2
	26	Low-cost and large-area thin-film solar cells with a conversion efficiency of 20% or higher	79	19	1	1							2	2	51	50	57	22	0						2	1	18	26	80	9	23	1
	80	Integrative medicine in which a lifelong regional electronic health record is introduced and community-based care is possible	19	73	0	8							1	3	40	47	34	64	1						1	3	30	34	43	49	47	1
	77	Development of drugs that can prevent cancer metastasis	96	1	0	3							0	3	75	48	51	23	8						0	3	59	33	65	6	28	3

Q1 Q2 Q3

Arranged in the order of the year of realization from earlier to later
Q1: 25 percentile of all answers
Q2: 50 percentile of all answers
Q3: 75 percentile of all answers

Distribution in the first round of the questionnaire

Distribution in the second round of the questionnaire

2-2. Major Survey Results

(1) Items that need a focused approach for the resolution of global and national challenges

◊ Many items that are directly or indirectly related to energy, resources and the environment have been cited as having key importance for the resolution of global/national challenges (Table 3). In the health and medical areas, prognosis and preventive medicine gathered attention, and so did therapy. Other items that received attention included ICT infrastructure, human resource development and management, and fundamental technology.

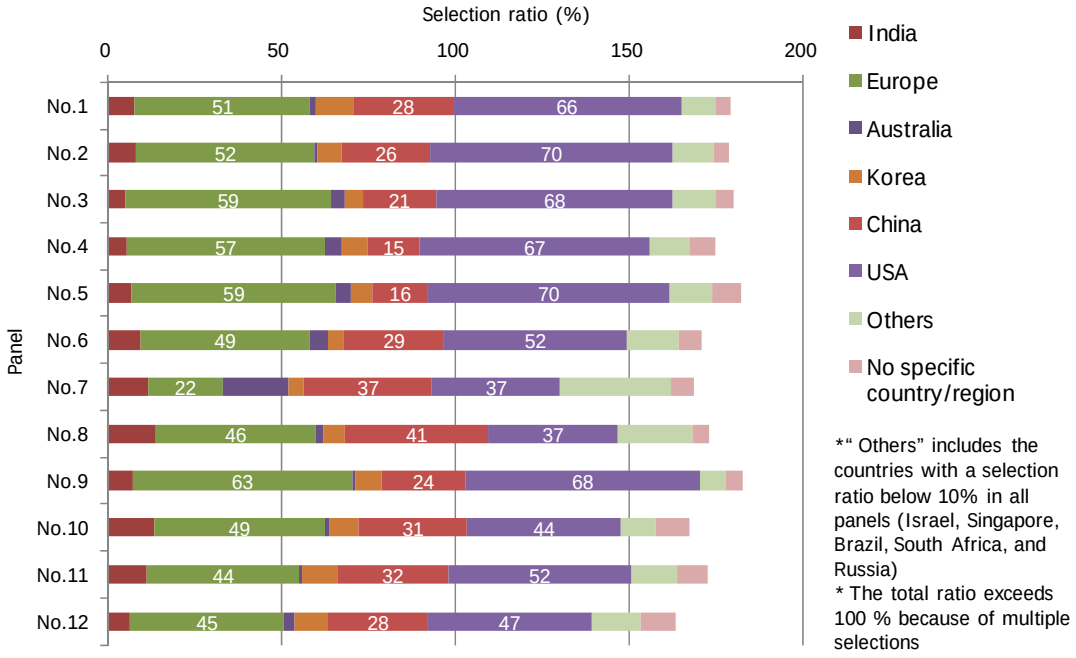
Table 3: Items of key importance for the resolution of global and national challenges

	Panel	Key item (selected from the areas defined by panels)
Energy, resources, and environment	No. 1	Energy-related
	No. 3	Industrial bio-nanotechnology related to energy and environment
	No. 5	Geo-diagnosis technology
	No. 5	Space and ocean management technology (including observations)
	No. 6	Nuclear energy
	No. 6	Renewable energy
	No. 6	Fossil energy
	No. 6	Efficient power storage system
	No. 6	Energy saving
	No. 7	Agriculture, forestry, and fisheries resources (including forest conservation, and biohazards)
	No. 7	Water resources
	No. 7	Environment, recyclable resources, recycling, LCA
	No. 7	Hydrocarbon resources, mineral resources, and CCS
	No. 8	Life style and environment (including environment ethics)
	No. 8	Evaluation of and countermeasures to global warming
	No. 8	Technology for urban waste minimization / material circulation for environmental conservation / resource- and energy- saving products
	No .8	Pollution prevention for atmosphere, water and soil / circulative use technology for water resources
	No. 10	Energy, resources, and environment
Medical	No. 3	Applied bio-nanotechnology
	No. 3	Healing (exogenous factor, metabolic disease, and psychiatric disease)
	No. 4	Medical treatment aiming at safety and security
	No. 4	Creation of new medical technology
	No. 4	Development of predictive and preventive medicine
Others	No. 2	Socialization of information
	No. 2	Cloud computing
	No. 2	New principle for information and communication
	No. 5	Space technologies (including space medicine)
	No. 9	Base materials for Nano-technology
	No. 9	Output (device, systemization and applied technology)
	No. 10	Globalization, value-adding and market creation
	No. 10	Unpopularity of science and engineering, human resource problem, the declining birth rate and aging population
	No. 11	Management (Global management) to prevent the decrease of competitiveness in the international market (international management), human resource development to compete with foreign workers, and cross-cultural cooperative management.
	No. 11	Service management, management in the education and research field, environment business management, governmental institution management
	No. 11	Framework for facilitation of social innovation and network building
	No. 11	Management of humans (e.g., to cope with disparity and diversity), creation, management, and transfer of knowledge, education, and maintenance of education level by standardization
	No. 12	Strategy toward sustainable infrastructure system

◊ As the sciences and technologies on which Japan has to focus on for the promotion of the key items, and, as the items Japan has to grapple with for addressing global environmental problems, the following topics were given: 90 topics related to energy, resources, and environment; 7 topics related to health and medical treatment; and other 23 topics (see Appendix).

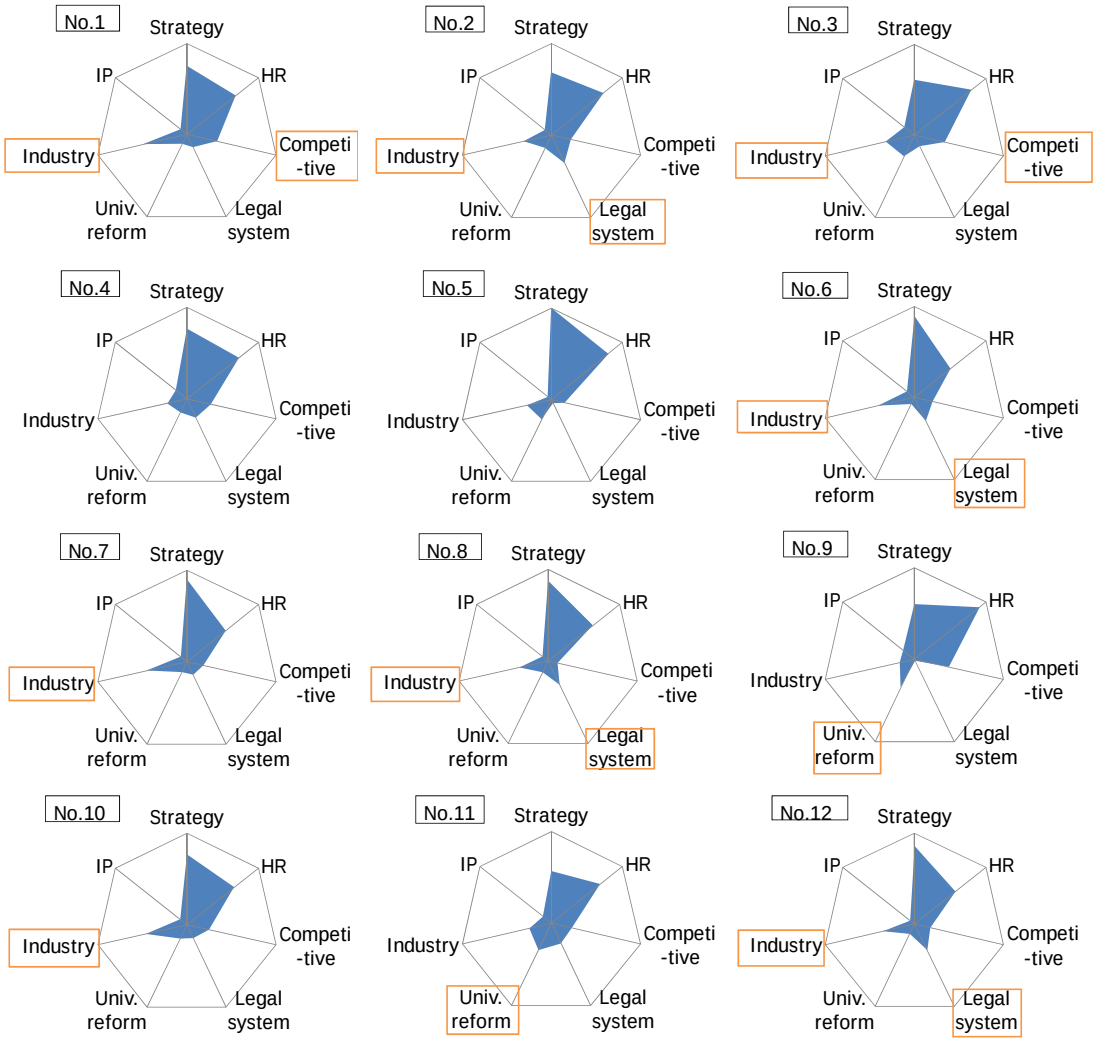
◊ In conjunction with "Japan's international strategy," the largest number of topics is related to the attainment and maintenance of the global leading role in research, development and commercialization. In the areas of global environment observation and prognosis/preventive medicine, participation in international collaboration projects gained much support. In conjunction with the "Countries/regions with which Japan should have strong relationships" in the future, China took precedence after USA and European countries (Figure 5). In particular, in the panels relating to environment and resources (Panel 7 and 8), interest was almost equally divided into three regions of USA, Europe, and China.

Figure 5: Countries/regions with which Japan should have close ties by panel



◊ In conjunction with the "priority items that the government should address," the respondents from all panels placed the "establishment of strategy and vision" and "human resource cultivation for the next generation" in the top two positions. The panels relating to information, energy, environment, and infrastructure technology (i.e. Panel 2, 6, 8, and 12) placed "legal system reform" in the third position, and those relating to electronics, biotechnology, and nanotechnology (Panel 1, 3, and 9) placed "streamlining of competitive environment" in the third position. The panels that require the overall context of the national policy, such as infrastructure improvement, and the securing of resources and energy, tend to call for the establishment of strategy and vision on a nation-wide basis, and those closely related to underlying elemental technologies tend to call for the cultivation of human resources for the next generation and the streamlining of a competitive environment. Those panels concerned with basic infrastructure as a social system call for legal system reform for further steps ahead.

Figure 6: Priority items that the government should address by panel



Items with a higher score (>20%) are shown in a box (except "Strategy (strategy formulation")) and "HR (human resource cultivation)")

Stragegy: Strategy formulation HR: Human resource cultivation Competitive: Competitive environment
Legal system: Legal system reform Univ. reform: University and public research institution reform
Industry: Support for industry IP: Intelledtrual property strategy

(2) Topic by topic considerations on future trend of evolution

◊ Most of the topics are considered to have common relevance across the world. Among these, the following were assessed to have special importance to Japan: the topics relating to social system creation (social infrastructure, medical system, prevention/ alleviation of disasters, and the regional environment), those relating to securing resources, and those relating to securing human resources (Figure 7).

◊ The following areas were mentioned as likely to be realized in Japanese society within the next ten years: medical system, energy management, cloud computing, and service management. On the other hand, regarding some technologies, such as medical treatment, and hydrogen and atomic energy, it is assessed that rendering their technical realization into social implementation will take nearly ten years (Figure 8).

Figure 7: The areas evaluated as "Especially important for Japan" (selection ratio >40%)

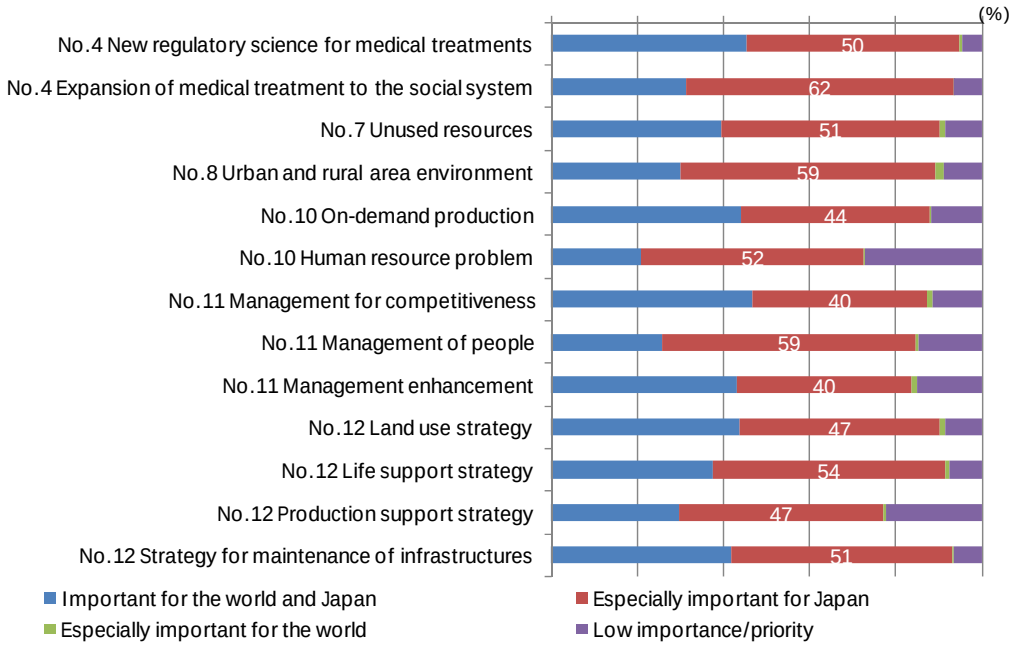
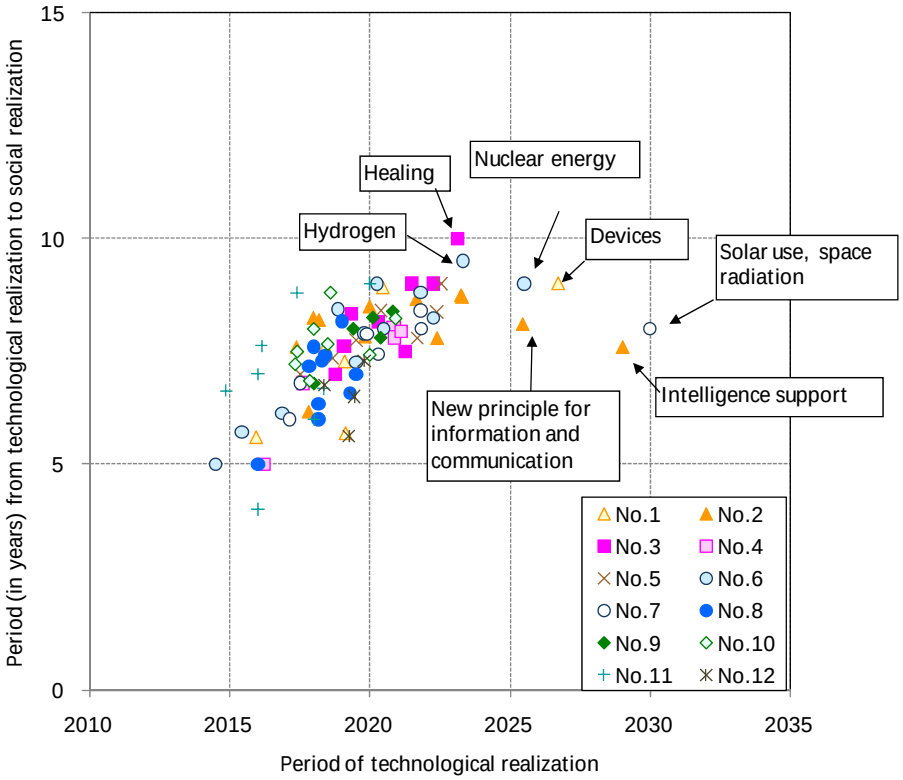
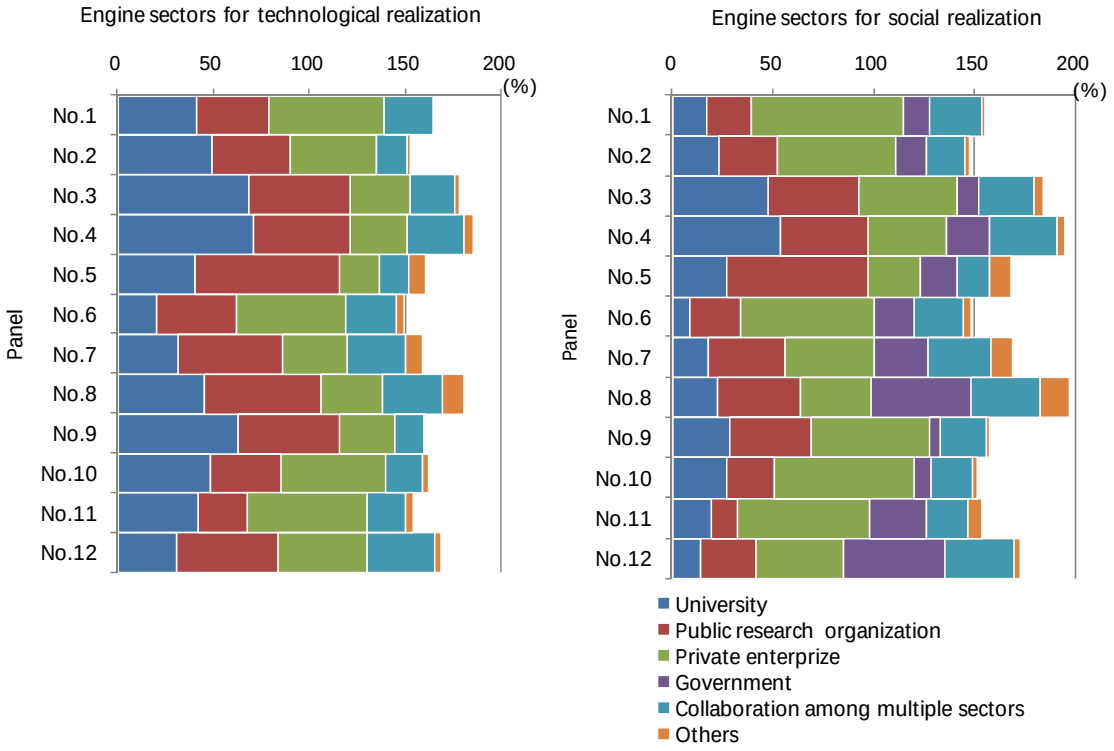


Figure 8: The period from technological realization to social realization



◊ The sector that serves as an engine toward the topic's realization depends on the type of science and technology. For the topics relating to biotechnology and medical care (Panel 3 and 4), universities are considered to play a leading role both in the establishment of technology and application in society. For the topics relating to energy (Panel 6), enterprises in the private sector are considered to serve as the engine both in the establishment of technology and application in society. Meanwhile, the government is expected to play a key role in social implementation of the topics relating to the environment (Panel 8) and social infrastructure (Panel 12).

Figure 9: Sectors that will pave the way to realization



Appendix: Priority items in science and technology for Japan

- Year: “Tech”: forecasted time of technological realization (somewhere in the world); “Social”: forecasted time of social realization (in Japan)
- Importance: “W/J”: important for Japan and the rest of the world; “J”: important especially for Japan; “Important for the world” and “Low importance/priority” columns are omitted because of a low selection rate (<40% in all topics)
- Leading sectors (tech/social) (Sectors that will pave the way to technological/social realization): “Uni”: University; “PRO”: public research organization; “Ent”: Enterprise in the private sector (including NPO); “Govt”: Government; “Coll”: collaboration among multiple sectors.
- Level of “Importance” and “Leading sectors”: “++”: indicates a selection rate over 70%, and “+”: indicates a selection rate over 40% but less than 70%.
- For each category, the topics are arranged in the order of the year of social realization (from earlier to later).

< Energy, environment, and resources >

Utilization of non-fossil energy

Delphi topic (Front numbers represent “panel-topic ID”)	year		Importance		Leading sectors (tech)					Leading to sectoris (social)					
	Tech	Social	W/J	J	Uni	PRO	Ent	Coll	Other	Uni	PRO	Ent	Govt	Coll	Other
5-11: Technology for the utilization of ocean energies such as the wind, waves and tides on a commercial basis.	2016	2024	++			+	+					+			
8-62: Gasification techniques for power generation or synthetic fuel production technology using unused biomass and waste that reduces dependence on fossil fuels.	2016	2024	++		+	+	++					++	+		
1-42: Home-use electric power storage cell technology, with a price tag of one million yen or less, that can stably cover approximately 90% of the necessary electric energy by integrating photovoltaic generation and secondary cells for All-DENKA house (a house in which electricity fully covers home-use energy).	2019	2026	++				++					++			
6-20: A large-scale thin-film solar cell with a conversion efficiency of 20% or higher.	2019	2027	++				++					++			
9-26: Low-cost and large-area thin-film solar cells with a conversion efficiency of 20% or higher.	2019	2027	++		+	+	+					++			
6-04: Technology to reduce waste dramatically through the nuclear transformation of radionuclides in high level waste.	2020	2028	++			+	+					+			
6-19: New material technology for solar cells leading to higher efficiency than silicon or GaAs.	2021	2029	++		+	+	+					++			
1-44: Solar cells with energy conversion efficiency of 60% or more.	2023	2030	++		+	+	+					++			
9-45: Materials with high energy conversion efficiency, high energy capacity, and low environmental load to utilize renewable energy sources.	2021	2030	++		+	+						+			
7-48: Implementation of utilization of solar energy at optimal places on a global basis, and energy interchange between the place of production and place of use.	2022	2031	++					+				+			

Delphi topic (Front numbers represent “panel-topic ID”)	year		Importance		Leading sectors (tech)					Leading to sectoris (social)					
	Tech	Social	W/J	J	Uni	PRO	Ent	Coll	Other	Uni	PRO	Ent	Govt	Coll	Other
9-34: Technology to produce hydrogen from water and sunlight with an energy conversion efficiency of 5% or more.	2024	2031	++		+	+					+	+			
6-01: Next generation light water reactor standard technology with such merits as the capability for enriched fuel over 5%, 80-year durability, and no location restrictions thanks to the adoption of seismic technology.	2026	2034	+				+					+			
7-53: Innovative technology that enables the diffusion of the use of non-fossil primary energy such as solar energy on a global basis.	2025	2034	++			+	+					+		+	
6-06: Geological disposal technology for high level radioactive waste.	2022	2034	++			++					+		+		
5-44: Solar photoelectric power generation plants in space that transmit electricity to the ground via microwaves or lasers.	2027	2037	+			++					+				
6-02: Fast breeder reactor cycle technology.	2029	2038	+			++					+				

Effective conversion/utilization of energy

Delphi topic (Front numbers represent “panel-topic ID”)	year		Importance		Sector leading to tech realization					Sector leading to social realization					
	Tech	Social	W/J	J	Uni	PRO	Ent	Coll	Other	Uni	PRO	Ent	Govt	Coll	Other
11-15: Various incentive systems to reduce the peak electric power demand facilitate the leveling of electric power demand and the effective utilization of resources.	-	2019	++		-	-	-	-	-			++	+	+	
2-61: More than half of the white goods (refrigerators, washing machines, microwave ovens, rice cookers, and air conditioners, etc.) are connected to home networks in 30% or more of the households in Japan.	2015	2022					++					++			
7-03: Technology for the formation of a material cycle by utilizing natural and unused energies by a community unit.	2018	2024	++					++					+	+	
1-52: Smart grid technology that can improve power efficiency and reduce the total Japanese power needs by 20%	2019	2026	++			+	+	+				++	+	+	
1-51: Component devices using novel materials such as SiC or GaN that allow a power density of 100 W/cc or more.	2019	2026	++				++					++			
12-58: Technology and a legal system for making the most of natural and renewable energy by region or district and realizing, for goods and material circulation, local production for local consumption will be developed.	2020	2027		+		+		++					+	+	
1-18: Network nodes for which power consumption will be 1,000 times as little as present consumption through nanophotonic technology.	2020	2027	++		+	+	+					++			
12-59: A material and energy circulation system will be constructed on a prefectural or larger administrative bloc levels, based on material correlation of biomass energy from forest resources, animal excrement, and unused material from cereal, as well as on that of by-products and functional materials.	2020	2028	+	+		+		+					+	+	

Delphi topic (Front numbers represent “panel-topic ID”)	year		Importance		Sector leading to tech realization					Sector leading to social realization					
	Tech	Social	W/J	J	Uni	PRO	Ent	Coll	Other	Uni	PRO	Ent	Govt	Coll	Other
8-57: Building of a recycling society using materials, energy and water efficiently within the community unit.	2021	2030	++			+		+					+	+	
9-22: A thermoelectric power generation module with a conversion efficiency of 10% or higher.	2022	2031	++		++	+						+			
3-55: Development of a nanoscale voltage separating device for an enzyme reaction fuel cell using bio organic substances, and expanding the scale of such fuel cells through integrating them.	2025	2032	+		++	+				+		+			
3-54: Highly efficient energy conversion technology that utilizes motor proteins (molecular motors) that convert chemical energy to mechanical energy.	2028	2035	+		++	+				+					
2-26: A Green ICTS system that reduces the energy necessary for the transmission and storage of information to one-millionth of that in 2010 (normalized by the amount of information handled).	2030	2036	++		+	+	+					+			

Industries in a recycle-based society

Delphi topic (Front numbers represent “panel-topic ID”)	year		Importance		Sector leading to tech realization					Sector leading to social realization					
	Tech	Social	W/J	J	Uni	PRO	Ent	Coll	Other	Uni	PRO	Ent	Govt	Coll	Other
4-85: Industrialization of a consistent medical waste treatment system including recycling.	2016	2020	+	+		+	+	+				+	+	+	
10-62: Solar cell system that is developed considering recycling and reuse with a low environmental load upon disposal.	2017	2024	+				+					++			
9-19: Technology for mass-producing fuel and bio-plastics from non-petroleum materials by using the function of plants or microorganisms	2018	2025	++		+	+	+					++			
10-63: A recycling production system unifying the processes of the "input of resource → design and production → use → disposition" and the "collection → separation → resource recycling."	2018	2025	++				+					++			
10-19: Comprehensive design methodology for total optimization, from the overall picture of the life cycle, from design and production to disposal and recycling, the overview of the global supply chain, and a product series that can flexibly correspond to the variety of customers' needs.	2017	2025	+		+		+					++			
3-52: A biocatalyst showing productivity equivalent to or greater than that of a chemical catalyst useable in industrial production.	2019	2026	++		++	+	+			+	+	+			
7-16: Technology for production of fuels and bio-chemicals on a commercial base by using plants and microorganisms as biomass cascading.	2019	2028	++			+	+					+		+	
3-51: More than half of the chemical polymers made from petroleum become renewable biomass resource-based products.	2022	2030	++		+	+	+			+	+	+			
8-58: Promotion of eco-factory and low-entropy technology that reduces the environmental load by 50% while considering the life cycle of products from production to disposition and the ecological influence of each industry.	2021	2030	++		+	+	+					++	+	+	

Delphi topic (Front numbers represent “panel-topic ID”)	year		Importance		Sector leading to tech realization					Sector leading to social realization					
	Tech	Social	W/J	J	Uni	PRO	Ent	Coll	Other	Uni	PRO	Ent	Govt	Coll	Other
10-02: Product and material manufacturing technology for safe, clean and energy-efficient mass production using knowledge of the mechanism of nature and organisms.	2021	2030	++		+							++			
12-50: A unified database (extending over business units such as railways, roads, electric power, and local public entities) of infrastructure investment history and deterioration data will be constructed to allow management of infrastructure assets at entire city and regional levels.	2018	2025		+		+		+					+		
12-52: Semipermanent recessed sensor technology notifying the degree of deterioration, lifespan, and time for replacement of structures will be disseminated.	2019	2026	+		+	+	+					+			
12-56: A system for evaluation of design systems, structural performance, and asset value, allowing the functional extension, renewal, removal, and reuse of large-scale structures will be disseminated.	2019	2027	+	+	+	+	+					+			
12-51: High-precision modeling of deterioration environments based on design and construction technology for infrastructure deterioration prevention, repair, and establishment will become feasible, and sufficiently precise life-cycle management and asset management will come into practical use.	2019	2025	+	+	+	+					+		+		
3-38: Technology for crop production and green technology in deserts achieved by improving the crop's adaptability (salt tolerance, drought tolerance, cold tolerance) and controlling its growth.	2020	2028	+		+	+				+	+	+			
3-56: Achievement of low-cost agriculture/forestry and rural communities oriented towards zero emission by using local agricultural and forestry resources and organic wastes.	2019	2027	+	+		++					+		+		
3-57: Biological crop protection methods that reduce the use of synthetic chemical pesticides and fertilizers by 50%.	2018	2026	++		+	++					+	+			
3-49: Growth regulation of crops and trees based on the clarification of the mechanism of biosynthesis, transport, and receptor-mediated signaling by growth regulators in plants.	2020	2029	++		++	+				+	+				

CO_2 emission reduction, CCS

Delphi topic (Front numbers represent “panel-topic ID”)	year		Importance		Sector leading to tech realization					Sector leading to social realization					
	Tech	Social	W/J	J	Uni	PRO	Ent	Coll	Other	Uni	PRO	Ent	Govt	Coll	Other
8-17: Introduction of environment education that has an effect of change in citizens' lifestyles through a specific behavior such as practical action to reduce household emissions of CO_2.	-	2018	++		-	-	-	-	-				++	+	
10-65: Comprehensive and objective evaluation indices that replace CO2 as an indicator for the environmental load of energy and resource consumption, production processes (plants) and products, and measurement techniques for such indices.	2017	2023	++		+	+					+				

Delphi topic (Front numbers represent "panel-topic ID")	year		Importance		Sector leading to tech realization					Sector leading to social realization					
	Tech	Social	W/J	J	Uni	PRO	Ent	Coll	Other	Uni	PRO	Ent	Govt	Coll	Other
5-32: Establishment of technology capable of dissolving CO2 in water or fixing CO2 under the ocean floor.	2018	2026	++			++					+				
7-39: Technology that gives economic incentives to geologic sequestration of CO_2, such as the development of energy resources from oil layers, gas pools, and coal beds by CO_2 injection, and recycling of sequestrated CO_2.	2019	2027	++			+		+				+			
7-35: Practical use of power generation, hydrogen production, and synthetic fuel production by gasification incorporating CCS, with economic efficiency, which is applicable to hydrocarbon resources such as coal, heavy oils and biomass.	2020	2028	++			+	+	+				+		+	
7-36: Storage and management technology concerning the deep brine layer for the expansion of the potential of geologic sequestration of CO_2.	2020	2028	+			+		+						+	
9-46: Materials for carbon fixation so as to reduce CO_2	2021	2030	++		+	+					+	+			
9-33: Membrane separation techniques to produce hydrogen from coal without emitting CO_2 into the environment.	2023	2031	++		+	+						+			

Untapped resources, recycling

Delphi topic (Front numbers represent "panel-topic ID")	year		Importance		Sector leading to tech realization					Sector leading to social realization					
	Tech	Social	W/J	J	Uni	PRO	Ent	Coll	Other	Uni	PRO	Ent	Govt	Coll	Other
7-28: Financially viable selective separation and recovery of rare metals from Waste Electrical and Electronic Equipment (WEEE) and incineration ash.	2015	2020	+	+			+					++			
7-23: Establishment of a regional water reclamation system dealing with the uneven distribution of water by utilizing an economical and practical seawater desalination technology using reverse osmosis membrane, and purification and recycling technology for contaminated water.	2014	2020	+				++					++			
7-04: Technology utilizing medium and low temperature geothermal sources by binary power generation and heat pumps.	2015	2021	+	+			+					++			
10-59: Safe and low-cost storage system for general waste, such as home appliances including rare metals for which reuse and efficient disposal methods have not yet been developed, in a condition enabling future use.	2017	2023	+	+		+	+					+		+	
8-59: Technology to reasonably recover and use rare metals from urban mines, such as general and industrial waste, incinerated ash and fly ash, to supply more than 50% of the required amount of many kinds of rare metals.	2018	2024		+		+	++					++			
10-61: Efficient application technology for the unused thermal energy that is generated intermittently.	2018	2025	++		+	+	+					+			
10-60: Technology to efficiently convert low-grade thermal energy, which is hard to use from the viewpoint of exergy, to high exergy.	2019	2026	+		+	+	+					+			
5-12: Technology for mining ocean floor resources such as hydrothermal deposits on a commercial basis.	2020	2027		++		+	+				+	+			

Delphi topic (Front numbers represent “panel-topic ID”)	year		Importance		Sector leading to tech realization					Sector leading to social realization					
	Tech	Social	W/J	J	Uni	PRO	Ent	Coll	Other	Uni	PRO	Ent	Govt	Coll	Other
8-60: Promotion of a design, production, collection and reuse system that recycles 90% or more of (thermal, chemical and material) products based on legislatively-defined product liability related to the collection and disposal of waste.	2019	2027	+	+			++					+	+		

Commuting, transport system

Delphi topic (Front numbers represent “panel-topic ID”)	year		Importance		Sector leading to tech realization					Sector leading to social realization					
	Tech	Social	W/J	J	Uni	PRO	Ent	Coll	Other	Uni	PRO	Ent	Govt	Coll	Other
2-23: A system under which 80% of office work can be changed into distance work in Japan, that is, where a person can work together with his/her colleagues at different offices with the same communication as if they were at the same office all the time.	2017	2024	+				++					++			
4-59: Design techniques for medical communities and medical cities (such as the residential area for elderly persons)	2018	2024		+		+	+	+				+		+	
1-43: Long life and highly reliable electric vehicle battery technology with high energy density (approximately 3 times as dense as at present) that enables electric vehicles to have a total driving distance on a single charge that is equivalent to that of current gasoline vehicles (approximately 500km)	2018	2025	++				++					++			
2-24: A virtual office system that can halve the number of workers in Japan compared with the present real office.	2018	2025	+				++					++			
6-41: Low-cost secondary cells for vehicles (such as cars) (specific energy: 100 Wh/kg or more, specific power: 2000 W/kg, and specific cost: 30-thousand yen per 1kWh or less).	2019	2025	++				++					++			
11-16: Alternative technology for energy intensive transportation devices for humans to cope with global warming and the escalation of environmental problems.	2018	2026	++				+					+		+	
12-46: Development of a next-generation environmentally-friendly ship (green ship) with 50% less CO_2 emissions and approx. 80% less NOx emissions than present ships.	2019	2026	++				++					++			
12-42: Development of a system to reduce by 50% the time, cost and environmental load at each node that links a railway and road, road and port/airport as well as a railway and port/airport so as to improve the efficiency of freight transportation between cities.	2020	2027	+	+		+	+	+				+	+	+	
9-32: High efficiency fuel cells for vehicles using no rare metals.	2020	2030	+		+	+	+					++			
2-53: Automatic driving technology for automobiles with a special lane that will enable the current usage efficiency of highways to triple.	2020	2031	+			+	+					+	+		

Observation, monitoring, simulation, and forecast

Delphi topic (Front numbers represent “panel-topic ID”)	year		Importance		Sector leading to tech realization					Sector leading to social realization					
	Tech	Social	W/J	J	Uni	PRO	Ent	Coll	Other	Uni	PRO	Ent	Govt	Coll	Other
8-42: Analyses of the current status and the mechanism of the natural emission, absorption and fixation of greenhouse gas.	2018	-	++		++	++				-	-	-	-	-	-
4-61: Elucidation of biological effects of micro-pollutants in the environment.	2019	-	++		++	+				-	-	-	-	-	-
4-63: Prediction of the risk of infectious disease outbreaks, enabled by the progress in modeling and simulation technology for large-scale systems such as the ecosystem and environment.	2018	2025	++		+	+		+		+	+			+	
5-02: Global Earth Observation System that is capable of identifying greenhouse gasses and the density of air pollutants within a 5 × 5 × 1km frame over land, and a 20 × 20 × 4km frame over water.	2020	2027	++			++					++				
5-01: Future modeling over the next 50 to 100 years for the purpose of grasping the CO2 balance in the global atmospheric layer including the ecosystem and living environments of human beings as well as the changes of water circulation.	2020	2027	++		+	++					+				
12-10: Quantitative forecasting of the impact on nature (topography, geology, groundwater, plants and animals, etc.) caused by development becomes available, and the impact of certain development projects will be evaluated based on a simulation considering the scale of the project, alternative options, mitigation measures, and speed of nature restoration.	2019	2027	++		+	+					+		+		
5-03: Global Earth Observation System that is capable of identifying the vapor content of the atmosphere, the wind vector, and the amount of cloud cover arising thereby within a 5 × 5 × 1km frame over land, and a 20 × 20 × 4km frame over water.	2020	2027	++			++					++				
8-23: Forecasting technology for the future global environment on a time scale of several decades based on a global system model that simultaneously takes into account the material cycles within the atmosphere, oceans and land.	2020	2028	++		+	++				+	++				
5-22: Wide-area observation techniques for ocean floors to clarify the global balance of heat and CO2.	2022	2029	++		+	++					++				
2-30: A system to predict conditions of global weather, oceans, environment, ecosystems, epidemics, economics, and human activity through a total simulation based on real-time data can tackle unknown global crises.	2022	2030	++		+	+					+				

Evaluation, consensus building

Delphi topic (Front numbers represent “panel-topic ID”)	year		Importance		Sector leading to tech realization					Sector leading to social realization					
	Tech	Social	W/J	J	Uni	PRO	Ent	Coll	Other	Uni	PRO	Ent	Govt	Coll	Other
7-57: Methodology for building international consensus on the cooperation in and transfer of technologies related to the environment, such as energy savings between developed countries, emerging countries and developing countries, so as to bring national interests, regional interests, and global interests to fruition.	2019	2025	++			+			+				+		+
11-37: A governance structure that monitors, manages, and coordinates within the world-wide framework beyond the framework of each national government's administration will be established to cope with such global issues as excessively speculative money, global warming and exploiting factories.	-	2025	++		-	-	-	-	-				+		+
8-20: Systems to support the relevant governments to make a rational political decision by enabling them to assemble and analyze various scientific knowledge, opinion and evaluation, and then recognize and understand the overview of the problem in cases of the global environmental issues such as climate change.	2020	2027	++			+			+				+		+
11-55: A coordinated decision-making system involving various stakeholders on the basis of use of a knowledge information platform, such as a database and a knowledge base related to the environment.	2019	2027	++		+		+					+			
11-57: In the context of risk management techniques, a scheme for long-term impact assessment to evaluate the influence of artificial and natural materials and systems on health and the environment will be established.	2019	2028	++		++	+				+	+				

<Topics related to health and medical care>

Delphi topic (Front numbers represent “panel-topic ID”)	year		Importance		Sector leading to tech realization					Sector leading to social realization					
	Tech	Social	W/J	J	Uni	PRO	Ent	Coll	Other	Uni	PRO	Ent	Govt	Coll	Other
3-27: Elucidation of the pathophysiology of cancer metastasis.	2019	-	++		++	+				-	-	-	-	-	-
3-03: Technology for identification and functional analysis of the material interaction within a cell or between the inside and outside of the cell.	2018	2025	++		++	+				+		+			
3-02: Technology for molecular imaging in the body with the precision of a single molecule.	2019	2027	++		++	+				+		+			
3-09: Technology that predicts in a detailed manner biological activity, including the interaction between proteins, interaction between protein and DNA or RNA, and interaction between protein and synthetic compounds, from the higher order structure of protein.	2019	2028	++		++	+				+	+	+			
3-07: Technology that analyzes the conformation of protein, which is in a functional state in the body, in a dynamic and detailed manner.	2023	2032	++		++	+				+	+				

Delphi topic (Front numbers represent “panel-topic ID”)	year		Importance		Sector leading to tech realization					Sector leading to social realization					
	Tech	Social	W/J	J	Uni	PRO	Ent	Coll	Other	Uni	PRO	Ent	Govt	Coll	Other
3-34: Technology for regenerative medicine using iPS cells.	2021	2032	++		++	+				+	+	+		+	
4-15: Systematic prevention and treatment methods for dementia that inhibits the decline in elderly people's brain functions.	2024	2033	++		++	+				+	+				

< Others >

Infrastructure management (including IT infrastructure)

Delphi topic (Front numbers represent “panel-topic ID”)	year		Importance		Sector leading to tech realization					Sector leading to social realization					
	Tech	Social	W/J	J	Uni	PRO	Ent	Coll	Other	Uni	PRO	Ent	Govt	Coll	Other
2-01: In the system providing various services to various users by flexible connection of more than a hundred million computers, efficient and semi-automatic technology that builds stable services without any system failures is established.	2018	2023	++				++					++			
2-28: An information traceability system under which an electronic ID given to contents at time of the information source is maintained without being erased or altered, and thereby stolen or scattered information can be tracked easily.	2017	2024	++		+	+	+					+			
12-52: Semipermanent recessed sensor technology notifying the degree of deterioration, lifespan, and time for replacement of structures will be disseminated.	2019	2026	+		+	+	+					+			
2-02: In the system providing various services to various users by flexible connection of more than a hundred million computers, an advanced autonomous service creates new value-added information or new functional services from existing functions and services or from the group of data lying in such services.	2020	2027	++				+					++			

Crisis management, disaster control

Delphi topic (Front numbers represent “panel-topic ID”)	year		Importance		Sector leading to tech realization					Sector leading to social realization					
	Tech	Social	W/J	J	Uni	PRO	Ent	Coll	Other	Uni	PRO	Ent	Govt	Coll	Other
12-16: Establishment of real-time damage recognition and forecast technology enabling the national and municipal emergency operation center to take emergency measures immediately and effectively in the case of a large-scale natural disaster that requires prefecture-level measures.	2018	2024		++		++		+					++		

Delphi topic (Front numbers represent “panel-topic ID”)	year		Importance		Sector leading to tech realization					Sector leading to social realization					
	Tech	Social	W/J	J	Uni	PRO	Ent	Coll	Other	Uni	PRO	Ent	Govt	Coll	Other
12-13: Nation-wide high-precision observation systems for the atmosphere, hydrosphere and geosphere will be established to prevent harm to humans caused by large-scale natural disasters (floods, landslides, debris flow, avalanches, etc.) caused by some weather phenomena (precipitation, typhoon, heavy rain, snowfall, etc.) requiring prefecture-level measures, enabling the alarm, evacuation, and control based on the prediction of (approx. 1 hour in advance) the disaster.	2019	2027	+		+	++					+		+		
2-30: A system to predict conditions of global weather, oceans, environment, ecosystems, epidemics, economics, and human activity through a total simulation based on real-time data can tackle unknown global crises.	2022	2030	++		+	+					+				

Safety in life

Delphi topic (Front numbers represent “panel-topic ID”)	year		Importance		Sector leading to tech realization					Sector leading to social realization					
	Tech	Social	W/J	J	Uni	PRO	Ent	Coll	Other	Uni	PRO	Ent	Govt	Coll	Other
4-42: An intelligent communication style living environment system including life support robots for elderly persons and disabled persons.	2019	2027	+		+		+	+				+		+	
2-29: A world wide traceability system covering most of the food products.	2019	2028	++				+					+			
2-31: Intelligent robotic technology that enables families and relatives to provide livelihood support to aged and handicapped people safely by remote control from a distance; the robots will be intelligent enough to avoid the risks that a teleoperator is unaware of.	2020	2028	+		+	+	+					+			

Human resource cultivation, mobility, diversification

Delphi topic (Front numbers represent “panel-topic ID”)	year		Importance		Sector leading to tech realization					Sector leading to social realization					
	Tech	Social	W/J	J	Uni	PRO	Ent	Coll	Other	Uni	PRO	Ent	Govt	Coll	Other
11-32: A support system enabling staff to reuse and learn about the judgment process, skills and know-how of skilled staff, through the clear demonstration thereof.	2016	2021		+			++					++			
11-34: A social environment enabling women to balance marriage, birth and child care with work to promote their social involvement (for example, 30% of listed companies will have a day-care center for children) will be realized.	-	2021		++	-	-	-	-	-			++	+		
11-6: Along with the improvement of global management abilities premised on foreign cultures, faculty development programs will be carried out to understand the history, culture, language, legislation system, value system and so on of foreign countries.	-	2021	+	+	-	-	-	-	-			+			

Delphi topic (Front numbers represent “panel-topic ID”)	year		Importance		Sector leading to tech realization					Sector leading to social realization					
	Tech	Social	W/J	J	Uni	PRO	Ent	Coll	Other	Uni	PRO	Ent	Govt	Coll	Other
11-31: Human resources will be mobilized according to changes in society and economics against the backdrop of the spread of the recurrent education for job training in graduate schools or later.	-	2022		++	-	-	-	-	-	+		+			+
10-68: Education system to train engineers who can rationally improve design in a more upper-stream phase than the conventional design process intends, and to continuously develop their ability.	-	2022		++	-	-	-	-	-	+		+			+
11-7: A globally networked human resource management system will be established, and it will help high-level experts to transfer freely beyond borders between countries.	-	2022	++		-	-	-	-	-			++			

Base technology, frontier technology

Delphi topic (Front numbers represent “panel-topic ID”)	year		Importance		Sector leading to tech realization					Sector leading to social realization					
	Tech	Social	W/J	J	Uni	PRO	Ent	Coll	Other	Uni	PRO	Ent	Govt	Coll	Other
9-3: New functional materials made of complex heterogeneous materials through nano-scale control of structure and interface.	2017	2023	++		+	+						++			
9-4: Industrial processing technology for 3-dimensional nano-scale integration.	2018	2025	+		+	+	+					++			
9-2: Industrial technology to control nanostructures of sizes of 10nm or less using self-assembly.	2019	2026	++		+	+						++			
9-16: Manufacturing technology that uses nano-order self-assembly techniques.	2019	2027	++		++	+						++			
5-57: Japanese-made highly reliable (high robustness) and competitive (cost-minimization, microminiaturization, and weight-minimization) space equipment (for space transportation and spacecraft, etc.)	2017	2022		++		+	+				+	+			
5-64: Radical technical measures to counter the debris problem (development of debris-free space systems, collection or disposal by injection into the atmosphere of debris already remaining, etc.)	2023	2032	++			++					++				
5-60: Japan's own manned space system (manned launch vehicle, manned spacecraft)	2024	2033		+		++					++				

Questionnaire result by panel

Panel 1:

Utilization of electronics, communication, and nanotechnology in a ubiquitous society

Implementation of the questionnaires

	Sent	Returned (response rate)
<1st Round>	291	240 (82%)
<2nd Round>	240	205 (85%)

Sex	Male	199	Affiliation	Private enterprise	77
	Female	6		University	107
	N.A.	0		Research Institute	14
generation	20’s	1		Association	1
	30’s	11		Others	6
	40’s	45		N.A.	0
	50’s	90	Job category	R&D	172
	60’s	49		Others	32
	70’s and over	9		N.A.	1
	N.A.	0		Total	205

Survey items

A: Advanced computing systems

B: Communications

C: I/O (including home electronics)

D: Energy-related

E: Devices

F: Mechatronics

Time-series tables of topics

<Technological realization>

year	Topic (Leading number represents ID)
2013	16: Ubiquitous computing technology supporting health control (calorie counting, exercise intensity and others) to maintain and to improve one's health in daily life using computer software.
	26: Public services helping to monitor the weak (such as elderly people, children, and women), detecting suspicious individuals and the like through the use of regional image information provided by image sensors (cameras) within the local residents network.
2014	22: Communications technology whereby multiple wireless information devices are directly connected to each other to transmit and receive information through multihop networks.
	24: A system providing optimized services whereby the position and the related information on the sender's surroundings are sent to the system instantly and automatically.
	29: Technology automatically detecting multiple wireless systems (for example, telephone lines and LANs) and thereby automatically detecting and connecting to the best network (cognitive wireless communication technology).
2015	07: Ubiquitous scanner technologies that glean timely environment information by extraction from miscellaneous information from RFIDs in order to support various ubiquitous services.
	20: 10 Gbps fiber-to-the-home telecommunication system.
	21: Fruition of millimeter wave communications of more than 10 Gbps between buildings (a few hundred meters apart).
	31: Network control and operation technology under which information from moving vehicles (such as busses, trains, Shinkansens, planes and ships) is managed in an integrated fashion.
	32: Thin and flexible portable electronic displays that may replace newspapers.
	41: Housing and office buildings constructed of intelligent construction modules with function units such as communications, sensors, display, lighting, air conditioning, sound effects, and/or power supply.
2016	08: Ubiquitous utilization circumstances in the form of social infrastructure providing safe and free access to one's own information processing environment anytime and anywhere.
	10: An evaluation methodology for information appliances using reliability indexes by which consumers can intuitively understand the reason for price increases.
	15: A single search system to be used for all objects, crossing various media and/or languages.
	23: Seamless communication technology which does not depend on various communication systems and enables users to use such technology with little awareness of the access method (enables broadcast, communication, seamless information distribution between home appliances in the home, and traffic information distribution between cars and/or between cars and an information center).
2016	27: Microgrid technology that optimizes power supply through distribution power network communication, control and management technology, and telecommunications.
	30: Technology establishing and managing a network that dynamically connects the members to each other as needed through the cognitive network.
2016	64: A system capable of predicting failures and avoiding accidents by utilizing various sensors mounted on the vehicles.

year	Topic (Leading number represents ID)
2017	01: Hierarchic system LSIs which take full advantage of the on-chip network technology that can scalably take advantage of highly integrated semiconductors.
	02: Network systems responding dynamically to the operating status and environmental condition of the inside and/or outside of the systems to provide required services with high reliability and without human intervention or any interruption.
	03: Network service technology responding automatically to the execution environment (operating systems, available devices and capabilities, network environments, etc.) to provide software that can implement the required services in the most appropriate manner.
	09: A distributed server system using wide-area networking virtualization technology providing services according to the dramatically increasing requests from clients, with low power consumption and high throughput (processing performance power consumption ratio is 100 times more than conventional systems), in an advanced information society.
	17: High speed communication technology of over 1Tbps through a single line.
	25: Wireless sensor networks strongly supporting human activities as needed by means of many sensors placed in the living space, with guaranteed practical security.
	28: Wireless communication technology which can be used at ease since it secures security by automatically detecting wiretapping and/or interception and by preventing radio wave jamming of communication lines.
	33: Portable assistance devices which recognize the voice of the owner and memorizes the owner's experience (the situation such as the place, time, action, outside scene, and sounds), and stimulates the owner's memory by replaying the voice recorded in the memory of the device when necessary by using the situation awareness technology sensing the same situation (to improve the QOL of elderly people).
	38: On-demand actuator technology that can assist the ability to move in day-to-day actions without causing muscular atrophy (to improve the QOL of elderly people).
	39: A wireless communication sensor with power harvesting (capturing energies from the surrounding environment).
	48: Mobile devices (PCs, cell phones, PDAs and others) powered via wireless power supply devices.
	49: Successive contactless charging technology that charges electric vehicles and/or hybrid vehicles when they are parked at public parking lots and/or stopped at roads and intersections.
2018	06: A handheld computer that can be used for one week or more on a single charge.
	43: Long life and highly reliable electric vehicle battery technology with high energy density (approximately 3 times as dense as at present) that enables electric vehicles to have a total driving distance on a single charge that is equivalent to that of current gasoline vehicles (approximately 500km).
	62: A system that can ensure the prevention of traffic accidents due to cars colliding with each other, etc. through utilizing an inter-vehicle communication system.
	63: Highly reliable communication technology for automatic tracking or autopilot that can provide high-speed (not less 100Mbps) communication between vehicles and a base station on a real-time basis, without communications blackout, and has a backup function that works even if communications fail for any reason.
2018	65: A supporting robot for human lives and activities (such as nursing care and domestic affairs) in general households.
2019	14: A teleconference supporting system (including automatic translation) with capabilities to automatically invite experts from all over the world who are competent in the theme of each issue and to facilitate their discussions.

year	Topic (Leading number represents ID)
	37: A noninvasive brain activity measuring device that can easily measure the true feelings of mystery shoppers during product estimation.
	42: Home-use electric power storage cell technology, with a price tag of one million yen or less, that can stably cover approximately 90% of the necessary electric energy by integrating photovoltaic generation and secondary cells for All-DENKA house (a house in which electricity fully covers home-use energy).
	45: Most of the mobile devices' (PCs, cell phones, PDAs and others) power sources shall be replaced with fuel cells.
	50: Power feeding infrastructure technology capable of continually charging electric vehicles and/or hybrid vehicles when they are driving on highways.
	51: Component devices using novel materials such as SiC or GaN that allow a power density of 100 W/cc or more.
	52: Smart grid technology that can improve power efficiency and reduce the total Japanese power needs by 20%.
	70: A safe transportation system that detects driver errors and copes with them in a proper manner.
2020	13: Practical quantum cryptography technology that will realize a secure global information society.
	18: Network nodes for which power consumption will be 1,000 times as little as present consumption through nanophotonic technology.
	19: Fruition (practical application) of a quantum cryptography network for specific use between cities over 100 km apart.
	34: A medical chip embedded in the human body that enables health-condition monitoring and/or vital function support providing such as a heart pace maker due to self power harvesting by bioenergy sources such as body heat or blood flow semi permanently.
	40: A display unit that can generate smells and tastes based on its sensing.
	46: LSIs that operate semi-permanently, powered by the energy (100 mW) of vibration.
	47: LSIs that operate semi-permanently by utilizing heat energy.
	56: A photonic sensor device to make efficient use of 1THz to 10THz electromagnetic waves.
	60: Control techniques for hybrid vehicles, activating the motors (actuators) of moving vehicles by using various energies such as fossil fuels, solar energy, wind power, electricity, air and heat.
	66: Autonomous robots with a judgment function that is capable of coping with complicated situations, such as production process work with process changes or situations like farm work.
	69: An assistant network robot that predicts risks by summarizing life space information detected by sensors and/or various information from networks, in order to encourage elderly people to go out and to guide them to comfortable places (to improve QOL of elderly people).
2021	35: Medical technology that is based on nanochips and/or microsensors, is embedded in the human body or moves through blood vessels, and has the capability to communicate with and/or be controlled by outside devices.
2021	61: An autopilot system that guides passengers to their destination if they input the desired destination into the system.
2022	57: A novel device that is capable of on-demand generation of single photons for quantum cryptography communications in order to improve the security of the network.

year	Topic (Leading number represents ID)
2023	36: A Brain-Machine Interface that communicates directly with the brains and/or neurons of humans.
	44: Solar cells with energy conversion efficiency of 60% or more.
2024	04: Supercomputer technology that will increase calculation capability to 100,000 times as great as present technology, and that is necessary for the advanced information-oriented society.
	05: LSI packaging technology that enhances the present processing performance power consumption ratio by a factor of at least several thousands, through the application of several thousand processor cores and the utilization of transistors with a 3nm gate length.
	54: Large scale system integration technology on a device systematizing nano-functional components such as molecules, CNT and submicron particles by combining top-down technology and bottom-up technology.
2025	11: Computing and/or networking technology imitating various mechanisms of organisms and living bodies (gleaning, processing, transmission, accumulation, and utilization of information).
	67: A minimal actuator that imitates a biomolecular motor and operates using molecule power.
2028	53: An information device surpassing CMOS device's features by using single spin technology as its information carrier.
	55: A highly reliable bio-organic device and/or DNA device that operate at ultra low voltage (tens of mV) and have a low-impact on the human body.
2030	68: A nano mechanical system made by self-organization.
2032	12: Versatile quantum computing that can be adapted to various algorithms.
	58: A storage device in which 1 atom or 1 molecule corresponds to 1 bit and that is capable of quickly accumulating and searching information data sets, which are increasing in size dramatically.
2033	59: New feature technology resulting from a fusion of electronics and unicellular or single-molecule level biological mechanisms.

<Social realization>

year	Topic (Leading number represents ID.)
2018	16: Ubiquitous computing technology supporting health control (calorie counting, exercise intensity and others) to maintain and to improve one's health in daily life using computer software.
2019	22: Communications technology whereby multiple wireless information devices are directly connected to each other to transmit and receive information through multihop networks.
	24: A system providing optimized services whereby the position and the related information on the sender's surroundings are sent to the system instantly and automatically.
	26: Public services helping to monitor the weak (such as elderly people, children, and women), detecting suspicious individuals and the like through the use of regional image information provided by image sensors (cameras) within the local residents network.
2019	29: Technology automatically detecting multiple wireless systems (for example, telephone lines and LANs) and thereby automatically detecting and connecting to the best network (cognitive wireless communication technology).

year	Topic (Leading number represents ID.)
2020	01: Hierarchic system LSIs which take full advantage of the on-chip network technology that can scalably take advantage of highly integrated semiconductors.
	03: Network service technology responding automatically to the execution environment (operating systems, available devices and capabilities, network environments, etc.) to provide software that can implement the required services in the most appropriate manner.
	07: Ubiquitous scanner technologies that glean timely environment information by extraction from miscellaneous information from RFIDs in order to support various ubiquitous services.
	08: Ubiquitous utilization circumstances in the form of social infrastructure providing safe and free access to one's own information processing environment anytime and anywhere.
	20: 10 Gbps fiber-to-the-home telecommunication system.
	21: Fruition of millimeter wave communications of more than 10 Gbps between buildings (a few hundred meters apart).
	27: Microgrid technology that optimizes power supply through distribution power network communication, control and management technology, and telecommunications.
	30: Technology establishing and managing a network that dynamically connects the members to each other as needed through the cognitive network.
	32: Thin and flexible portable electronic displays that may replace newspapers.
	41: Housing and office buildings constructed of intelligent construction modules with function units such as communications, sensors, display, lighting, air conditioning, sound effects, and/or power supply.
2021	10: An evaluation methodology for information appliances using reliability indexes by which consumers can intuitively understand the reason for price increases.
	15: A single search system to be used for all objects, crossing various media and/or languages.
	31: Network control and operation technology under which information from moving vehicles (such as busses, trains, Shinkansens, planes and ships) is managed in an integrated fashion.
2022	17: High speed communication technology of over 1Tbps through a single line.
	23: Seamless communication technology which does not depend on various communication systems and enables users to use such technology with little awareness of the access method (enables broadcast, communication, seamless information distribution between home appliances in the home, and traffic information distribution between cars and/or between cars and an information center).
2023	02: Network systems responding dynamically to the operating status and environmental condition of the inside and/or outside of the systems to provide required services with high reliability and without human intervention or any interruption.
	06: A handheld computer that can be used for one week or more on a single charge.
	09: A distributed server system using wide-area networking virtualization technology providing services according to the dramatically increasing requests from clients, with low power consumption and high throughput (processing performance power consumption ratio is 100 times more than conventional systems), in an advanced information society.
2023	28: Wireless communication technology which can be used at ease since it secures security by automatically detecting wiretapping and/or interception and by preventing radio wave jamming of communication lines.
	38: On-demand actuator technology that can assist the ability to move in day-to-day actions without causing muscular atrophy (to improve the QOL of elderly people).

year	Topic (Leading number represents ID.)
	39: A wireless communication sensor with power harvesting (capturing energies from the surrounding environment).
	49: Successive contactless charging technology that charges electric vehicles and/or hybrid vehicles when they are parked at public parking lots and/or stopped at roads and intersections.
2024	25: Wireless sensor networks strongly supporting human activities as needed by means of many sensors placed in the living space, with guaranteed practical security.
	33: Portable assistance devices which recognize the voice of the owner and memorizes the owner's experience (the situation such as the place, time, action, outside scene, and sounds), and stimulates the owner's memory by replaying the voice recorded in the memory of the device when necessary by using the situation awareness technology sensing the same situation (to improve the QOL of elderly people).
	48: Mobile devices (PCs, cell phones, PDAs and others) powered via wireless power supply devices.
	64: A system capable of predicting failures and avoiding accidents by utilizing various sensors mounted on the vehicles.
2025	43: Long life and highly reliable electric vehicle battery technology with high energy density (approximately 3 times as dense as at present) that enables electric vehicles to have a total driving distance on a single charge that is equivalent to that of current gasoline vehicles (approximately 500km).
2026	14: A teleconference supporting system (including automatic translation) with capabilities to automatically invite experts from all over the world who are competent in the theme of each issue and to facilitate their discussions.
	42: Home-use electric power storage cell technology, with a price tag of one million yen or less, that can stably cover approximately 90% of the necessary electric energy by integrating photovoltaic generation and secondary cells for All-DENKA house (a house in which electricity fully covers home-use energy).
	51: Component devices using novel materials such as SiC or GaN that allow a power density of 100 W/cc or more.
	52: Smart grid technology that can improve power efficiency and reduce the total Japanese power needs by 20%.
	62: A system that can ensure the prevention of traffic accidents due to cars colliding with each other, etc. through utilizing an inter-vehicle communication system.
	63: Highly reliable communication technology for automatic tracking or autopilot that can provide high-speed (not less 100Mbps) communication between vehicles and a base station on a real-time basis, without communications blackout, and has a backup function that works even if communications fail for any reason.
	65: A supporting robot for human lives and activities (such as nursing care and domestic affairs) in general households.
2027	18: Network nodes for which power consumption will be 1,000 times as little as present consumption through nanophotonic technology.
	45: Most of the mobile devices' (PCs, cell phones, PDAs and others) power sources shall be replaced with fuel cells.
2027	50: Power feeding infrastructure technology capable of continually charging electric vehicles and/or hybrid vehicles when they are driving on highways.
2028	19: Fruition (practical application) of a quantum cryptography network for specific use between cities over 100 km apart.

year	Topic (Leading number represents ID.)
	34: A medical chip embedded in the human body that enables health-condition monitoring and/or vital function support providing such as a heart pace maker due to self power harvesting by bioenergy sources such as body heat or blood flow semi permanently.
	40: A display unit that can generate smells and tastes based on its sensing.
	46: LSIs that operate semi-permanently, powered by the energy (100 mW) of vibration.
	47: LSIs that operate semi-permanently by utilizing heat energy.
	60: Control techniques for hybrid vehicles, activating the motors (actuators) of moving vehicles by using various energies such as fossil fuels, solar energy, wind power, electricity, air and heat.
	69: An assistant network robot that predicts risks by summarizing life space information detected by sensors and/or various information from networks, in order to encourage elderly people to go out and to guide them to comfortable places (to improve QOL of elderly people).
	70: A safe transportation system that detects driver errors and copes with them in a proper manner.
2029	56: A photonic sensor device to make efficient use of 1THz to 10THz electromagnetic waves.
	66: Autonomous robots with a judgment function that is capable of coping with complicated situations, such as production process work with process changes or situations like farm work.
2030	04: Supercomputer technology that will increase calculation capability to 100,000 times as great as present technology, and that is necessary for the advanced information-oriented society.
	13: Practical quantum cryptography technology that will realize a secure global information society.
	35: Medical technology that is based on nanochips and/or microsensors, is embedded in the human body or moves through blood vessels, and has the capability to communicate with and/or be controlled by outside devices.
	37: A noninvasive brain activity measuring device that can easily measure the true feelings of mystery shoppers during product estimation.
	44: Solar cells with energy conversion efficiency of 60% or more.
2031	05: LSI packaging technology that enhances the present processing performance power consumption ratio by a factor of at least several thousands, through the application of several thousand processor cores and the utilization of transistors with a 3nm gate length.
2033	11: Computing and/or networking technology imitating various mechanisms of organisms and living bodies (gleaning, processing, transmission, accumulation, and utilization of information).
	57: A novel device that is capable of on-demand generation of single photons for quantum cryptography communications in order to improve the security of the network.
2034	36: A Brain-Machine Interface that communicates directly with the brains and/or neurons of humans.
2034	54: Large scale system integration technology on a device systematizing nano-functional components such as molecules, CNT and submicron particles by combining top-down technology and bottom-up technology.
2035	61: An autopilot system that guides passengers to their destination if they input the desired destination into the system.

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	67: A minimal actuator that imitates a biomolecular motor and operates using molecule power.
2036	53: An information device surpassing CMOS device's features by using single spin technology as its information carrier.
2037	55: A highly reliable bio-organic device and/or DNA device that operate at ultra low voltage (tens of mV) and have a low-impact on the human body.
2038	12: Versatile quantum computing that can be adapted to various algorithms.
	68: A nano mechanical system made by self-organization.
2040	58: A storage device in which 1 atom or 1 molecule corresponds to 1 bit and that is capable of quickly accumulating and searching information data sets, which are increasing in size dramatically.
2041-	59: New feature technology resulting from a fusion of electronics and unicellular or single-molecule level biological mechanisms.

Area	Topic number	Topic	Round	Responses	Degree of expertise				Importance				Forecasted time of technological realization (to be realized somewhere in the world)							Sectors that will pave the way to technological realization					Forecasted time of social realization (to become applicable/widely used in Japan)							Sectors that will pave the way to social realization					
					High	Moderate	Low	None	Important for Japan and the rest of the world	Especially important for Japan	Especially important for the world	Low importance/priority	Already realized	2011-2015	2016-2020	2021-2030	2031-2040	2041-	will not be realized	don't know	University	Public research organization	Private enterprise	Collaboration of multiple sectors	Others	2011-2015	2016-2020	2021-2030	2031-2040	2041-	will not be realized	don't know	University	Public research organization	Private enterprise	Government	Collaboration of multiple sectors	Others
					(%)				(%)				(%)								(%)												(%)					
Advanced computing systems	1	Hierarchic system LSIs which take full advantage of the on-chip network technology that can scalably take advantage of highly integrated semiconductors.	1	152	14	28	58	-	72	18	2	8							0	7	29	24	68	35	1						0	7	7	14	81	8	18	2
			2	127	14	26	60	-	77	17	2	4							0	5	23	22	77	33	1						0	4	6	15	90	6	17	2
			E	18	100	0	0	-	94	6	0	0							0	0	33	17	78	33	0						0	0	11	11	89	11	17	0
	2	Network systems responding dynamically to the operating status and environmental condition of the inside and/or outside of the systems to provide required services with high reliability and without human intervention or any interruption.	1	167	10	37	53	-	76	14	2	8							2	5	36	38	60	24	3						2	5	11	18	74	14	20	5
			2	142	8	37	55	-	85	9	1	5							2	3	30	37	70	21	0						2	3	7	19	86	10	22	0
			E	12	100	0	0	-	82	9	0	9							9	0	50	67	50	17	0						9	0	17	25	75	8	33	0
	3	Network service technology responding automatically to the execution environment (operating systems, available devices and capabilities, network environments, etc.) to provide software that can implement the required services in the most appropriate manner.	1	158	8	37	55	-	77	9	4	10							1	3	33	28	69	20	4						2	3	10	14	82	10	20	3
			2	134	5	38	57	-	87	5	1	7							1	2	32	27	73	18	1						1	2	9	13	90	5	16	2
			E	7	100	0	0	-	100	0	0	0							0	0	71	57	43	14	0						0	0	14	14	100	0	29	0
	4	Supercomputer technology that will increase calculation capability to 100,000 times as great as present technology, and that is necessary for the advanced information-oriented society.	1	170	5	36	59	-	65	18	6	11							2	7	31	48	36	46	2						4	8	15	35	41	26	35	2
			2	141	5	34	61	-	73	14	3	10							1	4	24	55	33	45	1						1	5	9	37	47	17	39	1
			E	7	100	0	0	-	72	0	14	14							14	0	43	100	29	14	14						14	0	29	71	29	29	29	0
	5	LSI packaging technology that enhances the present processing performance power consumption ratio by a factor of at least several thousands, through the application of several thousand processor cores and the utilization of transistors with a 3nm gate length.	1	152	18	40	42	-	66	21	3	10							7	4	34	33	57	36	3						8	5	14	17	74	11	26	3
			2	135	16	33	51	-	69	19	1	11							8	2	29	34	67	38	2						5	3	9	16	78	9	27	2
			E	22	100	0	0	-	64	18	0	18							18	0	30	15	45	30	0						18	0	14	10	57	5	38	0
	6	A handheld computer that can be used for one week or more on a single charge.	1	191	8	35	57	-	68	13	4	15							4	3	18	20	86	14	0						3	3	6	6	93	4	9	1
			2	166	7	32	61	-	80	8	0	12							3	1	11	11	91	9	0						3	2	3	4	95	3	7	1
			E	12	100	0	0	-	84	8	0	8							8	0	8	0	83	8	0						9	0	0	0	100	0	0	0
	7	Ubiquitous scanner technologies that glean timely environment information by extraction from miscellaneous information from RFIDs in order to support various ubiquitous services.	1	181	16	33	51	-	64	21	3	12							1	2	29	30	65	31	1						1	2	10	18	70	17	25	2
			2	157	15	32	53	-	76	15	1	8							0	1	24	31	74	28	1						0	2	8	16	78	14	26	1
			E	23	100	0	0	-	74	17	0	9							0	0	30	30	74	22	0						0	5	13	22	78	22	13	0
	8	Ubiquitous utilization circumstances in the form of social infrastructure providing safe and free access to one's own information processing environment anytime and anywhere.	1	203	18	36	46	-	75	15	2	8							4	3	28	32	69	32	5						4	3	13	18	70	27	30	3
			2	176	15	34	51	-	85	9	1	5							2	2	25	32	73	34	2						2	2	8	15	76	26	30	1
			E	27	100	0	0	-	93	7	0	0							0	0	33	41	78	33	0						0	0	19	26	81	41	26	0

Area	Topic number	Topic	Round	Responses	Degree of expertise (%)				Importance (%)				Forecasted time of technological realization (to be realized somewhere in the world) (%)							Sectors that will pave the way to technological realization (%)					Forecasted time of social realization (to become applicable/widely used in Japan) (%)							Sectors that will pave the way to social realization (%)					
					High	Moderate	Low	None	Important for Japan and the rest of the world	Especially important for Japan	Especially important for the world	Low importance/priority	Already realized	2011-2015	2016-2020	2021-2030	2031-2040	2041-	don't know will not be realized	University	Public research organization	Private enterprise	Collaboration of multiple sectors	Others	2011-2015	2016-2020	2021-2030	2031-2040	2041-	don't know will not be realized	University	Public research organization	Private enterprise	Government	Collaboration of multiple sectors	Others
Advanced computing systems	9	A distributed server system using wide-area networking virtualization technology providing services according to the dramatically increasing requests from clients, with low power consumption and high throughput (processing performance power consumption ratio is 100 times more than conventional systems), in an advanced information society.	1	150	8	36	56	-	79	11	2	8							1	5	28	29	66	27	1						1	5	13	14	77	10	23	4
			2	125	7	34	59	-	87	6	1	6							1	3	22	29	71	27	1						1	3	9	15	81	7	24	2
			E	9	100	0	0	-	78	0	0	22							0	0	22	11	78	11	0						0	0	11	11	89	0	22	0
	10	An evaluation methodology for information appliances using reliability indexes by which consumers can intuitively understand the reason for price increases.	1	110	6	31	63	-	26	26	0	48							10	14	11	24	65	21	5						9	17	8	20	73	11	18	6
			2	102	5	27	68	-	23	23	0	54							7	12	5	21	68	22	3						7	15	2	18	76	9	15	2
			E	5	100	0	0	-	40	40	0	20							20	20	20	40	40	40	0						40	20	0	20	40	20	20	20
	11	Computing and/or networking technology imitating various mechanisms of organisms and living bodies (gleaning, processing, transmission, accumulation, and utilization of information).	1	172	7	30	63	-	69	11	2	18							2	10	74	41	18	18	1						2	12	37	32	47	10	21	1
			2	141	6	29	65	-	76	9	1	14							1	6	72	43	15	18	0						1	10	35	33	57	7	20	0
			E	9	100	0	0	-	78	11	0	11							11	0	56	22	11	44	0						11	0	11	33	33	22	22	0
	12	Versatile quantum computing that can be adapted to various algorithms.	1	151	7	23	70	-	68	12	2	18							9	11	72	52	20	26	3						11	12	42	42	40	14	28	4
			2	130	5	19	76	-	77	8	1	14							5	6	74	54	17	21	1						10	10	41	43	46	11	31	2
			E	7	100	0	0	-	100	0	0	0							0	0	86	71	43	0	0						0	0	86	71	29	14	14	0
	13	Practical quantum cryptography technology that will realize a secure global information society.	1	153	6	22	72	-	87	7	1	5							4	5	56	55	34	28	7						3	8	30	39	48	22	31	11
			2	129	5	18	77	-	92	2	1	5							3	2	60	56	32	29	5						2	5	30	40	55	19	30	10
			E	7	100	0	0	-	100	0	0	0							14	0	57	43	57	14	14						14	0	14	43	86	43	0	29
	14	A teleconference supporting system (including automatic translation) with capabilities to automatically invite experts from all over the world who are competent in the theme of each issue and to facilitate their discussions.	1	147	10	24	66	-	58	12	5	25							5	6	38	43	40	29	8						6	8	18	32	43	17	25	14
			2	127	7	22	71	-	63	9	6	22							2	5	39	49	39	34	7						2	8	16	37	53	13	27	13
			E	9	100	0	0	-	89	0	0	11							0	0	44	67	56	22	0						0	22	22	44	67	22	11	11
	15	A single search system to be used for all objects, crossing various media and/or languages.	1	148	11	24	65	-	78	10	3	9							0	2	45	39	60	22	5						0	4	26	27	72	12	21	10
			2	132	11	19	70	-	81	10	2	7							0	2	42	32	70	20	4						0	3	20	20	80	9	22	8
			E	15	100	0	0	-	93	0	0	7							0	0	67	47	73	27	7						0	0	60	40	80	20	27	7
	16	Ubiquitous computing technology supporting health control (calorie counting, exercise intensity and others) to maintain and to improve one's health in daily life using computer software.	1	156	16	26	58	-	44	22	1	33							0	2	26	30	82	16	3						1	5	18	20	80	16	18	6
			2	136	12	26	62	-	48	20	0	32							0	2	19	28	84	17	2						1	5	12	15	87	13	15	3
			E	16	100	0	0	-	80	13	0	7							0	0	31	38	81	19	0						0	7	19	31	75	19	31	0

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					High	Moderate	Low	None	Important for Japan and the rest of the world	Especially important for Japan	Especially important for the world	Low importance/priority	Already realized	2011-2015	2016-2020	2021-2030	2031-2040	2041-	don't know will not be realized		University	Public research organization	Private enterprise	Collaboration of multiple sectors	Others	2011-2015	2016-2020	2021-2030	2031-2040	2041-	don't know will not be realized		University	Public research organization	Private enterprise	Government	Collaboration of multiple sectors	Others
Communications	17	High speed communication technology of over 1Tbps through a single line.	1	177	20	34	46	-	89	5	1	5							1	3	37	48	58	28	5						0	4	14	26	69	20	28	6
			2	153	18	32	50	-	91	5	0	4							0	0	31	49	67	28	3						0	1	9	22	79	16	27	2
			E	27	100	0	0	-	100	0	0	0							0	0	12	31	65	46	8						0	4	4	20	72	20	32	8
	18	Network nodes for which power consumption will be 1,000 times as little as present consumption through nanophotonic technology.	1	149	13	28	59	-	84	15	0	1							1	7	51	50	46	32	1						1	7	24	30	65	13	27	3
			2	125	11	30	59	-	87	11	0	2							1	4	50	52	51	30	0						1	4	15	25	75	8	30	0
			E	14	100	0	0	-	93	7	0	0							0	0	43	50	50	29	0						0	0	14	21	71	7	36	0
	19	Fruition (practical application) of a quantum cryptography network for specific use between cities over 100 km apart.	1	130	10	22	68	-	67	13	0	20							2	11	46	52	46	25	3						4	12	24	36	56	24	30	5
			2	109	8	24	68	-	76	3	0	21							0	9	45	54	48	24	3						2	9	19	35	65	17	31	3
			E	9	100	0	0	-	78	0	0	22							0	11	44	67	56	11	0						11	11	22	56	67	22	33	0
	20	10 Gbps fiber-to-the-home telecommunication system.	1	171	19	32	49	-	50	29	0	21							1	2	17	29	80	16	1						4	5	7	16	87	15	18	1
			2	146	16	31	53	-	60	20	0	20							0	3	6	20	88	14	0						3	3	3	10	91	11	14	0
			E	23	100	0	0	-	78	13	0	9							0	0	4	4	91	9	0						4	0	4	4	91	13	9	0
	21	Fruition of millimeter wave communications of more than 10 Gbps between buildings (a few hundred meters apart).	1	145	14	34	52	-	44	27	2	27							3	5	25	40	70	16	3						2	8	13	26	81	13	16	2
			2	121	16	33	51	-	51	23	1	25							2	3	14	34	82	14	2						2	6	8	21	88	8	14	1
			E	19	100	0	0	-	71	17	6	6							0	0	21	26	89	16	0						0	0	11	17	89	11	22	0
	22	Communications technology whereby multiple wireless information devices are directly connected to each other to transmit and receive information through multihop networks.	1	149	23	30	47	-	71	16	3	10							1	1	40	40	68	23	3						2	3	13	21	80	17	16	5
			2	130	22	28	50	-	75	13	2	10							0	2	33	34	77	23	1						1	3	10	17	84	10	20	2
			E	29	100	0	0	-	89	4	0	7							0	0	52	45	76	31	0						0	0	15	27	92	15	23	8
	23	Seamless communication technology which does not depend on various communication systems and enables users to use such technology with little awareness of the access method (enables broadcast, communication, seamless information distribution between home appliances in the home, and traffic information distribution between cars and/or between cars and an information center).	1	162	20	33	47	-	71	21	0	8							2	3	29	40	64	33	5						2	3	13	24	76	20	24	6
			2	140	18	30	52	-	78	14	0	8							1	1	23	42	74	34	4						1	2	9	23	83	16	26	4
			E	25	100	0	0	-	83	13	0	4							0	0	48	60	76	40	8						0	4	17	26	96	22	30	4
	24	A system providing optimized services whereby the position and the related information on the sender's surroundings are sent to the system instantly and automatically.	1	173	16	34	50	-	53	22	2	23							2	5	33	30	70	21	0						3	4	11	18	80	13	20	2
			2	152	14	30	56	-	62	19	0	19							1	3	24	25	81	24	0						2	3	6	16	88	12	20	1
			E	22	100	0	0	-	77	14	0	9							0	0	41	27	77	41	0						0	0	10	14	95	10	24	0

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Communications	25	Wireless sensor networks strongly supporting human activities as needed by means of many sensors placed in the living space, with guaranteed practical security.	1	191	19	38	43	-	62	23	1	14							1	4	44	43	55	32	3						1	7	18	24	67	22	31	4
			2	169	15	38	47	-	72	14	0	14							1	2	41	43	60	34	2						1	3	11	19	76	23	33	1
			E	26	100	0	0	-	96	4	0	0							0	0	65	50	58	46	4						0	0	20	28	68	36	36	0
	26	Public services helping to monitor the weak (such as elderly people, children, and women), detecting suspicious individuals and the like through the use of regional image information provided by image sensors (cameras) within the local residents network.	1	186	18	31	51	-	47	38	2	13							1	2	25	42	54	42	2						1	6	11	23	52	45	37	2
			2	160	16	33	51	-	53	36	1	10							1	4	18	39	63	45	1						1	5	5	13	65	46	36	0
			E	25	100	0	0	-	62	38	0	0							0	0	36	52	68	40	4						0	0	8	20	72	48	20	0
	27	Microgrid technology that optimizes power supply through distribution power network communication, control and management technology, and telecommunications.	1	167	13	31	56	-	75	17	5	3							1	2	30	45	61	45	3						1	2	13	27	64	37	39	4
			2	146	10	29	61	-	84	13	2	1							1	1	21	42	67	49	2						1	1	7	19	75	32	40	1
			E	15	100	0	0	-	80	13	0	7							0	0	27	33	80	53	0						0	0	7	27	67	40	33	0
	28	Wireless communication technology which can be used at ease since it secures security by automatically detecting wiretapping and/or interception and by preventing radio wave jamming of communication lines.	1	151	16	26	58	-	81	11	3	5							9	4	45	51	56	32	5						8	6	19	32	61	17	32	4
			2	136	15	26	59	-	88	7	1	4							9	3	37	50	63	34	3						8	3	10	28	75	11	34	3
			E	20	100	0	0	-	100	0	0	0							20	5	63	58	68	37	5						20	5	32	42	74	21	37	0
	29	Technology automatically detecting multiple wireless systems (for example, telephone lines and LANs) and thereby automatically detecting and connecting to the best network (cognitive wireless communication technology).	1	151	17	30	53	-	74	14	3	9							0	2	31	39	71	26	3						1	2	13	23	79	14	23	5
			2	132	15	22	63	-	78	15	2	5							0	1	21	36	79	27	2						1	1	4	18	82	13	24	2
			E	20	100	0	0	-	100	0	0	0							0	0	28	28	83	28	6						0	0	10	20	85	25	20	0
	30	Technology establishing and managing a network that dynamically connects the members to each other as needed through the cognitive network.	1	136	15	27	58	-	71	10	1	18							0	4	40	45	65	21	2						0	4	15	24	76	16	24	4
			2	116	15	22	63	-	76	7	0	17							0	2	30	45	74	23	4						0	2	9	22	85	10	24	2
			E	17	100	0	0	-	94	0	0	6							0	0	44	38	75	25	6						0	0	24	41	82	18	24	0
	31	Network control and operation technology under which information from moving vehicles (such as busses, trains, Shinkansens, planes and ships) is managed in an integrated fashion.	1	142	13	28	59	-	53	31	0	16							2	7	29	43	57	34	4						2	7	13	23	64	26	34	5
			2	123	12	27	61	-	56	31	0	13							2	2	17	42	66	40	2						2	2	6	17	76	24	39	2
			E	15	100	0	0	-	60	33	0	7							0	0	27	40	67	53	7						0	0	14	29	93	36	21	0
I/O (including home electronics)	32	Thin and flexible portable electronic displays that may replace newspapers.	1	185	12	33	55	-	66	20	2	12							1	2	32	28	80	17	1						1	2	11	15	89	3	12	1
			2	161	10	31	59	-	74	15	1	10							0	0	22	23	85	13	0						1	1	6	10	95	1	9	1
			E	16	100	0	0	-	68	13	6	13							0	0	13	0	87	13	0						0	0	7	0	100	0	0	0

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I/O (including home electronics)	33	Portable assistance devices which recognize the voice of the owner and memorizes the owner's experience (the situation such as the place, time, action, outside scene, and sounds), and stimulates the owner's memory by replaying the voice recorded in the memory of the device when necessary by using the situation awareness technology sensing the same situation (to improve the QOL of elderly people).	1	127	10	26	64	-	42	33	0	25							1 6	51	42	44	21	1						2 12	19	20	63	19	23	1
			2	115	9	25	66	-	43	36	0	21							0 6	53	41	50	18	1						1 10	13	24	74	15	22	0
			E	10	100	0	0	-	80	0	0	20							0 10	50	30	50	30	0						10 10	30	30	80	0	10	0
	34	A medical chip embedded in the human body that enables health-condition monitoring and/or vital function support providing such as a heart pace maker due to self power harvesting by bioenergy sources such as body heat or blood flow semi permanently.	1	135	12	26	62	-	71	20	1	8							2 5	58	45	39	32	2						3 5	27	34	53	20	33	2
			2	119	7	28	65	-	82	13	0	5							1 6	58	42	44	32	1						1 7	21	26	69	15	29	0
			E	8	100	0	0	-	71	29	0	0							0 0	25	13	25	63	0						0 0	0	13	50	13	50	0
	35	Medical technology that is based on nanochips and/or microsensors, is embedded in the human body or moves through blood vessels, and has the capability to communicate with and/or be controlled by outside devices.	1	141	9	28	63	-	74	16	2	8							1 5	59	44	36	30	3						3 5	33	34	49	17	30	2
			2	124	6	28	66	-	84	10	1	5							0 4	62	44	40	29	2						2 4	30	33	63	12	33	0
			E	7	100	0	0	-	100	0	0	0							0 0	71	57	43	43	0						0 0	29	14	71	14	57	0
	36	A Brain-Machine Interface that communicates directly with the brains and/or neurons of humans.	1	135	9	30	61	-	73	11	0	16							0 5	73	45	23	22	2						2 8	39	33	44	10	31	1
			2	119	8	24	68	-	73	9	0	18							0 6	76	47	20	16	3						1 9	43	36	54	8	25	1
			E	10	100	0	0	-	89	11	0	0							0 0	70	80	30	10	0						0 0	60	60	60	20	40	0
	37	A noninvasive brain activity measuring device that can easily measure the true feelings of mystery shoppers during product estimation.	1	102	6	28	66	-	31	14	1	54							5 7	54	43	36	17	3						5 9	28	30	56	7	15	2
			2	88	3	24	73	-	28	14	0	58							4 5	61	35	42	16	1						4 7	25	28	69	4	14	1
			E	3	100	0	0	-	100	0	0	0							0 0	67	33	33	33	0						0 0	0	33	67	33	0	0
	38	On-demand actuator technology that can assist the ability to move in day-to-day actions without causing muscular atrophy (to improve the QOL of elderly people).	1	128	6	21	73	-	56	34	2	8							2 2	57	46	42	26	2						2 2	29	31	57	16	26	0
			2	113	5	21	74	-	59	38	1	2							1 3	59	44	48	26	1						2 3	28	28	71	12	26	0
			E	6	100	0	0	-	80	20	0	0							0 0	50	0	50	50	0						0 0	17	0	50	0	67	0
	39	A wireless communication sensor with power harvesting (capturing energies from the surrounding environment).	1	157	15	29	56	-	70	15	4	11							2 4	47	38	59	21	2						2 5	19	22	74	10	20	1
			2	136	11	29	60	-	78	11	2	9							2 4	43	33	77	16	2						2 3	12	21	88	8	16	1
			E	15	100	0	0	-	84	8	0	8							0 0	33	20	67	20	0						0 0	13	27	73	13	20	0
	40	A display unit that can generate smells and tastes based on its sensing.	1	116	11	20	69	-	36	14	0	50							4 10	64	37	43	8	0						5 11	33	29	67	5	14	1
			2	103	9	17	74	-	32	11	0	57							7 9	71	32	42	9	0						6 10	32	21	77	3	15	1
			E	9	100	0	0	-	38	13	0	49							0 0	56	11	56	22	0						0 0	22	22	89	0	22	0

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I/O (including home electronics)	41	Housing and office buildings constructed of intelligent construction modules with function units such as communications, sensors, display, lighting, air conditioning, sound effects, and/or power supply.	1	143	10	26	64	-	50	32	0	18							4 7	17	25	78	24	1						2 9	7	15	80	12	24	3
			2	123	9	21	70	-	62	23	0	15							3 4	12	20	85	20	3						3 7	5	10	87	8	19	2
			E	11	100	0	0	-	100	0	0	0							0 0	27	27	91	27	0						0 0	18	18	91	18	18	0
Energy-related	42	Home-use electric power storage cell technology, with a price tag of one million yen or less, that can stably cover approximately 90% of the necessary electric energy by integrating photovoltaic generation and secondary cells for All-DENKA house (a house in which electricity fully covers home-use energy).	1	137	11	33	56	-	65	31	0	4							0 3	27	34	73	37	2						0 4	11	19	78	28	29	2
			2	122	11	26	63	-	71	25	0	4							0 2	14	22	78	36	2						0 3	6	12	83	24	27	1
			E	13	100	0	0	-	77	23	0	0							0 0	8	23	85	15	0						0 0	0	15	85	15	8	0
	43	Long life and highly reliable electric vehicle battery technology with high energy density (approximately 3 times as dense as at present) that enables electric vehicles to have a total driving distance on a single charge that is equivalent to that of current gasoline vehicles (approximately 500km).	1	138	7	30	63	-	81	17	1	1							1 3	34	36	78	36	1						1 4	14	19	84	20	26	2
			2	124	6	28	66	-	85	11	2	2							1 3	26	28	87	29	1						1 3	7	10	90	17	23	0
			E	7	100	0	0	-	100	0	0	0							0 0	0	0	100	14	0						0 0	0	0	100	0	0	0
	44	Solar cells with energy conversion efficiency of 60% or more.	1	154	10	32	58	-	78	15	1	6							10 11	57	45	53	27	2						10 13	26	26	70	17	26	2
			2	132	11	28	61	-	86	9	0	5							9 7	59	42	59	23	2						9 6	23	23	76	14	25	2
			E	15	100	0	0	-	80	13	0	7							7 0	67	33	47	20	0						7 0	7	20	60	13	27	0
	45	Most of the mobile devices' (PCs, cell phones, PDAs and others) power sources shall be replaced with fuel cells.	1	151	5	23	72	-	51	12	0	37							14 12	32	30	76	21	1						17 14	20	22	81	11	19	0
			2	135	6	22	72	-	53	8	1	38							13 8	29	23	82	16	0						17 10	12	17	84	9	14	0
			E	8	100	0	0	-	62	13	0	25							14 0	14	14	71	0	0						14 0	17	33	50	0	0	0
	46	LSIs that operate semi-permanently, powered by the energy (100 mW) of vibration.	1	136	10	34	56	-	51	19	2	28							9 8	52	35	57	20	0						9 9	26	22	70	8	23	0
			2	119	8	32	60	-	66	11	2	21							6 4	52	31	63	19	0						6 6	22	15	79	3	20	1
			E	10	100	0	0	-	80	0	0	20							0 0	40	20	80	10	0						0 0	20	20	90	0	10	0
	47	LSIs that operate semi-permanently by utilizing heat energy.	1	133	11	33	56	-	56	15	1	28							10 16	57	40	53	15	0						9 18	29	25	65	6	15	0
			2	118	8	32	60	-	65	10	0	25							10 10	58	32	55	12	0						11 10	26	20	68	4	17	1
			E	9	100	0	0	-	89	0	0	11							0 0	44	33	67	0	0						0 0	38	50	63	0	0	0
	48	Mobile devices (PCs, cell phones, PDAs and others) powered via wireless power supply devices.	1	167	12	34	54	-	66	13	2	19							4 5	47	36	71	22	1						5 7	25	20	80	9	17	2
			2	147	10	33	57	-	72	10	1	17							3 3	45	33	78	19	1						6 4	19	16	86	6	17	1
			E	14	100	0	0	-	100	0	0	0							0 0	36	29	100	0	0						0 0	7	0	100	0	0	0

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Energy-related	49	Successive contactless charging technology that charges electric vehicles and/or hybrid vehicles when they are parked at public parking lots and/or stopped at roads and intersections.	1	135	10	27	63	-	57	28	0	15							5	4	27	35	66	33	2						5	5	13	21	60	37	39	4
			2	120	11	23	66	-	63	24	0	13							4	2	19	32	72	40	1						5	4	9	19	64	36	42	1
			E	13	100	0	0	-	84	8	0	8							0	0	23	23	77	46	0						0	8	0	8	85	38	23	0
	50	Power feeding infrastructure technology capable of continually charging electric vehicles and/or hybrid vehicles when they are driving on highways.	1	128	9	23	68	-	48	27	0	25							10	6	24	39	54	43	4						14	7	12	21	52	35	42	5
			2	118	8	20	72	-	56	17	0	27							12	4	17	36	61	43	1						17	5	11	18	62	37	43	1
			E	10	100	0	0	-	70	10	0	20							20	0	10	20	80	30	0						30	0	10	10	80	10	10	0
	51	Component devices using novel materials such as SiC or GaN that allow a power density of 100 W/cc or more.	1	116	20	37	43	-	73	23	0	4							0	6	46	39	63	28	0						0	6	17	23	76	7	28	0
			2	103	19	31	50	-	87	13	0	0							0	2	39	39	71	24	0						1	2	10	19	81	6	24	0
			E	20	100	0	0	-	90	10	0	0							0	0	37	26	63	37	0						0	0	0	11	68	0	37	0
	52	Smart grid technology that can improve power efficiency and reduce the total Japanese power needs by 20%.	1	135	8	30	62	-	60	38	0	2							4	6	29	45	54	50	3						2	7	12	29	59	40	46	2
			2	125	6	26	68	-	72	27	1	0							2	2	23	47	66	52	2						2	2	10	26	71	41	50	2
			E	8	100	0	0	-	100	0	0	0							13	0	13	38	88	63	0						13	0	0	25	100	38	38	13
Devices	53	An information device surpassing CMOS device's features by using single spin technology as its information carrier.	1	118	15	38	47	-	63	17	1	19							14	9	71	43	29	22	0						16	11	41	26	56	9	30	1
			2	100	15	31	54	-	73	12	0	15							13	5	77	44	30	18	0						15	8	39	26	66	4	29	1
			E	15	100	0	0	-	67	20	0	13							20	0	73	53	40	7	0						20	0	40	47	60	0	20	0
	54	Large scale system integration technology on a device systematizing nano-functional components such as molecules, CNT and submicron particles by combining top-down technology and bottom-up technology.	1	114	21	41	38	-	73	14	2	11							5	9	71	40	29	30	1						4	11	37	27	58	9	30	1
			2	96	18	39	43	-	83	9	1	7							5	7	75	36	24	29	1						5	7	35	22	70	3	33	1
			E	17	100	0	0	-	82	12	0	6							0	6	82	29	29	18	0						0	6	35	12	65	0	29	0
	55	A highly reliable bio-organic device and/or DNA device that operate at ultra low voltage (tens of mV) and have a low-impact on the human body.	1	106	10	33	57	-	68	10	1	21							11	9	77	42	24	22	1						13	11	42	30	46	6	30	1
			2	91	7	32	61	-	78	5	1	16							10	6	85	38	17	16	1						12	7	47	28	60	6	27	1
			E	6	100	0	0	-	66	17	0	17							0	0	67	17	33	33	0						0	0	33	33	83	0	17	0
	56	A photonic sensor device to make efficient use of 1THz to 10THz electromagnetic waves.	1	111	16	41	43	-	75	15	0	10							2	5	70	39	40	24	0						3	5	35	24	64	8	25	1
			2	96	16	35	49	-	86	6	0	8							1	5	77	44	41	16	0						1	5	35	21	76	5	20	1
			E	15	100	0	0	-	93	7	0	0							0	0	67	33	13	33	0						0	0	40	20	53	0	33	0

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					High	Moderate	Low	None	Important for Japan and the rest of the world	Especially important for Japan	Especially important for the world	Low importance/priority	Already realized	2011-2015	2016-2020	2021-2030	2031-2040	2041-	don't know will not be realized		University	Public research organization	Private enterprise	Collaboration of multiple sectors	Others	2011-2015	2016-2020	2021-2030	2031-2040	2041-	don't know will not be realized		University	Public research organization	Private enterprise	Government	Collaboration of multiple sectors	Others
Devices	57	A novel device that is capable of on-demand generation of single photons for quantum cryptography communications in order to improve the security of the network.	1	93	13	30	57	-	67	14	1	18							5	9	77	52	31	17	2						7	12	40	42	55	13	25	3
			2	80	8	36	56	-	75	10	0	15							6	5	81	53	28	19	1						6	6	35	40	65	6	29	1
			E	6	100	0	0	-	83	17	0	0							0	0	83	67	67	0	0						0	0	67	67	83	0	17	0
	58	A storage device in which 1 atom or 1 molecule corresponds to 1 bit and that is capable of quickly accumulating and searching information data sets, which are increasing in size dramatically.	1	111	12	34	54	-	74	13	0	13							15	11	77	50	27	17	1						14	13	42	32	54	11	24	1
			2	97	11	33	56	-	77	8	0	15							15	7	79	51	26	18	0						14	9	36	31	65	7	28	0
			E	11	100	0	0	-	64	9	0	27							27	9	82	45	27	9	0						30	0	20	10	60	0	30	0
	59	New feature technology resulting from a fusion of electronics and unicellular or single-molecule level biological mechanisms.	1	106	7	32	61	-	77	10	1	12							4	13	78	47	24	21	2						4	15	50	36	41	3	27	4
			2	91	4	26	70	-	81	7	2	10							1	12	82	40	15	23	2						6	10	52	34	46	1	29	5
			E	4	100	0	0	-	100	0	0	0							0	0	75	25	50	0	0						0	0	50	0	25	0	25	0
Mechatronics	60	Control techniques for hybrid vehicles, activating the motors (actuators) of moving vehicles by using various energies such as fossil fuels, solar energy, wind power, electricity, air and heat.	1	103	4	31	65	-	66	20	2	12							5	5	43	44	61	30	2						5	5	27	26	69	19	30	1
			2	94	3	22	75	-	73	15	1	11							1	2	36	35	64	31	1						0	4	16	16	76	13	32	1
			E	3	100	0	0	-	67	33	0	0							0	0	33	33	67	0	0						0	0	33	0	67	0	0	0
	61	An autopilot system that guides passengers to their destination if they input the desired destination into the system.	1	143	6	27	67	-	47	23	5	25							7	8	37	40	62	37	4						10	12	18	28	69	28	37	5
			2	130	6	21	73	-	47	20	5	28							4	6	30	37	68	30	3						6	9	11	23	73	22	33	3
			E	8	100	0	0	-	75	25	0	0							0	0	38	63	100	25	0						0	0	13	25	100	0	25	0
	62	A system that can ensure the prevention of traffic accidents due to cars colliding with each other, etc. through utilizing an inter-vehicle communication system.	1	158	9	34	57	-	67	28	1	4							3	2	26	38	79	38	1						3	3	11	25	79	33	36	1
			2	142	11	32	57	-	74	22	1	3							1	1	17	36	78	34	0						2	1	5	18	80	30	32	0
			E	15	100	0	0	-	87	13	0	0							0	0	20	40	87	40	0						0	0	13	27	93	27	27	0
	63	Highly reliable communication technology for automatic tracking or autopilot that can provide high-speed (not less 100Mbps) communication between vehicles and a base station on a real-time basis, without communications blackout, and has a backup function that works even if communications fail for any reason.	1	130	12	32	56	-	57	32	2	9							2	3	34	37	74	38	0						2	3	16	26	74	23	37	1
			2	120	12	30	58	-	65	25	2	8							0	0	26	38	79	33	0						2	1	8	21	78	25	32	1
			E	14	100	0	0	-	71	29	0	0							0	0	36	43	79	36	0						0	0	21	21	86	29	29	0
	64	A system capable of predicting failures and avoiding accidents by utilizing various sensors mounted on the vehicles.	1	151	9	32	59	-	60	26	3	11							2	4	25	33	86	20	1						3	5	11	20	89	14	21	1
			2	139	9	29	62	-	73	19	1	7							1	1	18	28	86	17	1						2	1	4	14	89	13	20	1
			E	12	100	0	0	-	83	17	0	0							0	0	17	25	100	8	0						0	0	0	17	100	0	8	0

Area	Topic number	Topic	Round	Responses	Degree of expertise				Importance				Forecasted time of technological realization (to be realized somewhere in the world)						Sectors that will pave the way to technological realization					Forecasted time of social realization (to become applicable/widely used in Japan)						Sectors that will pave the way to social realization					
					High	Moderate	Low	None	Important for Japan and the rest of the world	Especially important for Japan	Especially important for the world	Low importance/priority	Already realized	2011-2015	2016-2020	2021-2030	2031-2040	2041-	don't know	will not be realized	University	Public research organization	Private enterprise	Collaboration of multiple sectors	Others	2011-2015	2016-2020	2021-2030	2031-2040	2041-	don't know	will not be realized	University	Public research organization	Private enterprise	Government	Collaboration of multiple sectors	Others
					(%)				(%)				(%)								(%)												(%)					
Mechatronics	65	A supporting robot for human lives and activities (such as nursing care and domestic affairs) in general households.	1	165	8	30	62	-	47	48	0	5							0	1	48	52	64	30	1						0	2	23	27	72	21	36	3
			2	145	8	29	63	-	49	48	0	3							0	1	42	49	69	31	1						0	2	15	23	80	16	33	1
			E	12	100	0	0	-	58	42	0	0							0	0	58	58	83	33	8						0	8	33	33	92	0	25	0
	66	Autonomous robots with a judgment function that is capable of coping with complicated situations, such as production process work with process changes or situations like farm work.	1	143	10	27	63	-	55	36	3	6							0	3	50	48	60	27	1						0	4	24	27	77	16	32	1
			2	127	9	26	65	-	63	34	1	2							0	2	48	42	70	27	1						1	3	20	26	84	10	28	2
			E	11	100	0	0	-	64	36	0	0							0	0	73	27	64	27	0						0	0	36	36	91	0	9	0
	67	A minimal actuator that imitates a biomolecular motor and operates using molecule power.	1	104	5	21	74	-	57	16	2	25							5	14	82	56	22	10	0						5	14	46	40	52	7	23	0
			2	87	3	22	75	-	66	14	0	20							5	8	80	51	20	13	0						2	12	46	38	57	2	27	0
			E	3	100	0	0	-	100	0	0	0							0	0	33	0	33	33	0						0	0	33	0	67	0	33	0
	68	A nano mechanical system made by self-organization.	1	92	8	25	67	-	59	14	1	26							9	16	80	53	20	16	0						9	16	45	36	47	8	24	0
			2	85	4	29	67	-	66	9	0	25							10	11	80	56	22	15	0						9	14	43	38	58	3	26	0
			E	3	100	0	0	-	33	0	0	67							67	0	33	0	33	33	0						67	0	0	0	33	0	67	0
	69	An assistant network robot that predicts risks by summarizing life space information detected by sensors and/or various information from networks, in order to encourage elderly people to go out and to guide them to comfortable places (to improve QOL of elderly people).	1	132	4	36	60	-	40	49	0	11							2	6	52	56	49	31	2						3	5	25	33	58	28	33	2
			2	121	6	26	68	-	42	50	0	8							1	3	53	59	54	31	2						2	3	21	32	71	23	32	2
			E	7	100	0	0	-	71	29	0	0							0	0	86	57	43	29	0						0	0	29	29	86	14	14	0
	70	A safe transportation system that detects driver errors and copes with them in a proper manner.	1	142	6	27	67	-	75	21	1	3							0	6	42	39	74	25	1						0	5	17	24	79	21	25	0
			2	128	8	23	69	-	81	18	0	1							0	1	43	39	76	23	0						0	2	10	19	85	18	26	0
			E	10	100	0	0	-	90	10	0	0							0	0	60	50	90	20	0						0	0	10	30	100	20	10	0

Panel 2:

Information technology including media and contents

Implementation of the questionnaires

	Sent	Returned (response rate)
<1st Round>	309	253 (82%)
<2nd Round>	252	209 (83%)

Sex	Male	198	Affiliation	Private enterprise	80
	Female	11		University	91
	N.A.	0		Research Institute	21
generation	20’s	1		Association	3
	30’s	18		Others	14
	40’s	59		N.A.	0
	50’s	62	Job category	R&D	160
	60’s	62		Others	49
	70’s and over	7		N.A.	0
	N.A.	0		Total	209

Survey items

A: Cloud computing (ultra-decentralized scalable computing)

B: New principle for information and communication

C: Spatial communications

D: Socialization of information

E: Multicultural exchange

F: Intelligence support

G: Movement support

H: Assurance of appropriateness of information

I: Ubiquitous networking

J: Ultra-large scale software

K: Contents service

L: Other boundaries, fusion, or emerging sectors

Time-series tables of topics

<Technological realization>

year	Topic (Leading number represents ID.)
2014	17: Broadcasting technology capable of free multiple-perspective video; for example, technology that would enable people to select views from a specific soccer player or views from the ceiling to watch the entire play during live broadcasting of soccer games.
2015	22: Image-recognition and image-analysis technology that recognizes a person's face from images of people in a crowd, and specifies an individual for such purposes as finding a runaway from home.
	61: More than half of the white goods (refrigerators, washing machines, microwave ovens, rice cookers, and air conditioners, etc.) are connected to home networks in 30% or more of the households in Japan.
2016	04: Technology that enables information of a nature highly related to public interest and social welfare to be utilized in an environment where credibility is ensured and personal information is safely managed against leakage; for example, identifying the whereabouts of missing persons by using cell phones.
	05: A system that gives appropriate advice for daily activities by taking hold of information on the lifestyle, health conditions and working situation of each individual, in a continuous and comprehensive manner.
	13: An environment where various sensors are placed all over the real world, enabling us to search for any information in the whole real world through networks, for instance, weather conditions and landscapes of any place in Japan, by specifying them with a retrieval key.
	60: RFID tag prices become about 0.01 yen, and the attachment of tags to groceries and daily commodities is widely realized.
	63: Popularization of an appropriate guiding and leading service for everyone to reach their destination without looking for signboards and other landmarks, where the detailed information of a purchased ticket is transmitted to the support tools in station yards by near-field transmission.
2017	23: A system under which 80% of office work can be changed into distance work in Japan, that is, where a person can work together with his/her colleagues at different offices with the same communication as if they were at the same office all the time.
	28: An information traceability system under which an electronic ID given to contents at time of the information source is maintained without being erased or altered, and thereby stolen or scattered information can be tracked easily.
	38: Biometric authentication technology that allows overseas trips without passports.
	57: A digital signature system under which citizens can use various information (such as information of noise and trouble) as evidence for disputes because the information is proved to be unaltered.
	59: A social consensus on privacy is formed, and a ubiquitous information system in cooperation with monitoring cameras and street displays is established.
2018	01: In the system providing various services to various users by flexible connection of more than a hundred million computers, efficient and semi-automatic technology that builds stable services without any system failures is established.
	03: A service that realizes a realistic simulation for individual lives and corporate activities by connecting the real and virtual worlds and synchronizing the various information of both worlds.

year	Topic (Leading number represents ID.)
2018	24: A virtual office system that can halve the number of workers in Japan compared with the present real office; due to the development of telework, workers can remotely manage their businesses and tasks, giving instructions by pointing, having a confidential talk, or handing over documents through their printers, and thereby having a realistic ambience just like working all together in one office.
	52: A cooperative system between automobiles and the road, that transmits information on pedestrians, automobiles, and obstacles outside the driver's view to the driver or the car being driven, is set up in most areas where the visibility is poor or traffic accidents occur frequently in Japan.
	54: An artificial agent that detects problematic information such as libel and slander, and intervenes to cause the self-cleaning action (preventing such problematic acts by becoming aware of the problem) of the individual or group at that time.
	56: Agent technology that manages and guarantees online information by knowing who wrote the information, how accurate it is, and how it has been altered since then, without being reported from the author him/herself.
	58: An automatic service providing necessary information to get along in society according to the recipient's ability to understand.
	70: A practical system for content management and small-amount payment, whereby a copyright management database is operated integrally across a wide range of genres and the copyright is handled semi-automatically with negligible costs in conjunction with searching and matching systems and with the system of small-amount payment, and whereby incomes from copyrights are delivered to the right holders without fail.
2019	06: A system under which information of all individuals' daily activities is statistically handled, and crowding and accidents are detected appropriately to facilitate automatic countermeasures
	14: An environment where sensors are placed all over the real world, enabling people present at any place in Japan specified by a retrieval key to communicate in response to any situation without knowing their IDs.
	15: Popularization of retrieval technology for specified information in the real world as well as information stored on computers, at high speed and low cost.
	20: Technology where a person unable to go traveling can enjoy the feeling of being in another place, by using remote-operated robots placed at tourist spots together with wide angle or stereoscopic cameras, high-performing microphones with realistic sensation, and other sensors for touch, feeling, and smell. (Tele-existence technology)
	29: A world wide traceability system covering most of the food products.
	36: Establishment of a system that finds out whether the proposed service conforms to the laws and regulations of each country by retrieving them, and indicates the conditions for providing such service in each country.
	51: Disaster rescue robot that distinguishes and rescues survivors at the disaster site.
	69: Simulations of the changes in the customer's purchase activity and sense of value from various standpoints before a service starts to be provided by a company.
	72: Technology that collects and synthesizes the knowledge and opinions of a number of ordinary people via the internet is widely used for the purposes of futuristic overview and decision making by the government, corporations, and society in general, and is used as a supplement or substitute for the judgments of business managers, politicians, bureaucrats, analysts, and other specialists.

year	Topic (Leading number represents ID.)
2019	73: Technology that enables ordinary people to produce high-quality CG animation movies indistinguishable from live-action movies at a cost individuals can afford, owing to advances in CG technology and agent technology that easily produce widely-accepted virtual actors
	75: Most of the residents in isolated and depopulated areas do not feel an information gap between themselves and the residents in metropolitan areas, thanks to the elimination of digital divides made possible by ICTs such as online shopping and high-quality virtual reality systems for concerts, exhibitions, meetings, friendly talks, and long-distance relationships.
2020	02: In the system providing various services to various users by flexible connection of more than a hundred million computers, an advanced autonomous service creates new value-added information or new functional services from existing functions and services or from the group of data lying in such services.
	09: A practical quantum cryptography.
	19: A remote clinical examination system under which the doctor can use a stethoscope and palpate the patient or smell the patient's breath from a distance, as if they were face to face.
	21: Technology of image recognition and image understanding that can automatically create the scripts of past movies and films; not only the scripts and instructions to the actors, but also descriptions of the scenery and movie props.
	31: Intelligent robotic technology that enables families and relatives to provide livelihood support to aged and handicapped people safely by remote control from a distance; the robots will be intelligent enough to avoid the risks that a teleoperator is unaware of.
	33: An inheritance support system of skills and cultures by which the performance of excellent artists and craftsmanship are automatically obtained and archived.
	37: A machine translation system that can automatically learn cultural backgrounds and proper nouns, such as place names and people's names, as well as languages.
	39: A corpus, where multilingual knowledge is automatically accumulated from books, newspapers, broadcasting, and academic papers on websites all over the world, is utilized for simultaneous multilingual translation.
	53: Automatic driving technology for automobiles with a special lane that will enable the current usage efficiency of highways to triple.
	55: Imaging technology under which an artificial agent receives transmitted information from online communications, and creates the image of face-to-face communication with other participants based on the information, and urges the relevant person to judge whether his/her act was appropriate or not.
	71: A prediction technique for the occurrence and propagation of infectious diseases in an expeditious way, whereby the prediction is made after taking into consideration various factors, such as the factor of economic activities together with the global and local movement of people, environmental factors including temperature, humidity and wind direction in each area, and physiological factors such as the immune function.
2021	18: Technology delivering touch, fragrance and taste; enabling shopping at home just like shopping at stores, where goods are checked by hand.
	32: An intelligent robot that conducts daily conversation and keeps people company during daily activities such as watching TV and reading newspapers and magazines.
	48: A system that detects a sign of the critical situation in human bodies in daily life, and informs the person him/herself or people nearby of such situation.
	66: Technology capable of autonomously preventing system failure by quick detection of risk exceeding the acceptable value when an ultra-large scale complex system is in operation.

year	Topic (Leading number represents ID.)
2021	74: Remote-controlled humanoid robotics technology that serves as a communication tool for encouraging social participation of people who cannot take part in society for various reasons such as sickness, injury, age, and mental or physical disorder.
2022	30: A system to predict conditions of global weather, oceans, environment, ecosystems, epidemics, economics, and human activity through a total simulation based on real-time data can tackle unknown global crises.
	67: An automatic system construction tool that limits the participation of human workers to the development of ultra-large scale software to 50%.
2023	40: Technology that enables people in Japan to watch TV programs from all over the world through networks free from the language barrier (contribution to the improvement of international understanding).
	41: Technology that is capable of transmitting various image information including 3D images, and voice and sound information including sound effects, to the visually and hearing impaired people with texture and reality.
	62: Implantable health management devices are used by 30% or more of the Japanese population.
2024	08: Establishment of a sufficiently accurate and efficient pseudo-experimental technique for subjective evaluation of values brought about by various services and applications in the information and communications fields, without using real test subjects
	43: A portable conversation environment where a motor-impaired person, such as someone suffering from amyotrophic lateral sclerosis (ALS), can intuitively express his/her own will and intentions to a conversation partner.
	68: Technology that can figure out the problems in making policy recommendations and institutional designs by simulating the social acceptance, domestic and international influences and other matters in detail at the level of each individual or each issue.
2025	34: An inheritance support system of skills and cultures by which the thinking process of an excellent creator such as a novelist, project leader, researcher, and educator is automatically obtained and archived without bothering him/her.
	47: Powered suits that enable unskilled workers to master the skills of skilled workers in a short period of time, by reproducing the same sense the skilled workers have.
	64: Specification-writing techniques to enable the creation of consistent specification by representing and verifying the specifications of ultra-large scale software consisting of more than 100 million lines of code.
	65: Automatic development technology for systems that control the operational quality of ultra-large scale software consisting of more than 100 million lines of code at the same quality as the current software.
	76: The length of hospital stays for medical treatment are reduced to half of the current length by estimating the quantitative effect of drugs, where both genetic information and biological information of each individual are systematically linked to the drug information.
2028	16: Technology that can naturally use the total system of external computers, their networks, various sensors and the peripherals connected to the networks as an extension of human brains, sense organs and bodies.
	42: Technology for the people with impaired vision, hearing or speaking to be able to transmit the information they picture in their minds to others by visualizing, making the sound audible, or verbalizing the information faithfully.
	49: Most of the automobiles are driven automatically on the ordinary roads.

year	Topic (Leading number represents ID.)
2030	26: A Green ICTS system that reduces the energy necessary for the transmission and storage of information to one-millionth of that in 2010 (normalized by the amount of information handled).
2031	10: Technology directly transmitting the information obtained by one's eyes and ears to a third party's brain, to support such third party's eyesight and hearing.
	27: An intracorporeal and extracorporeal system of electronic information for high level medical service is developed for anti-aging, and the average life expectancy becomes 5 years longer than it is in 2010 due to the effects of such system. According to statistics in 2003, the extension of 5 years in the average life expectancy was brought about by the lifestyle improvement and advancement in medical services in the past 20 years, but such extension will reach biotic limitations in the near future.
2032	50: Artificial vision that enables the visually impaired to live daily life at the same safety level as persons without any disability.
2033	44: Clarification of the mechanism for memorizing information, such as experience, knowledge, language and picturing in our brains.
	45: Technology providing information in a representative form according to the mechanism of memory in the brain so that the brain can memorize the information easily.
2036	07: Communication utilizing neutrinos, gravity waves, or unknown principles of physics.
	11: Technology transmitting the contents of one's thoughts to the brains of someone else without using eyes or ears, for communication between people.
2037	46: Technology that transfers a private memory to a computer, and that retrieves and processes the information with a interface similar to one's own memory as if the memory function of the brain were extended.
2041-	12: Clarification of the mechanisms of senses other than the five senses, such as telepathy, the sixth sense and thought vibes, for use in daily communications.

<Social realization>

year	Topic (Leading number represents ID.)
2020	04: Technology that enables information of a nature highly related to public interest and social welfare to be utilized in an environment where credibility is ensured and personal information is safely managed against leakage; for example, identifying the whereabouts of missing persons by using cell phones.
2021	60: RFID tag prices become about 0.01 yen, and the attachment of tags to groceries and daily commodities is widely realized.
2022	05: A system that gives appropriate advice for daily activities by taking hold of information on the lifestyle, health conditions and working situation of each individual, in a continuous and comprehensive manner.
	17: Broadcasting technology capable of free multiple-perspective video; for example, technology that would enable people to select views from a specific soccer player or views from the ceiling to watch the entire play during live broadcasting of soccer games.
	22: Image-recognition and image-analysis technology that recognizes a person's face from images of people in a crowd, and specifies an individual for such purposes as finding a runaway from home.
	25: The 3D-virtual world service such as Second Life is used in connection with the real world, and becomes a place for social activities by spreading as a social infrastructure where the real world is supplemented, substituted, or mixed.

year	Topic (Leading number represents ID.)
2022	61: More than half of the white goods (refrigerators, washing machines, microwave ovens, rice cookers, and air conditioners, etc.) are connected to home networks in 30% or more of the households in Japan.
	63: Popularization of an appropriate guiding and leading service for everyone to reach their destination without looking for signboards and other landmarks, where the detailed information of a purchased ticket is transmitted to the support tools in station yards by near-field transmission.
2023	01: In the system providing various services to various users by flexible connection of more than a hundred million computers, efficient and semi-automatic technology that builds stable services without any system failures is established.
	13: An environment where various sensors are placed all over the real world, enabling us to search for any information in the whole real world through networks, for instance, weather conditions and landscapes of any place in Japan, by specifying them with a retrieval key.
2024	23: A system under which 80% of office work can be changed into distance work in Japan, that is, where a person can work together with his/her colleagues at different offices with the same communication as if they were at the same office all the time.
	28: An information traceability system under which an electronic ID given to contents at time of the information source is maintained without being erased or altered, and thereby stolen or scattered information can be tracked easily.
	57: A digital signature system under which citizens can use various information (such as information of noise and trouble) as evidence for disputes because the information is proved to be unaltered.
2025	03: A service that realizes a realistic simulation for individual lives and corporate activities by connecting the real and virtual worlds and synchronizing the various information of both worlds.
	24: A virtual office system that can halve the number of workers in Japan compared with the present real office; due to the development of telework, workers can remotely manage their businesses and tasks, giving instructions by pointing, having a confidential talk, or handing over documents through their printers, and thereby having a realistic ambience just like working all together in one office.
	54: An artificial agent that detects problematic information such as libel and slander, and intervenes to cause the self-cleaning action (preventing such problematic acts by becoming aware of the problem) of the individual or group at that time.
	58: An automatic service providing necessary information to get along in society according to the recipient's ability to understand.
	59: A social consensus on privacy is formed, and a ubiquitous information system in cooperation with monitoring cameras and street displays is established.
2026	38: Biometric authentication technology that allows overseas trips without passports.
	52: A cooperative system between automobiles and the road, that transmits information on pedestrians, automobiles, and obstacles outside the driver's view to the driver or the car being driven, is set up in most areas where the visibility is poor or traffic accidents occur frequently in Japan.
	69: Simulations of the changes in the customer's purchase activity and sense of value from various standpoints before a service starts to be provided by a company.

year	Topic (Leading number represents ID.)
2026	70: A practical system for content management and small-amount payment, whereby a copyright management database is operated integrally across a wide range of genres and the copyright is handled semi-automatically with negligible costs in conjunction with searching and matching systems and with the system of small-amount payment, and whereby incomes from copyrights are delivered to the right holders without fail.
2027	02: In the system providing various services to various users by flexible connection of more than a hundred million computers, an advanced autonomous service creates new value-added information or new functional services from existing functions and services or from the group of data lying in such services.
	06: A system under which information of all individuals' daily activities is statistically handled, and crowding and accidents are detected appropriately to facilitate automatic countermeasures
	35: It becomes customary for avatars or a virtual personalities with a handle name, as well as real people, to sign a contract of employment or sale, to pay tax, and to conduct other social activities in Japan, and some of such virtual personalities are treated as registered persons or juridical personalities.
	36: Establishment of a system that finds out whether the proposed service conforms to the laws and regulations of each country by retrieving them, and indicates the conditions for providing such service in each country.
	51: Disaster rescue robot that distinguishes and rescues survivors at the disaster site.
	56: Agent technology that manages and guarantees online information by knowing who wrote the information, how accurate it is, and how it has been altered since then, without being reported from the author him/herself.
	71: A prediction technique for the occurrence and propagation of infectious diseases in an expeditious way, whereby the prediction is made after taking into consideration various factors, such as the factor of economic activities together with the global and local movement of people, environmental factors including temperature, humidity and wind direction in each area, and physiological factors such as the immune function.
	72: Technology that collects and synthesizes the knowledge and opinions of a number of ordinary people via the internet is widely used for the purposes of futuristic overview and decision making by the government, corporations, and society in general, and is used as a supplement or substitute for the judgments of business managers, politicians, bureaucrats, analysts, and other specialists.
	73: Technology that enables ordinary people to produce high-quality CG animation movies indistinguishable from live-action movies at a cost individuals can afford, owing to advances in CG technology and agent technology that easily produce widely-accepted virtual actors
2028	14: An environment where sensors are placed all over the real world, enabling people present at any place in Japan specified by a retrieval key to communicate in response to any situation without knowing their IDs.
	15: Popularization of retrieval technology for specified information in the real world as well as information stored on computers, at high speed and low cost.
	20: Technology where a person unable to go traveling can enjoy the feeling of being in another place, by using remote-operated robots placed at tourist spots together with wide angle or stereoscopic cameras, high-performing microphones with realistic sensation, and other sensors for touch, feeling, and smell. (Tele-existence technology)
	29: A world wide traceability system covering most of the food products.
	31: Intelligent robotic technology that enables families and relatives to provide livelihood support to aged and handicapped people safely by remote control from a distance; the robots will be intelligent enough to avoid the risks that a teleoperator is unaware of.

year	Topic (Leading number represents ID.)
2028	33: An inheritance support system of skills and cultures by which the performance of excellent artists and craftsmanship are automatically obtained and archived.
	39: A corpus, where multilingual knowledge is automatically accumulated from books, newspapers, broadcasting, and academic papers on websites all over the world, is utilized for simultaneous multilingual translation.
	75: Most of the residents in isolated and depopulated areas do not feel an information gap between themselves and the residents in metropolitan areas, thanks to the elimination of digital divides made possible by ICTs such as online shopping and high-quality virtual reality systems for concerts, exhibitions, meetings, friendly talks, and long-distance relationships.
2029	19: A remote clinical examination system under which the doctor can use a stethoscope and palpate the patient or smell the patient's breath from a distance, as if they were face to face.
	37: A machine translation system that can automatically learn cultural backgrounds and proper nouns, such as place names and people's names, as well as languages.
2030	09: A practical quantum cryptography.
	18: Technology delivering touch, fragrance and taste; enabling shopping at home just like shopping at stores, where goods are checked by hand.
	21: Technology of image recognition and image understanding that can automatically create the scripts of past movies and films; not only the scripts and instructions to the actors, but also descriptions of the scenery and movie props.
	30: A system to predict conditions of global weather, oceans, environment, ecosystems, epidemics, economics, and human activity through a total simulation based on real-time data can tackle unknown global crises.
	32: An intelligent robot that conducts daily conversation and keeps people company during daily activities such as watching TV and reading newspapers and magazines.
	48: A system that detects a sign of the critical situation in human bodies in daily life, and informs the person him/herself or people nearby of such situation.
	74: Remote-controlled humanoid robotics technology that serves as a communication tool for encouraging social participation of people who cannot take part in society for various reasons such as sickness, injury, age, and mental or physical disorder.
2031	40: Technology that enables people in Japan to watch TV programs from all over the world through networks free from the language barrier (contribution to the improvement of international understanding).
	53: Automatic driving technology for automobiles with a special lane that will enable the current usage efficiency of highways to triple.
	55: Imaging technology under which an artificial agent receives transmitted information from online communications, and creates the image of face-to-face communication with other participants based on the information, and urges the relevant person to judge whether his/her act was appropriate or not.
	66: Technology capable of autonomously preventing system failure by quick detection of risk exceeding the acceptable value when an ultra-large scale complex system is in operation.
	67: An automatic system construction tool that limits the participation of human workers to the development of ultra-large scale software to 50%.
2032	08: Establishment of a sufficiently accurate and efficient pseudo-experimental technique for subjective evaluation of values brought about by various services and applications in the information and communications fields, without using real test subjects

year	Topic (Leading number represents ID.)
2032	41: Technology that is capable of transmitting various image information including 3D images, and voice and sound information including sound effects, to the visually and hearing impaired people with texture and reality.
2033	34: An inheritance support system of skills and cultures by which the thinking process of an excellent creator such as a novelist, project leader, researcher, and educator is automatically obtained and archived without bothering him/her.
	43: A portable conversation environment where a motor-impaired person, such as someone suffering from amyotrophic lateral sclerosis (ALS), can intuitively express his/her own will and intentions to a conversation partner.
	47: Powered suits that enable unskilled workers to master the skills of skilled workers in a short period of time, by reproducing the same sense the skilled workers have.
	64: Specification-writing techniques to enable the creation of consistent specification by representing and verifying the specifications of ultra-large scale software consisting of more than 100 million lines of code.
	65: Automatic development technology for systems that control the operational quality of ultra-large scale software consisting of more than 100 million lines of code at the same quality as the current software.
	68: Technology that can figure out the problems in making policy recommendations and institutional designs by simulating the social acceptance, domestic and international influences and other matters in detail at the level of each individual or each issue.
	76: The length of hospital stays for medical treatment are reduced to half of the current length by estimating the quantitative effect of drugs, where both genetic information and biological information of each individual are systematically linked to the drug information.
2035	62: Implantable health management devices are used by 30% or more of the Japanese population.
2036	26: A Green ICTS system that reduces the energy necessary for the transmission and storage of information to one-millionth of that in 2010 (normalized by the amount of information handled).
2037	16: Technology that can naturally use the total system of external computers, their networks, various sensors and the peripherals connected to the networks as an extension of human brains, sense organs and bodies.
	42: Technology for the people with impaired vision, hearing or speaking to be able to transmit the information they picture in their minds to others by visualizing, making the sound audible, or verbalizing the information faithfully.
2038	27: An intracorporeal and extracorporeal system of electronic information for high level medical service is developed for anti-aging, and the average life expectancy becomes 5 years longer than it is in 2010 due to the effects of such system. According to statistics in 2003, the extension of 5 years in the average life expectancy was brought about by the lifestyle improvement and advancement in medical services in the past 20 years, but such extension will reach biotic limitations in the near future.
	50: Artificial vision that enables the visually impaired to live daily life at the same safety level as persons without any disability.
2039	10: Technology directly transmitting the information obtained by one's eyes and ears to a third party's brain, to support such third party's eyesight and hearing.
	45: Technology providing information in a representative form according to the mechanism of memory in the brain so that the brain can memorize the information easily.
	49: Most of the automobiles are driven automatically on the ordinary roads.

year	Topic (Leading number represents ID.)
2041-	11: Technology transmitting the contents of one's thoughts to the brains of someone else without using eyes or ears, for communication between people. 46: Technology that transfers a private memory to a computer, and that retrieves and processes the information with a interface similar to one's own memory as if the memory function of the brain were extended. 07: Communication utilizing neutrinos, gravity waves, or unknown principles of physics.

Area	Topic number	Topic	Round	Responses	Degree of expertise (%)				Importance (%)				Forecasted time of technological realization (to be realized somewhere in the world) (%)						Sectors that will pave the way to technological (%)					Forecasted time of social realization (to become applicable/widely used in Japan) (%)						Sectors that willpave the way to social realization (%)					
					High	Moderate	Low	None	Important for Japan and the rest of the world	Especially important for Japan	Especially important for the world	Low importance/priority	Already realized	2011-2015	2016-2020	2021-2030	2031-2040	2041-	will not be realized	don't know	Others	Collaboration of multiple sectors	Private enterprise	Public research organization	University	2011-2015	2016-2020	2021-2030	2031-2040	2041-	don't know	will not be realized	Others	Collaboration of multiple sectors	Government	Private enterprise	Public research organization	University
Cloud computing (ultra-decentralized scalable computing)	1	In the system providing various services to various users by flexible connection of more than a hundred million computers, efficient and semi-automatic technology that builds stable services without any system failures is established.	1	204	15	50	35	-	91	1	3	5							5	2	5	28	67	26	23							4	4	5	23	9	74	16	10
			2	174	14	49	37	-	93	2	2	3							2	2	2	26	75	21	16							2	3	2	23	5	79	13	6
			E	25	100	0	0	-	96	0	0	4							0	4	0	32	64	20	24							0	8	0	20	8	80	12	12
	2	In the system providing various services to various users by flexible connection of more than a hundred million computers, an advanced autonomous service creates new value-added information or new functional services from existing functions and services or from the group of data lying in such services.	1	205	16	50	34	-	81	4	2	13							6	6	4	24	58	28	34							6	8	6	26	6	70	14	13
			2	177	13	52	35	-	84	3	2	11							4	5	2	20	69	24	30							3	7	3	23	1	75	10	9
			E	23	100	0	0	-	96	0	0	4							0	4	0	22	57	39	30							4	4	4	22	4	74	13	9
	3	A service that realizes a realistic simulation for individual lives and corporate activities by connecting the real and virtual worlds and synchronizing the various information of both worlds.	1	213	19	44	37	-	69	8	1	22							2	7	1	18	60	32	38							3	7	3	25	4	65	22	14
			2	179	18	40	42	-	73	7	0	20							2	4	1	16	69	28	33							1	6	1	24	2	76	16	8
			E	33	100	0	0	-	88	3	0	9							0	3	0	15	61	30	48							0	6	0	21	0	67	18	15
	4	Technology that enables information of a nature highly related to public interest and social welfare to be utilized in an environment where credibility is ensured and personal information is safely managed against leakage; for example, identifying the whereabouts of missing persons by using cell phones	1	216	17	42	41	-	76	19	1	4							4	2	3	28	58	37	24							4	3	1	28	25	59	20	9
			2	183	15	42	43	-	82	15	1	2							3	3	2	31	63	32	18							3	3	1	30	19	64	18	5
			E	27	100	0	0	-	89	11	0	0							0	0	7	33	59	30	19							0	0	0	33	7	56	26	4
	5	A system that gives appropriate advice for daily activities by taking hold of information on the lifestyle, health conditions and working situation of each individual, in a continuous and comprehensive manner.	1	218	16	41	43	-	55	25	0	20							2	3	1	19	63	28	30							3	4	1	21	11	72	14	10
			2	182	14	44	42	-	57	22	1	20							2	4	1	15	68	25	29							2	5	1	23	6	74	12	6
			E	26	100	0	0	-	65	23	0	12							0	4	0	12	56	20	36							0	4	0	12	4	76	12	12
	6	A system under which information of all individuals' daily activities is statistically handled, and crowding and accidents are detected appropriately to facilitate automatic countermeasures.	1	207	15	38	47	-	51	16	0	33							8	10	1	30	43	37	35							9	11	2	30	23	50	19	14
			2	175	14	39	47	-	54	14	1	31							5	7	1	30	51	33	28							6	6	1	34	17	59	15	9
			E	24	100	0	0	-	70	17	0	13							0	4	0	29	58	29	42							4	4	0	38	21	63	4	13
New principle for information and communication	7	ommunication utilizing neutrinos, gravity waves, or unknown principles of physics.	1	111	1	17	82	-	50	6	6	38							15	22	5	9	6	39	75							17	25	14	11	25	46	45	5
			2	101	0	17	83	-	58	4	0	38							13	20	3	4	4	36	82							15	22	8	7	20	50	56	3
			E		0	0	0	-	0	0	0	0							0	0	0	0	0	0	0							0	0	0	0	0	0	0	0
	8	Establishment of a sufficiently accurate and efficient pseudo-experimental technique for subjective evaluation of values brought about by various services and applications in the information and communications fields, without using real test subjects.	1	164	13	38	49	-	45	14	1	40							13	11	7	11	29	44	65							13	13	5	14	5	43	36	38
			2	144	13	34	53	-	51	9	0	40							9	7	5	8	26	40	64							8	8	2	11	5	44	37	41
			E	18	100	0	0	-	61	22	0	17							0	6	12	6	41	65	59							0	6	6	12	6	59	65	41

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New principle for information and communication	9	A practical quantum cryptography.	1	121	4	33	63	-	77	9	3	11							5	8	67	47	31	17	3						3	9	36	36	46	14	19	5
			2	116	3	28	69	-	82	9	1	8							3	7	66	43	31	16	1						2	10	35	38	52	4	15	1
			E	3	100	0	0	-	67	0	0	33							33	0	0	50	50	50	0						0	0	0	50	50	0	100	0
	10	Technology directly transmitting the information obtained by one's eyes and ears to a third party's brain, to support such third party's eyesight and hearing.	1	151	7	29	64	-	58	5	1	36							11	11	80	47	16	13	3						16	11	53	43	26	12	15	4
			2	140	7	26	67	-	65	4	0	31							6	11	81	43	11	11	1						13	13	58	47	20	8	13	2
			E	10	100	0	0	-	80	0	0	20							0	20	67	44	22	11	0						13	25	63	50	25	25	13	13
	11	Technology transmitting the contents of one's thoughts to the brains of someone else without using eyes or ears, for communication between people.	1	146	7	27	66	-	46	3	1	50							23	11	80	38	12	11	2						26	12	58	34	22	6	15	3
			2	139	7	24	69	-	50	4	0	46							18	11	82	32	10	9	1						23	12	69	35	19	5	10	2
			E	10	100	0	0	-	70	0	0	30							10	20	80	40	30	0	0						20	20	78	56	44	22	0	0
	12	Clarification of the mechanisms of senses other than the five senses, such as telepathy, the sixth sense and thought vibes, for use in daily communications.	1	105	8	20	72	-	27	2	1	70							38	26	74	28	16	2	10												
			2	95	6	19	75	-	24	2	1	73							34	23	78	21	16	5	7												
			E	6	100	0	0	-	33	0	0	67							67	17	100	50	17	0	17												
	13	An environment where various sensors are placed all over the real world, enabling us to search for any information in the whole real world through networks, for instance, weather conditions and landscapes of any place in Japan, by specifying them with a retrieval key.	1	216	18	44	38	-	57	21	1	21							1	1	29	33	54	35	2						3	3	12	26	55	24	36	3
			2	184	15	44	41	-	62	19	1	18							2	1	20	32	57	35	2						3	2	10	23	61	19	35	2
			E	28	100	0	0	-	82	4	0	14							0	4	44	48	67	33	4						0	4	26	41	74	19	30	0
	14	An environment where sensors are placed all over the real world, enabling people present at any place in Japan specified by a retrieval key to communicate in response to any situation without knowing their IDs.	1	196	17	43	40	-	38	19	0	43							4	6	34	35	49	28	4						7	9	14	23	57	19	28	5
			2	176	14	43	43	-	37	16	0	47							3	5	30	35	53	24	1						8	6	12	19	63	14	27	2
			E	24	100	0	0	-	54	13	0	33							0	4	46	50	67	33	4						4	8	21	38	67	13	25	0
	15	Popularization of retrieval technology for specified information in the real world as well as information stored on computers, at high speed and low cost.	1	192	18	43	39	-	74	8	3	15							2	8	46	37	46	24	1						1	9	21	27	59	13	27	2
			2	164	15	47	38	-	83	4	1	12							1	4	43	30	57	23	0						1	5	15	23	66	10	26	1
			E	25	100	0	0	-	92	0	0	8							0	4	56	40	56	28	0						0	4	20	32	68	16	32	0
	16	Technology that can naturally use the total system of external computers, their networks, various sensors and the peripherals connected to the networks as an extension of human brains, sense organs and bodies.	1	187	12	34	54	-	67	9	3	21							6	7	69	44	30	17	1						8	9	37	33	44	9	30	2
			2	159	10	35	55	-	72	6	2	20							3	5	72	40	25	16	1						3	7	38	36	47	6	28	1
			E	16	100	0	0	-	81	0	0	19							6	6	75	50	25	25	0						0	7	44	56	38	25	44	0

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Spatial communications	17	Broadcasting technology capable of free multiple-perspective video; for example, technology that would enable people to select views from a specific soccer player or views from the ceiling to watch the entire play during live broadcasting of soccer games.	1	193	19	38	43	-	51	12	1	36							2	4	47	32	57	15	1						3	6	19	17	76	5	17	2
			2	170	18	38	44	-	54	9	2	35							1	3	43	31	66	10	1						2	2	13	16	81	1	14	1
			E	31	100	0	0	-	75	6	0	19							0	0	50	43	73	0	3						3	0	16	29	84	0	16	0
	18	Technology delivering touch, fragrance and taste; enabling shopping at home just like shopping at stores, where goods are checked by hand.	1	198	15	33	52	-	52	11	1	36							6	4	50	34	55	20	1						6	8	18	19	74	2	19	2
			2	168	15	32	53	-	54	8	0	38							4	2	45	26	61	16	2						5	3	14	17	78	1	16	1
			E	25	100	0	0	-	76	4	0	20							4	0	56	32	44	20	8						8	0	26	26	70	0	22	0
	19	A remote clinical examination system under which the doctor can use a stethoscope and palpate the patient or smell the patient's breath from a distance, as if they were face to face.	1	196	16	35	49	-	79	13	2	6							5	3	61	53	37	29	2						6	5	33	40	46	23	32	3
			2	173	16	38	46	-	85	8	2	5							2	2	59	53	32	27	2						3	2	28	42	51	17	30	2
			E	28	100	0	0	-	89	11	0	0							0	0	62	50	38	19	4						0	0	39	50	50	11	32	4
	20	Technology where a person unable to go traveling can enjoy the feeling of being in another place, by using remote-operated robots placed at tourist spots together with wide angle or stereoscopic cameras, high-performing microphones with realistic sensation, and other sensors for touch, feeling, and smell. (Tele-existence technology)	1	200	16	37	47	-	50	13	2	35							4	5	59	39	46	20	2						8	6	25	25	61	5	26	2
			2	172	16	40	44	-	56	9	1	34							3	2	61	35	49	13	1						6	4	21	20	66	3	26	1
			E	27	100	0	0	-	74	7	0	19							0	0	67	41	48	7	4						7	0	32	32	60	4	24	0
	21	Technology of image recognition and image understanding that can automatically create the scripts of past movies and films; not only the scripts and instructions to the actors, but also descriptions of the scenery and movie props.	1	166	14	33	53	-	33	6	2	59							11	7	57	29	44	16	1						13	9	30	25	59	2	18	3
			2	147	16	33	51	-	32	5	1	62							10	3	63	25	42	10	0						12	5	34	16	64	0	11	1
			E	23	100	0	0	-	52	13	0	35							9	0	82	36	41	0	0						9	0	48	22	65	0	9	0
	22	Image-recognition and image-analysis technology that recognizes a person's face from images of people in a crowd, and specifies an individual for such purposes as finding a runaway from home.	1	205	20	39	41	-	84	4	1	11							0	0	52	43	57	18	2						0	1	18	27	60	28	22	2
			2	175	22	38	40	-	89	3	0	8							1	0	51	38	60	14	0						1	1	13	23	70	22	17	0
			E	38	100	0	0	-	97	0	0	3							0	0	63	37	71	8	0						0	0	24	21	87	18	16	0
	23	A system under which 80% of office work can be changed into distance work in Japan, that is, where a person can work together with his/her colleagues at different offices with the same communication as if they were at the same office all the time.	1	207	20	42	38	-	62	16	2	20							6	3	34	30	73	19	2						9	5	17	17	74	10	23	2
			2	178	20	42	38	-	69	14	1	16							4	2	27	24	78	14	1						8	2	11	11	81	8	19	0
			E	35	100	0	0	-	79	9	0	12							9	0	32	21	76	15	0						14	0	15	9	85	12	18	0
	24	A virtual office system that can halve the number of workers in Japan compared with the present real office; due to the development of telework, workers can remotely manage their businesses and tasks, giving instructions by pointing, having a confidential talk, or handing over documents through their printers, and thereby having a realistic ambience just like working all together in one office.	1	202	21	39	40	-	54	17	2	27							4	5	39	32	70	18	1						6	6	16	16	77	13	19	3
			2	175	20	39	41	-	60	14	1	25							3	2	31	27	74	12	0						6	1	10	11	82	8	16	0
			E	35	100	0	0	-	71	9	0	20							6	0	44	26	71	12	0						11	0	12	12	79	12	21	0

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Socialization of information communications	25	The 3D-virtual world service such as Second Life is used in connection with the real world, and becomes a place for social activities by spreading as a social infrastructure where the real world is supplemented, substituted, or mixed.	1	182	18	35	47	-	34	4	3	59							16	12	19	16	70	10	19	3
			2	165	14	36	50	-	32	3	1	64							14	9	14	8	77	6	13	3
			E	23	100	0	0	-	57	4	0	39							17	9	23	9	91	5	5	0
	26	A Green ICTS system that reduces the energy necessary for the transmission and storage of information to one-millionth of that in 2010 (normalized by the amount of information handled).	1	142	11	29	60	-	88	6	1	5					13	16	56	51	44	24	4					13	14	29	31	52	23	24	4
			2	128	10	24	66	-	95	2	0	3					12	11	55	47	48	18	3					14	12	26	33	64	17	19	3
			E	13	100	0	0	-	100	0	0	0					23	8	67	33	50	17	8					23	8	58	17	50	17	33	8
	27	An intracorporeal and extracorporeal system of electronic information for high level medical service is developed for anti-aging, and the average life expectancy becomes 5 years longer than it is in 2010 due to the effects of such system. According to statistics in 2003, the extension of 5 years in the average life expectancy was brought about by the lifestyle improvement and advancement in medical services in the past 20 years, but such extension will reach biotic limitations in the near future.	1	98	3	12	85	-	58	7	6	29					5	19	65	50	25	23	4					4	20	40	40	33	19	27	9
			2	105	3	10	87	-	68	5	4	23					4	16	68	45	21	17	3					5	16	49	40	34	10	23	6
			E	3	100	0	0	-	100	0	0	0					0	0	67	67	33	0	0					0	0	67	67	67	33	33	33
	28	An information traceability system under which an electronic ID given to contents at time of the information source is maintained without being erased or altered, and thereby stolen or scattered information can be tracked easily.	1	182	13	36	51	-	81	7	2	10					6	7	52	49	52	16	4					6	7	19	29	57	27	24	7
			2	161	13	34	53	-	86	4	1	9					4	6	49	45	55	12	3					6	7	13	26	68	24	18	3
			E	21	100	0	0	-	100	0	0	0					5	0	50	50	55	5	0					5	5	20	40	70	25	15	0
	29	A world wide traceability system covering most of the food products.	1	172	9	26	65	-	74	13	4	9					5	4	26	41	55	30	10					8	8	10	23	52	35	31	15
			2	156	8	27	65	-	86	9	1	4					2	3	17	37	64	27	8					5	6	5	17	65	30	28	9
			E	12	100	0	0	-	100	0	0	0					0	0	42	50	75	33	25					0	8	17	8	75	58	33	17
	30	A system to predict conditions of global weather, oceans, environment, ecosystems, epidemics, economics, and human activity through a total simulation based on real-time data can tackle unknown global crises.	1	162	11	28	61	-	87	3	4	6					4	7	52	64	18	26	7					4	8	27	58	20	30	31	10
			2	145	10	26	64	-	91	1	1	7					4	4	54	64	14	25	5					4	5	26	65	18	23	30	7
			E	14	100	0	0	-	100	0	0	0					0	0	57	50	21	14	0					0	0	50	57	21	0	21	0
	31	Intelligent robotic technology that enables families and relatives to provide livelihood support to aged and handicapped people safely by remote control from a distance; the robots will be intelligent enough to avoid the risks that a teleoperator is unaware of.	1	193	9	38	53	-	52	39	1	8					5	3	55	51	46	27	1					4	3	22	31	59	22	26	1
			2	170	9	38	53	-	57	35	1	7					4	2	56	50	47	24	1					4	2	23	33	64	17	26	0
			E	15	100	0	0	-	79	14	0	7					0	0	67	53	40	13	0					0	0	27	27	60	33	20	0
	32	An intelligent robot that conducts daily conversation and keeps people company during daily activities such as watching TV and reading newspapers and magazines.	1	195	16	37	47	-	35	29	1	35					7	5	59	40	51	17	1					8	5	26	25	69	10	17	1
			2	169	15	38	47	-	36	25	0	39					5	4	61	38	52	14	1					5	4	27	26	73	6	13	1
			E	25	100	0	0	-	56	16	0	28					0	0	75	42	50	0	0					4	0	50	33	67	0	4	0

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Socialization of information	33	An inheritance support system of skills and cultures by which the performance of excellent artists and craftsmanship are automatically obtained and archived.	1	170	12	37	51	-	35	34	1	30							10	3	70	49	22	10	1							12	5	41	42	29	21	15	3
			2	151	13	33	54	-	40	29	1	30							5	3	69	49	18	7	1							8	5	44	52	29	13	13	1
			E	19	100	0	0	-	63	32	0	5							5	0	74	32	37	0	0							5	0	47	42	47	5	0	0
	34	An inheritance support system of skills and cultures by which the thinking process of an excellent creator such as a novelist, project leader, researcher, and educator is automatically obtained and archived without bothering him/her.	1	153	12	34	54	-	31	20	2	47							25	11	72	49	16	9	2							26	11	47	44	26	13	13	4
			2	137	13	31	56	-	34	16	1	49							23	8	75	43	10	9	1							26	8	56	44	23	6	10	2
			E	18	100	0	0	-	55	17	0	28							28	17	94	31	13	6	0							29	12	75	31	25	6	6	0
	35	It becomes customary for avatars or a virtual personalities with a handle name, as well as real people, to sign a contract of employment or sale, to pay tax, and to conduct other social activities in Japan, and some of such virtual personalities are treated as registered persons or juridical personalities.	1	132	7	34	59	-	15	11	2	72																				22	27	18	15	39	38	15	4
			2	124	6	31	63	-	12	8	1	79																				24	21	16	14	47	34	9	3
			E	8	100	0	0	-	13	25	0	62																				25	13	43	0	57	14	0	0
	36	Establishment of a system that finds out whether the proposed service conforms to the laws and regulations of each country by retrieving them, and indicates the conditions for providing such service in each country.	1	143	3	32	65	-	72	11	6	11							4	3	39	56	26	18	10							5	4	14	35	30	46	20	15
			2	135	3	30	67	-	79	8	5	8							2	3	29	72	23	15	8							4	4	10	42	31	51	16	11
			E	4	100	0	0	-	100	0	0	0							0	0	75	50	25	25	0							0	0	50	25	25	50	25	0
Multicultural exchange	37	A machine translation system that can automatically learn cultural backgrounds and proper nouns, such as place names and people's names, as well as languages.	1	171	14	39	47	-	71	19	2	8							2	5	62	50	42	19	1							2	4	33	34	57	11	20	4
			2	154	14	34	52	-	82	12	1	5							2	3	64	49	44	15	3							1	2	29	36	66	5	16	3
			E	21	100	0	0	-	95	5	0	0							5	0	62	52	48	19	10							5	0	33	48	67	10	19	14
	38	Biometric authentication technology that allows overseas trips without passports.	1	166	10	34	56	-	74	2	6	18							4	4	34	55	43	23	12							11	10	13	30	26	50	21	25
			2	150	11	33	56	-	82	2	3	13							3	3	27	63	44	18	7							6	6	10	32	25	53	17	20
			E	16	100	0	0	-	100	0	0	0							0	0	50	69	44	31	6							6	0	38	44	31	63	38	25
	39	A corpus, where multilingual knowledge is automatically accumulated from books, newspapers, broadcasting, and academic papers on websites all over the world, is utilized for simultaneous multilingual translation.	1	187	15	41	44	-	75	15	3	7							3	4	54	48	42	19	5							2	4	30	34	58	10	20	7
			2	161	16	40	44	-	80	12	0	8							3	1	56	49	44	18	4							3	3	26	32	64	6	18	6
			E	25	100	0	0	-	92	4	0	4							0	0	68	64	40	16	8							0	0	40	36	60	12	24	12
	40	Technology that enables people in Japan to watch TV programs from all over the world through networks free from the language barrier (contribution to the improvement of international understanding).	1	175	15	38	47	-	47	31	1	21							6	5	45	47	49	17	4							9	8	20	29	64	14	23	11
			2	150	17	39	44	-	51	28	1	20							3	3	43	46	57	14	3							7	5	16	29	70	12	21	8
			E	25	100	0	0	-	68	28	0	4							0	0	48	56	36	12	8							0	4	20	44	56	20	28	12

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Inteligence support	41	Technology that is capable of transmitting various image information including 3D images, and voice and sound information including sound effects, to the visually and hearing impaired people with texture and reality.	1	170	15	38	47	-	68	12	2	18							5	8	61	54	26	20	0							6	9	34	41	40	24	24	1
			2	154	16	32	52	-	80	5	1	14							5	7	67	52	22	17	1							7	6	35	46	45	18	20	2
			E	24	100	0	0	-	79	8	0	13							8	0	79	63	33	21	0							13	0	59	64	55	41	18	5
	42	Technology for the people with impaired vision, hearing or speaking to be able to transmit the information they picture in their minds to others by visualizing, making the sound audible, or verbalizing the information faithfully.	1	160	14	29	57	-	78	7	2	13							6	11	69	58	20	17	0							6	15	42	46	34	20	21	1
			2	144	15	26	59	-	89	1	1	9							6	10	71	54	15	16	1							6	12	48	47	36	14	18	2
			E	21	100	0	0	-	89	0	0	11							15	0	85	60	20	15	0							5	10	63	58	26	26	11	0
	43	A portable conversation environment where a motor-impaired person, such as someone suffering from amyotrophic lateral sclerosis (ALS), can intuitively express his/her own will and intentions to a conversation partner.	1	147	13	29	58	-	86	3	4	7							1	4	67	57	21	18	1							1	7	40	47	40	19	21	1
			2	136	13	24	63	-	93	1	2	4							1	4	68	54	18	15	1							1	6	39	48	45	13	18	2
			E	18	100	0	0	-	88	0	6	6							0	0	83	56	22	11	0							0	0	71	59	41	18	18	0
	44	Clarification of the mechanism for memorizing information, such as experience, knowledge, language and picturing in our brains.	1	144	15	25	60	-	80	6	1	13							6	10	79	51	10	13	2													
			2	133	14	24	62	-	86	3	2	9							4	7	81	47	7	10	1													
			E	19	100	0	0	-	88	6	0	6							0	11	89	58	11	11	0													
	45	Technology providing information in a representative form according to the mechanism of memory in the brain so that the brain can memorize the information easily.	1	136	15	26	59	-	71	7	1	21							5	13	79	49	15	15	1							4	16	53	44	35	8	19	2
			2	127	16	20	64	-	80	2	1	17							5	9	83	48	9	10	0							2	12	61	45	38	4	14	1
			E	20	100	0	0	-	100	0	0	0							0	5	90	55	20	15	0							0	5	70	55	45	5	5	0
	46	Technology that transfers a private memory to a computer, and that retrieves and processes the information with a interface similar to one's own memory as if the memory function of the brain were extended.	1	138	12	23	65	-	56	7	2	35							23	12	79	43	11	11	2							24	16	57	35	24	5	15	6
			2	129	12	19	69	-	65	2	2	31							22	9	85	41	9	9	1							24	13	66	36	27	2	13	3
			E	15	100	0	0	-	71	0	0	29							20	13	87	47	13	13	0							20	13	80	40	20	7	20	0
Movement support	47	Powered suits that enable unskilled workers to master the skills of skilled workers in a short period of time, by reproducing the same sense the skilled workers have.	1	142	9	21	70	-	47	24	1	28							11	8	65	47	31	14	2							7	10	36	37	56	9	19	2
			2	131	7	21	72	-	52	19	1	28							8	5	69	46	27	10	2							7	8	34	33	63	5	13	2
			E	9	100	0	0	-	62	13	0	25							11	0	100	38	13	13	0							0	0	57	43	57	14	0	0
	48	A system that detects a sign of the critical situation in human bodies in daily life, and informs the person him/herself or people nearby of such situation.	1	146	8	18	74	-	85	10	2	3							3	7	63	52	33	22	1							1	8	29	35	49	22	31	1
			2	137	7	18	75	-	89	7	0	4							0	5	63	50	26	20	0							0	5	23	36	54	14	25	1
			E	9	100	0	0	-	89	11	0	0							0	22	89	56	22	33	0							0	22	44	44	44	33	56	0

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Movement support	49	Most of the automobiles are driven automatically on the ordinary roads.	1	173	8	31	61	-	52	17	2	29							14 4	37	38	65	28	0						18 7	13	23	59	36	26	4
			2	160	8	28	64	-	57	14	1	28							14 3	30	35	74	22	0						23 5	10	19	72	35	21	4
			E	12	100	0	0	-	92	8	0	0							8 0	42	42	75	17	0						25 8	33	25	83	33	8	0
	50	Artificial vision that enables the visually impaired to live daily life at the same safety level as persons without any disability.	1	128	12	28	60	-	86	4	4	6							6 9	67	56	30	21	0						6 12	37	39	45	21	25	1
			2	125	11	22	67	-	92	2	1	5							4 9	70	54	26	17	2						5 12	36	42	50	19	22	3
			E	14	100	0	0	-	93	0	0	7							7 0	92	62	31	31	0						0 0	62	62	62	38	46	8
	51	Disaster rescue robot that distinguishes and rescues survivors at the disaster site.	1	165	9	28	63	-	84	12	1	3							3 2	53	57	38	25	1						2 2	25	37	48	36	25	2
			2	151	7	26	67	-	90	9	0	1							2 1	51	59	32	21	1						1 2	19	33	55	33	22	1
			E	11	100	0	0	-	100	0	0	0							0 0	82	55	45	27	0						0 0	55	55	64	45	27	0
	52	A cooperative system between automobiles and the road, that transmits information on pedestrians, automobiles, and obstacles outside the driver's view to the driver or the car being driven, is set up in most areas where the visibility is poor or traffic accidents occur frequently in Japan.	1	180	10	38	52	-	53	41	1	5							0 3	31	47	59	35	1						2 4	10	25	53	50	30	2
			2	164	9	37	54	-	60	38	0	2							0 1	22	47	62	28	1						0 2	8	20	59	49	24	0
			E	14	100	0	0	-	64	36	0	0							0 0	21	50	64	21	0						0 0	21	36	71	50	21	0
	53	Automatic driving technology for automobiles with a special lane that will enable the current usage efficiency of highways to triple.	1	152	8	33	59	-	50	32	1	17							5 3	33	49	58	30	1						6 5	10	25	49	49	29	2
			2	139	7	29	64	-	58	26	1	15							2 2	21	46	64	24	0						4 4	6	19	64	47	23	1
			E	10	100	0	0	-	60	20	0	20							0 10	33	56	44	22	0						0 10	30	50	50	40	20	0
Assurance of appropriateness of information	54	An artificial agent that detects problematic information such as libel and slander, and intervenes to cause the self-cleaning action (preventing such problematic acts by becoming aware of the problem) of the individual or group at that time.	1	166	17	41	42	-	76	8	0	16							10 4	60	43	38	22	1						12 4	30	33	52	23	22	3
			2	145	16	42	42	-	82	5	0	13							8 1	60	39	39	15	1						9 2	24	32	59	14	18	1
			E	23	100	0	0	-	87	0	0	13							4 0	83	48	43	13	4						9 0	43	43	52	17	13	4
	55	Imaging technology under which an artificial agent receives transmitted information from online communications, and creates the image of face-to-face communication with other participants based on the information, and urges the relevant person to judge whether his/her act was appropriate or not.	1	144	13	44	43	-	44	10	0	46							10 11	68	37	32	9	2						14 13	38	34	42	11	17	4
			2	132	11	39	50	-	44	5	0	51							7 7	68	35	32	7	1						8 9	40	35	49	7	13	3
			E	14	100	0	0	-	57	0	0	43							7 7	93	57	36	7	0						7 7	64	64	50	21	21	7
	56	Agent technology that manages and guarantees online information by knowing who wrote the information, how accurate it is, and how it has been altered since then, without being reported from the author him/herself.	1	164	16	40	44	-	79	4	1	16							4 4	58	40	45	17	1						4 4	24	30	54	17	22	2
			2	149	13	40	47	-	87	3	0	10							2 1	58	40	49	17	1						1 3	20	34	67	12	22	1
			E	20	100	0	0	-	100	0	0	0							0 0	80	50	50	10	0						0 0	40	35	70	20	20	0

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Assurance of appropriateness of information	57	A digital signature system under which citizens can use various information (such as information of noise and trouble) as evidence for disputes because the information is proved to be unaltered.	1	150	9	38	53	-	69	12	1	18							3	6	53	51	46	16	1						4	8	19	35	47	35	23	3
			2	144	8	32	60	-	78	9	0	13							1	1	56	54	45	11	0						1	1	13	37	62	33	17	1
			E	12	100	0	0	-	84	8	0	8							0	0	58	50	42	25	0						0	0	18	18	55	27	36	0
	58	An automatic service providing necessary information to get along in society according to the recipient's ability to understand.	1	165	13	41	46	-	63	14	1	22							4	7	58	48	45	14	0						4	8	23	31	61	21	18	1
			2	152	11	39	50	-	71	10	0	19							2	5	57	44	45	11	0						3	5	19	31	67	16	13	0
			E	17	100	0	0	-	88	6	0	6							6	0	76	47	53	6	0						6	0	31	25	63	25	25	0
Ubiquitous networking	59	A social consensus on privacy is formed, and a ubiquitous information system in cooperation with monitoring cameras and street displays is established.	1	204	21	41	38	-	68	15	3	14							6	3	36	50	46	31	2						5	7	12	30	45	44	31	5
			2	175	19	42	39	-	72	13	2	13							4	2	27	51	51	29	1						4	4	10	27	49	47	30	4
			E	33	100	0	0	-	79	9	3	9							9	0	35	48	45	26	3						6	0	20	33	47	50	30	7
	60	RFID tag prices become about 0.01 yen, and the attachment of tags to groceries and daily commodities is widely realized.	1	203	17	42	41	-	71	19	2	8							2	1	15	21	80	21	3						2	3	7	11	79	24	22	5
			2	175	18	41	41	-	83	10	1	6							1	1	8	16	82	19	2						1	2	3	8	85	17	18	4
			E	32	100	0	0	-	81	3	3	13							6	0	13	26	68	19	0						3	0	10	17	80	17	20	7
	61	More than half of the white goods (refrigerators, washing machines, microwave ovens, rice cookers, and air conditioners, etc.) are connected to home networks in 30% or more of the households in Japan.	1	203	19	42	39	-	35	37	0	28							2	2	16	21	84	16	2						2	2	6	8	89	13	15	3
			2	176	18	43	39	-	37	34	0	29							2	2	12	15	88	10	0						1	2	4	7	90	7	11	1
			E	32	100	0	0	-	46	38	0	16							0	3	19	22	84	3	0						0	3	9	6	91	13	9	0
	62	Implantable health management devices are used by 30% or more of the Japanese population.	1	146	12	27	61	-	47	24	1	28							8	4	47	52	52	16	2						13	10	15	30	55	26	24	3
			2	136	10	23	67	-	51	22	1	26							6	3	36	50	61	11	1						10	5	8	30	66	20	18	2
			E	14	100	0	0	-	50	21	0	29							8	0	50	50	57	0	7						8	15	7	21	57	21	14	0
	63	Popularization of an appropriate guiding and leading service for everyone to reach their destination without looking for signboards and other landmarks, where the detailed information of a purchased ticket is transmitted to the support tools in station yards by near-field transmission.	1	186	16	42	42	-	41	30	1	28							2	5	26	28	74	21	0						4	7	9	15	80	15	22	2
			2	164	16	38	46	-	44	29	0	27							1	3	14	25	79	16	0						2	5	3	12	83	11	19	1
			E	26	100	0	0	-	50	31	0	19							0	0	24	28	64	20	0						0	0	13	17	71	4	29	0
Ultra-large scale software	64	Specification-writing techniques to enable the creation of consistent specification by representing and verifying the specifications of ultra-large scale software consisting of more than 100 million lines of code.	1	142	21	38	41	-	75	11	2	12							21	9	63	43	50	17	2						20	10	36	32	67	7	18	4
			2	131	20	36	44	-	84	5	1	10							18	5	62	34	56	16	1						17	6	36	27	69	3	16	2
			E	26	100	0	0	-	88	4	0	8							38	4	70	35	52	17	0						33	8	52	19	71	5	5	0

Area	Topic number	Topic	Round	Responses	Degree of expertise (%)				Importance (%)				Forecasted time of technological realization (to be realized somewhere in the world)							Sectors that will pave the way to technological (%)					Forecasted time of social realization (to become applicable/widely used in Japan)							Sectors that willpave the way to social realization (%)					
					High	Moderate	Low	None	Important for Japan and the rest of the world	Especially important for Japan	Especially important for the world	Low importance/priority	Already realized	2011-2015	2016-2020	2021-2030	2031-2040	2041-	will not be realized	don't know	University	Public research organization	Private enterprise	Collaboration of multiple sectors	Others	2011-2015	2016-2020	2021-2030	2031-2040	2041-	will not be realized	don't know	University	Public research organization	Private enterprise	Government	Collaboration of multiple sectors	Others
Ultra-large scale software	65	Automatic development technology for systems that control the operational quality of ultra-large scale software consisting of more than 100 million lines of code at the same quality as the current software.	1	139	22	37	41	-	76	12	1	11							12	10	53	43	54	18	2							9	11	30	32	68	5	20	2
			2	131	18	35	47	-	89	6	0	5							8	5	54	34	61	15	2							7	5	28	27	73	2	15	1
			E	24	100	0	0	-	92	8	0	0							17	4	59	36	59	18	5							14	5	43	29	76	10	14	0
	66	Technology capable of autonomously preventing system failure by quick detection of risk exceeding the acceptable value when an ultra-large scale complex system is in operation.	1	143	22	36	42	-	87	7	1	5							4	8	46	34	64	17	1							4	7	23	27	76	7	17	2
			2	133	18	35	47	-	95	2	0	3							5	5	47	27	74	11	1							5	4	23	23	81	4	12	2
			E	24	100	0	0	-	100	0	0	0							13	0	48	17	74	9	0							9	0	27	14	82	5	9	0
	67	An automatic system construction tool that limits the participation of human workers to the development of ultra-large scale software to 50%.	1	141	21	35	44	-	79	14	1	6							4	9	47	36	62	19	2							5	9	25	20	75	5	17	3
			2	131	15	36	49	-	91	5	0	4							4	5	48	31	68	15	2							4	5	26	21	79	2	15	2
			E	20	100	0	0	-	90	5	0	5							10	5	42	32	68	11	0							5	5	37	16	79	0	5	0
Contents service	68	Technology that can figure out the problems in making policy recommendations and institutional designs by simulating the social acceptance, domestic and international influences and other matters in detail at the level of each individual or each issue.	1	132	14	31	55	-	52	22	2	24							13	12	58	59	14	17	2							13	12	27	44	24	32	24	2
			2	124	10	27	63	-	62	16	2	20							8	10	55	61	13	11	2							9	10	24	55	22	28	20	1
			E	13	100	0	0	-	69	23	0	8							0	0	62	54	0	8	0							0	0	33	42	8	25	17	0
	69	Simulations of the changes in the customer's purchase activity and sense of value from various standpoints before a service starts to be provided by a company.	1	155	15	28	57	-	53	25	1	21							3	7	40	28	77	12	1							3	7	18	20	86	5	13	1
			2	136	14	29	57	-	66	13	1	20							1	5	35	18	81	8	0							0	5	14	18	85	2	9	0
			E	19	100	0	0	-	52	32	0	16							0	0	63	26	63	0	0							0	0	37	32	79	0	0	0
	70	A practical system for content management and small-amount payment, whereby a copyright management database is operated integrally across a wide range of genres and the copyright is handled semi-automatically with negligible costs in conjunction with searching and matching systems and with the system of small-amount payment, and whereby incomes from copyrights are delivered to the right holders without fail.	1	144	13	33	54	-	70	18	1	11							1	4	26	28	70	20	2							2	8	11	18	68	25	29	7
			2	129	12	33	55	-	79	13	0	8							2	2	21	27	76	15	2							3	3	11	13	73	19	23	5
			E	15	100	0	0	-	87	13	0	0							0	0	40	13	67	13	0							0	0	29	14	71	21	29	0
	71	A prediction technique for the occurrence and propagation of infectious diseases in an expeditious way, whereby the prediction is made after taking into consideration various factors, such as the factor of economic activities together with the global and local movement of people, environmental factors including temperature, humidity and wind direction in each area, and physiological factors such as the immune function.	1	128	11	22	67	-	94	0	2	4							2	6	57	63	20	28	7							2	7	25	52	25	39	32	11
			2	118	9	20	71	-	96	0	2	2							2	4	54	67	15	19	5							2	5	20	59	19	39	22	8
			E	11	100	0	0	-	100	0	0	0							0	0	82	64	18	9	0							0	0	55	36	18	45	9	18
	72	Technology that collects and synthesizes the knowledge and opinions of a number of ordinary people via the internet is widely used for the purposes of futuristic overview and decision making by the government, corporations, and society in general, and is used as a supplement or substitute for the judgments of business managers, politicians, bureaucrats, analysts, and other specialists.	1	162	19	30	51	-	67	14	1	18							4	5	55	51	37	28	3							6	7	25	35	42	34	30	5
			2	143	16	29	55	-	81	7	1	11							2	4	56	46	34	25	1							4	4	20	34	46	31	30	2
			E	23	100	0	0	-	87	4	0	9							4	4	82	45	32	14	0							4	0	41	36	45	27	23	0

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Contents service	73	Technology that enables ordinary people to produce high-quality CG animation movies indistinguishable from live-action movies at a cost individuals can afford, owing to advances in CG technology and agent technology that easily produce widely-accepted virtual actors.	1	166	16	36	48	-	30	19	2	49							2	5	37	18	81	10	1							2	8	16	9	85	0	9	1
			2	150	16	31	53	-	31	17	1	51							1	2	32	11	89	5	1							2	4	11	8	92	1	6	1
			E	24	100	0	0	-	46	29	4	21							0	0	38	8	83	4	0							0	0	17	13	83	4	4	0
Other boundaries, fusion, or emerging sectors	74	Remote-controlled humanoid robotics technology that serves as a communication tool for encouraging social participation of people who cannot take part in society for various reasons such as sickness, injury, age, and mental or physical disorder.	1	161	11	27	62	-	51	24	1	24							4	11	66	59	39	18	1							4	11	32	39	50	22	23	3
			2	144	10	28	62	-	58	20	0	22							5	8	64	54	33	15	1							6	9	29	39	55	17	20	1
			E	15	100	0	0	-	60	13	0	27							0	0	73	80	20	13	0							7	0	40	53	40	27	13	0
	75	Most of the residents in isolated and depopulated areas do not feel an information gap between themselves and the residents in metropolitan areas, thanks to the elimination of digital divides made possible by ICTs such as online shopping and high-quality virtual reality systems for concerts, exhibitions, meetings, friendly talks, and long-distance relationships.	1	178	13	38	49	-	50	31	1	18							11	8	38	46	57	22	2							13	11	17	29	52	39	22	2
			2	158	11	38	51	-	52	29	0	19							8	6	35	42	63	14	1							10	8	15	26	66	33	18	0
			E	18	100	0	0	-	66	28	0	6							11	0	35	47	41	24	0							12	0	24	35	41	35	18	0
	76	The length of hospital stays for medical treatment are reduced to half of the current length by estimating the quantitative effect of drugs, where both genetic information and biological information of each individual are systematically linked to the drug information.	1	105	7	25	68	-	73	21	4	2							3	6	52	57	43	28	1							1	10	27	44	44	31	35	3
			2	109	6	23	71	-	80	17	1	2							2	5	47	58	39	19	1							1	6	23	49	50	23	25	3
			E	6	100	0	0	-	100	0	0	0							0	0	83	33	33	17	0							0	0	33	17	50	33	17	0

Panel 3:

Biotechnology and nanotechnology to contribute to humankind

Implementation of the questionnaires

	Sent	Returned (response rate)
<1st Round>	386	333 (86%)
<2nd Round>	332	291 (88%)

Sex	Male	270	Affiliation	Private enterprise	48
	Female	21		University	191
	N.A.	0		Research Institute	28
generation	20's	0		Association	6
	30's	19		Others	18
	40's	83		N.A.	0
	50's	105	Job category	R&D	244
	60's	69		Others	46
	70's and over	15		N.A.	1
	N.A.	0		Total	291

Survey items

A: Basic bio-nanotechnology (principles, mechanisms)

B: Applied bio-nanotechnology

C: Medical bio-nanotechnology

D: Preventive healthcare and diagnosis

E: Healing (exegenous factor, metabolic disease, and psychiatric disease)

F: Regenerative medicine

G: Industrial bio-nanotechnology related to agricultural, forestry and fisheries (including functional foods)

H: Industrial bio-nanotechnology related to energy and environment

Time-series tables of topics

<Technological realization>

year	Topic (Leading number represents ID.)
2018	03: Technology for identification and functional analysis of the material interaction within a cell or between the inside and outside of the cell.
	04: Technology that automatically analyzes the configuration of sugar chains composed of 20 or more sugar units, as well as the branching and linkage thereof.
	10: Technology that designs highly active artificial antibodies based on the study of the antigen recognition mechanism of antibodies.
	12: Nano chamber arrays that enable the detection of many biological reactions in an instant, such as enzymatic reactions, antigen-antibody reactions, ligand discovery, and reaction conditions, by integrating thousands or several tens of thousands of reaction vessels on a semiconductor chip and utilizing it as various reaction libraries.
	45: Foods and dietary approaches that support a healthy aged society by preventing the decline in antioxidant function, brain function and masticatory function that is typical in elderly persons.
	46: Precision taste analysis robots that are capable of detecting and analyzing the constituents and physical properties of agricultural, marine and livestock products before they are placed on the market.
	57: Biological crop protection methods (phage, plant activators, natural enemies, pheromones, allelopathy, etc.) that reduce the use of synthetic chemical pesticides and fertilizers by 50%.
2019	Technology for molecular imaging in the body with the precision of a single molecule
	09: Technology that predicts in a detailed manner biological activity, including the interaction between proteins, interaction between protein and DNA or RNA, and interaction between protein and synthetic compounds, from the higher order structure of protein.
	11: In silico drug development technology that enables simulation of the kinetics and effects of drugs in the body.
	18: A system that makes a precise diagnosis of the risk of developing cancers and intractable diseases by using biochips, and provides information for medical treatment guidelines in an extremely short time.
	19: Technology capable of predicting the onset of cranial nerve disease (such as dementia and Parkinson's Disease).
	27: Elucidation of the pathophysiology of cancer metastasis.
	36: Long-term culture and preservation techniques for the transplantation of organs (including autologous tissues).
	40: Robotic technology that fully automates farm work.
	41: Technology of introducing favorable characteristics for breeding marketable aquacultured species (that have disease tolerance and high growth potential, and are allergen free).
	42: Functional foods tailored to individual physical characteristics to prevent lifestyle disease.
	43: Disease-preventing foods that reduce the future risks of catching diseases.
	44: Production technology for foods and drugs using the physiology of unused microorganisms from the deep sea.

year	Topic (Leading number represents ID.)
2019	47: Sensor network technology under which foods are monitored continuously from the production site to the dining table, using DNA chips or various sensors such as spectrum sensors, and are prevented from the contamination of harmful substances or bacteria.
	48: Production of livestock clones from somatic cells based on the elucidation of epigenetic and other nuclear genetic information reprogramming mechanisms.
	50: Genetically engineered plants in which artificially introduced genes do not spread over the environment thanks to the utilization of stage- and site- specific expressions of the gene.
	52: A biocatalyst showing productivity equivalent to or greater than that of a chemical catalyst useable in industrial production.
	56: Achievement of low-cost agriculture/forestry and rural communities oriented towards zero emission by using local agricultural and forestry resources and organic wastes.
	58: Sensor networks that monitor environmental and biological data in fields, barns, ponds and so on, on a real-time basis for the early detection of growth retardation and the occurrence of disease and insect damage, and of abnormalities in livestock caused by infectious diseases such as avian influenza.
2020	01: Comprehensive risk management system based on simulations for predictions of virus mutations.
	14: A nano carrier system that carries drugs and genes to a specific intracellular site of a target cell by using external energy control, meso control, or Micro Electro Mechanical Systems (MEMS) technology.
	17: Technology capable of predicting the onset of mental disorders such as sporadic depression and schizophrenia.
	24: Technology that prevents progression of Alzheimer's Disease and other degenerative diseases, by clarifying the causes thereof at the molecular level.
	30: Treatment of disease by the systemic administration of nucleic acid drugs, such as siRNAs.
	37: Equipment or system that gives alternative functions for sight or hearing to visually and hearing impaired people in their daily lives.
	38: Technology for crop production and green technology in deserts achieved by improving the crop's adaptability (salt tolerance, drought tolerance, cold tolerance) and controlling its growth.
	39: Production technology for the useful compounds obtained by the creation of artificial cells consisting of a minimum gene set necessary for the production of compounds.
	49: Growth regulation of crops and trees based on the clarification of the mechanism of biosynthesis, transport, and receptor-mediated signaling by growth regulators in plants.
	53: Technology capable of controlling the spread of microorganisms that are capable of breaking down hazardous substances scattered throughout the natural environment.
2021	06: New medical and industrial technology based on the control of the interaction between cells and materials at the meso-scale (a size lying between the "nano space (1-5 nm)" and "bulk space (100 nm or more)").
	20: A treatment method based on the clarification of the carcinogenic mechanism by epigenetic gene expression regulation.
	34: Technology for regenerative medicine using iPS cells.
	35: Therapeutic technology using functional cells induced from stem cells, including iPS cells, without risks of carcinogenesis.

year	Topic (Leading number represents ID.)
2022	05:Clarification of the whole gene network that controls the growth (morphogenesis, reproduction, differentiation) of plants.
	15: A micro machine based on Micro Electro Mechanical Systems technology for diagnosis and treatment that freely moves within an organism (hollow viscus), and carries out the relevant operation.
	28: A treatment method that enables autoimmune diseases be cured.
	29: A treatment method that promotes recovery from brain dysfunction, by transplanting stem cells.
	51: More than half of the chemical polymers made from petroleum become renewable biomass resource-based products.
2023	07: Technology that analyzes the conformation of protein, which is in a functional state in the body, in a dynamic and detailed manner.
	13: Technology capable of freely making specific cells within an organism survive or leave, based on the study of the molecule mechanisms of apoptosis (applying such technology to therapeutical drugs for disease arising from cancer and failure in homeostasis maintenance).
2024	08: Technology that comprehensively analyzes the gene transcription cascade and signal transduction cascade during the process of differentiation from a fertilized egg to an adult of some kind of higher organism, as typified by mice.
	16: Technology that indicates human thought by detecting the neuronal activity and converting it to signals, or processing or transmitting it by computer.
	21: Clarification of the pathogenic mechanism by utilizing a virtual patient with a human body (the structure, physiology, and pathological condition) reproduced on a computer.
	23: Clarification of the regulatory mechanism for emotional behaviors such as anger and attacking.
	25: A treatment method based on the clarification of the causes for schizophrenia and bipolar disorder at the molecule level.
	32: Technology for constructing artificial cells and tissues with all sorts of channels and receptors, that substitutes functions such as cell membrane transport, material exchange, and energy conversion and reduces animal testing.
	33: Artificial organs (such as artificial pancreases, artificial kidneys, and artificial livers) which include human cells or tissues derived from iPS cells.
2025	22: Clarification of the mechanism of the formation of neural networks, including the relationship between memory and synaptic plasticity, at the molecular level.
	55: Development of a nanoscale voltage separating device for an enzyme reaction fuel cell using bio organic substances, and expanding the scale of such fuel cells through integrating them.
2026	26: A treatment method based on the clarification of the causes of developmental disorders (such as pervasive developmental disorders, learning disabilities, and Attention Deficit Hyperactivity Disorder (ADHD)) at the molecular level.
2028	54: Highly efficient energy conversion technology that utilizes motor proteins (molecular motors) that convert chemical energy to mechanical energy.
2030	31: Technology capable of repairing, within the body, the abnormal genes that cause genetic diseases and other diseases.

<Social realization>

year	Topic (Leading number represents ID.)
2024	04: Technology that automatically analyzes the configuration of sugar chains composed of 20 or more sugar units, as well as the branching and linkage thereof.
	12: Nano chamber arrays that enable the detection of many biological reactions in an instant, such as enzymatic reactions, antigen-antibody reactions, ligand discovery, and reaction conditions, by integrating thousands or several tens of thousands of reaction vessels on a semiconductor chip and utilizing it as various reaction libraries.
	46: Precision taste analysis robots that are capable of detecting and analyzing the constituents and physical properties of agricultural, marine and livestock products before they are placed on the market.
2025	03: Technology for identification and functional analysis of the material interaction within a cell or between the inside and outside of the cell.
	10: Technology that designs highly active artificial antibodies based on the study of the antigen recognition mechanism of antibodies.
	43: Disease-preventing foods that reduce the future risks of catching diseases.
	45: Foods and dietary approaches that support a healthy aged society by preventing the decline in antioxidant function, brain function and masticatory function that is typical in elderly persons.
2026	11: In silico drug development technology that enables simulation of the kinetics and effects of drugs in the body.
	42: Functional foods tailored to individual physical characteristics to prevent lifestyle disease.
	47: Sensor network technology under which foods are monitored continuously from the production site to the dining table, using DNA chips or various sensors such as spectrum sensors, and are prevented from the contamination of harmful substances or bacteria.
	52: A biocatalyst showing productivity equivalent to or greater than that of a chemical catalyst useable in industrial production.
	57: Biological crop protection methods (phage, plant activators, natural enemies, pheromones, allelopathy, etc.) that reduce the use of synthetic chemical pesticides and fertilizers by 50%.
	58: Sensor networks that monitor environmental and biological data in fields, barns, ponds and so on, on a real-time basis for the early detection of growth retardation and the occurrence of disease and insect damage, and of abnormalities in livestock caused by infectious diseases such as avian influenza.
2027	01: Comprehensive risk management system based on simulations for predictions of virus mutations.
	Technology for molecular imaging in the body with the precision of a single molecule
	18: A system that makes a precise diagnosis of the risk of developing cancers and intractable diseases by using biochips, and provides information for medical treatment guidelines in an extremely short time.
	19: Technology capable of predicting the onset of cranial nerve disease (such as dementia and Parkinson's Disease).
	36: Long-term culture and preservation techniques for the transplantation of organs (including autologous tissues).
	40: Robotic technology that fully automates farm work.
	41: Technology of introducing favorable characteristics for breeding marketable aquacultured species (that have disease tolerance and high growth potential, and are allergen free).

year	Topic (Leading number represents ID.)
2027	44: Production technology for foods and drugs using the physiology of unused microorganisms from the deep sea.
	48: Production of livestock clones from somatic cells based on the elucidation of epigenetic and other nuclear genetic information reprogramming mechanisms.
	50: Genetically engineered plants in which artificially introduced genes do not spread over the environment thanks to the utilization of stage- and site- specific expressions of the gene.
	56: Achievement of low-cost agriculture/forestry and rural communities oriented towards zero emission by using local agricultural and forestry resources and organic wastes.
2028	09: Technology that predicts in a detailed manner biological activity, including the interaction between proteins, interaction between protein and DNA or RNA, and interaction between protein and synthetic compounds, from the higher order structure of protein.
	37: Equipment or system that gives alternative functions for sight or hearing to visually and hearing impaired people in their daily lives.
	38: Technology for crop production and green technology in deserts achieved by improving the crop's adaptability (salt tolerance, drought tolerance, cold tolerance) and controlling its growth.
	53: Technology capable of controlling the spread of microorganisms that are capable of breaking down hazardous substances scattered throughout the natural environment.
2029	14: A nano carrier system that carries drugs and genes to a specific intracellular site of a target cell by using external energy control, meso control, or Micro Electro Mechanical Systems (MEMS) technology.
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	49: Growth regulation of crops and trees based on the clarification of the mechanism of biosynthesis, transport, and receptor-mediated signaling by growth regulators in plants.
2030	30: Treatment of disease by the systemic administration of nucleic acid drugs, such as siRNAs.
	35: Therapeutic technology using functional cells induced from stem cells, including iPS cells, without risks of carcinogenesis.
	51: More than half of the chemical polymers made from petroleum become renewable biomass resource-based products.
2031	06: New medical and industrial technology based on the control of the interaction between cells and materials at the meso-scale (a size lying between the "nano space (1-5 nm)" and "bulk space (100 nm or more)").
	15: A micro machine based on Micro Electro Mechanical Systems technology for diagnosis and treatment that freely moves within an organism (hollow viscus), and carries out the relevant operation.
	24: Technology that prevents progression of Alzheimer's Disease and other degenerative diseases, by clarifying the causes thereof at the molecular level.
2032	07: Technology that analyzes the conformation of protein, which is in a functional state in the body, in a dynamic and detailed manner.
	16: Technology that indicates human thought by detecting the neuronal activity and converting it to signals, or processing or transmitting it by computer.

year	Topic (Leading number represents ID.)
2032	20: A treatment method based on the clarification of the carcinogenic mechanism by epigenetic gene expression regulation.
	34: Technology for regenerative medicine using iPS cells.
	55: Development of a nanoscale voltage separating device for an enzyme reaction fuel cell using bio organic substances, and expanding the scale of such fuel cells through integrating them.
2033	08: Technology that comprehensively analyzes the gene transcription cascade and signal transduction cascade during the process of differentiation from a fertilized egg to an adult of some kind of higher organism, as typified by mice.
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Basic bio-nanotechnology (principles, mechanisms)	1	Comprehensive risk management system based on simulations for predictions of virus mutations.	1	174	3	29	68	-	79	2	10	9							5	8	48	60	11	30	23							6	9	21	52	12	32	22	27
			2	163	3	26	71	-	89	1	6	4							4	5	41	68	7	26	21							4	6	18	69	8	29	18	25
			E	5	100	0	0	-	100	0	0	0							0	0	40	80	0	40	20							0	0	60	100	0	40	0	40
	2	Technology for molecular imaging in the body with the precision of a single molecule.	1	243	10	42	48	-	80	8	2	10							2	6	76	43	24	20	3							2	7	47	34	44	8	25	3
			2	214	9	38	53	-	88	5	0	7							1	3	77	44	15	20	1							1	6	51	34	44	6	24	3
			E	20	100	0	0	-	95	0	0	5							0	10	89	22	17	17	0							0	10	67	44	61	0	6	0
	3	Technology for identification and functional analysis of the material interaction within a cell or between the inside and outside of the cell.	1	268	27	49	24	-	85	5	2	8							0	4	80	43	22	21	3							1	7	57	39	40	7	24	4
			2	231	29	42	29	-	90	5	0	5							0	3	81	44	20	18	2							0	4	62	38	42	5	23	3
			E	66	100	0	0	-	93	5	0	2							0	2	91	39	19	17	0							0	3	63	30	47	2	25	0
	4	Technology that automatically analyzes the configuration of sugar chains composed of 20 or more sugar units, as well as the branching and linkage thereof.	1	197	8	32	60	-	67	15	1	17							2	11	65	46	35	23	1							2	12	40	39	46	5	27	2
			2	175	6	29	65	-	70	12	0	18							1	9	67	47	31	21	1							1	10	39	37	53	3	24	3
			E	10	100	0	0	-	80	0	0	20							0	10	78	44	33	33	0							0	10	56	22	33	0	44	0
	5	Clarification of the whole gene network that controls the growth (morphogenesis, reproduction, differentiation) of plants.	1	175	19	25	56	-	74	10	5	11							1	8	71	56	13	22	5												
			2	155	19	26	55	-	83	5	5	7							1	5	73	56	10	17	4												
			E	30	100	0	0	-	90	3	7	0							0	0	83	63	10	23	3												
Applied bio-nanotechnology	6	New medical and industrial technology based on the control of the interaction between cells and materials at the meso-scale (a size lying between the "nano space (1-5 nm)" and "bulk space (100 nm or more)").	1	170	15	32	53	-	71	12	3	14							2	11	67	41	34	28	1							2	11	47	37	43	8	27	5
			2	149	9	33	58	-	77	8	1	14							1	8	70	41	31	25	1							1	8	51	39	44	5	24	4
			E	14	100	0	0	-	93	7	0	0							0	0	79	29	21	36	0							0	0	69	38	69	0	23	8
	7	Technology that analyzes the conformation of protein, which is in a functional state in the body, in a dynamic and detailed manner.	1	238	10	36	54	-	80	9	4	7							3	6	76	51	25	25	5							3	9	54	46	38	7	23	5
			2	210	10	34	56	-	88	4	2	6							2	4	76	49	23	20	5							2	5	59	49	36	4	22	6
			E	20	100	0	0	-	77	11	6	6							0	0	79	42	32	26	5							0	6	59	41	35	6	12	0
	8	Technology that comprehensively analyzes the gene transcription cascade and signal transduction cascade during the process of differentiation from a fertilized egg to an adult of some kind of higher organism, as typified by mice.	1	213	19	37	44	-	84	5	3	8							1	5	79	52	16	27	10							2	9	64	48	24	6	29	8
			2	195	17	32	51	-	89	4	1	6							1	1	79	53	9	22	6							1	4	67	49	18	4	29	6
			E	33	100	0	0	-	91	3	3	3							0	0	81	66	19	19	9							3	0	61	55	29	0	26	13

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Applied bio-nanotechnology	9	Technology that predicts in a detailed manner biological activity, including the interaction between proteins, interaction between protein and DNA or RNA, and interaction between protein and synthetic compounds, from the higher order structure of protein.	1	264	20	34	46	-	88	5	2	5							1	3	76	53	28	25	4						1	7	55	42	45	5	28	5
			2	236	18	36	46	-	93	4	0	3							1	1	79	56	23	20	2						1	3	60	46	44	4	26	3
			E	42	100	0	0	-	91	2	0	7							2	2	76	59	22	22	2						2	2	51	37	54	7	27	2
	10	Technology that designs highly active artificial antibodies based on the study of the antigen recognition mechanism of antibodies.	1	223	23	37	40	-	83	5	3	9							2	3	67	46	45	23	3						2	5	41	31	63	4	27	5
			2	202	19	34	47	-	88	4	1	7							1	2	70	46	48	22	2						0	5	45	32	66	4	22	3
			E	39	100	0	0	-	87	5	0	8							0	3	71	45	50	18	5						0	3	47	26	68	8	21	5
	11	In silico drug development technology that enables simulation of the kinetics and effects of drugs in the body.	1	198	16	35	49	-	78	12	2	8							3	4	60	38	59	22	2						4	6	37	30	70	6	23	5
			2	182	14	30	56	-	79	11	1	9							3	3	59	34	58	22	2						3	3	39	28	73	5	19	3
			E	26	100	0	0	-	92	4	0	4							8	0	77	38	35	31	4						8	0	58	38	58	15	35	8
	12	Nano chamber arrays that enable the detection of many biological reactions in an instant, such as enzymatic reactions, antigen-antibody reactions, ligand discovery, and reaction conditions, by integrating thousands or several tens of thousands of reaction vessels on a semiconductor chip and utilizing it as various reaction libraries.	1	211	14	24	62	-	73	14	4	9							2	5	53	41	52	26	2						2	6	33	33	65	4	28	4
			2	191	11	23	66	-	79	10	2	9							1	3	53	39	57	24	2						2	4	35	32	68	3	24	3
			E	21	100	0	0	-	86	0	0	14							0	5	60	30	25	20	10						0	5	45	25	45	15	25	10
Medical bio-nanotechnology	13	Technology capable of freely making specific cells within an organism survive or leave, based on the study of the molecule mechanisms of apoptosis (applying such technology to therapeutical drugs for disease arising from cancer and failure in homeostasis maintenance).	1	220	17	35	48	-	85	5	2	8							6	8	81	45	27	24	4						6	8	56	39	47	7	27	8
			2	198	14	34	52	-	90	5	1	4							4	4	81	45	21	20	4						5	4	62	38	48	5	26	5
			E	28	100	0	0	-	86	7	0	7							4	4	78	44	33	19	11						14	4	65	31	50	8	31	15
	14	A nano carrier system that carries drugs and genes to a specific intracellular site of a target cell by using external energy control, meso control, or Micro Electro Mechanical Systems (MEMS) technology.	1	154	11	27	62	-	76	10	4	10							3	14	67	42	40	28	1						4	14	45	32	58	7	32	4
			2	138	9	22	69	-	80	7	1	12							3	7	71	45	42	24	2						5	7	51	32	66	6	27	2
			E	12	100	0	0	-	92	8	0	0							8	0	75	42	33	33	0						0	0	50	33	58	0	25	0
	15	A micro machine based on Micro Electro Mechanical Systems technology for diagnosis and treatment that freely moves within an organism (hollow viscus), and carries out the relevant operation.	1	142	9	20	71	-	78	12	3	7							4	6	60	37	45	31	0						4	6	37	29	63	10	27	4
			2	131	8	16	76	-	78	12	2	8							3	3	63	37	46	31	1						5	3	39	28	64	7	28	4
			E	10	100	0	0	-	90	10	0	0							0	0	50	10	30	60	0						10	0	40	0	50	0	30	0
	16	Technology that indicates human thought by detecting the neuronal activity and converting it to signals, or processing or transmitting it by computer.	1	146	10	19	71	-	72	8	3	17							7	10	70	52	23	26	1						11	11	49	44	42	8	28	4
			2	131	6	14	80	-	78	5	3	14							6	9	71	53	22	24	2						9	8	54	46	40	8	30	3
			E	8	100	0	0	-	75	0	0	25							13	0	43	43	0	57	0						13	0	50	38	25	0	50	0

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Preventive healthcare and diagnosis	17	Technology capable of predicting the onset of mental disorders such as sporadic depression and schizophrenia.	1	125	9	29	62	-	79	10	2	9							2	9	75	51	19	29	5							2	10	53	44	35	14	28	7
			2	115	6	26	68	-	85	7	3	5							0	5	77	51	15	28	4							3	5	60	40	32	9	32	5
			E	7	100	0	0	-	100	0	0	0							0	0	71	43	14	43	14							0	0	57	29	14	0	43	14
	18	A system that makes a precise diagnosis of the risk of developing cancers and intractable diseases by using biochips, and provides information for medical treatment guidelines in an extremely short time.	1	210	15	35	50	-	87	8	2	3							0	5	60	49	45	33	2							0	6	40	38	60	12	34	3
			2	187	11	33	56	-	94	4	0	2							0	1	66	49	46	29	2							0	2	42	35	64	9	35	4
			E	21	100	0	0	-	90	10	0	0							0	5	55	35	30	45	0							0	5	42	32	53	21	42	11
	19	Technology capable of predicting the onset of cranial nerve disease (such as dementia and Parkinson's Disease).	1	171	12	31	57	-	87	8	2	3							0	5	69	51	29	34	4							1	5	52	40	48	12	33	6
			2	154	8	25	67	-	90	7	1	2							0	1	73	53	25	27	2							1	1	59	41	44	9	34	5
			E	12	100	0	0	-	100	0	0	0							0	0	58	42	17	42	8							0	0	58	42	33	0	42	8
Healing (exegenous factor, metabolic disease, and psychiatric disease)	20	A treatment method based on the clarification of the carcinogenic mechanism by epigenetic gene expression regulation.	1	194	22	30	48	-	84	6	3	7							2	8	76	47	23	25	4							3	9	56	40	42	6	27	5
			2	178	20	27	53	-	88	5	1	6							2	3	81	46	18	23	2							2	3	64	39	42	5	29	5
			E	36	100	0	0	-	91	6	0	3							3	3	71	51	29	23	6							3	3	69	40	37	11	31	9
	21	Clarification of the pathogenic mechanism by utilizing a virtual patient with a human body (the structure, physiology, and pathological condition) reproduced on a computer.	1	128	4	23	73	-	62	9	1	28							13	14	63	42	28	26	8													
			2	120	3	20	77	-	65	9	1	25							10	8	70	43	24	22	4													
			E	3	100	0	0	-	100	0	0	0							0	0	33	0	0	67	0													
	22	Clarification of the mechanism of the formation of neural networks, including the relationship between memory and synaptic plasticity, at the molecular level.	1	143	16	27	57	-	84	4	4	8							3	10	84	52	10	21	4													
			2	134	12	22	66	-	89	3	1	7							2	5	86	50	8	19	2													
			E	16	100	0	0	-	87	0	0	13							6	6	81	69	0	19	0													
	23	Clarification of the regulatory mechanism for emotional behaviors such as anger and attacking.	1	116	14	24	62	-	69	8	5	18							7	9	84	54	9	19	4													
			2	111	6	20	74	-	71	5	4	20							7	7	86	48	4	18	2													
			E	7	100	0	0	-	86	0	0	14							0	14	86	57	0	29	0													
	24	Technology that prevents progression of Alzheimer's Disease and other degenerative diseases, by clarifying the causes thereof at the molecular level.	1	190	13	33	54	-	88	8	2	2							1	5	75	54	38	28	5							2	5	51	38	54	10	31	7
			2	172	9	30	61	-	93	5	0	2							0	2	80	53	36	23	3							1	2	53	37	63	8	30	5
			E	16	100	0	0	-	100	0	0	0							0	0	75	56	31	31	6							0	0	50	31	44	19	25	6

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					(%)				(%)				(%)								(%)					(%)							(%)						
Healing (exegenous factor, metabolic disease, and psychiatric disease)	25	A treatment method based on the clarification of the causes for schizophrenia and bipolar disorder at the molecule level.	1	137	12	28	60	-	87	10	1	2							1	8	75	51	31	25	5						0	9	52	37	48	10	36	6
			2	127	7	27	66	-	92	6	2	0							1	3	79	50	27	23	3						0	4	61	37	53	8	36	6
			E	9	100	0	0	-	100	0	0	0							0	0	56	44	33	56	0						0	0	22	33	44	0	56	0
	26	A treatment method based on the clarification of the causes of developmental disorders (such as pervasive developmental disorders, learning disabilities, and Attention Deficit Hyperactivity Disorder (ADHD)) at the molecular level.	1	120	13	25	62	-	77	11	3	9							3	9	76	51	24	27	5						4	10	54	42	38	12	32	7
			2	116	7	22	71	-	82	11	0	7							5	4	79	54	19	21	4						5	6	66	48	37	11	35	6
			E	8	100	0	0	-	75	25	0	0							0	13	63	50	13	50	0						0	13	38	50	38	13	50	0
	27	Elucidation of the pathophysiology of cancer metastasis.	1	204	22	32	46	-	91	3	2	4							1	5	83	55	26	25	6													
			2	193	19	31	50	-	95	2	0	3							0	3	85	55	22	20	3													
			E	36	100	0	0	-	88	6	0	6							0	3	85	50	24	21	3													
	28	A treatment method that enables autoimmune diseases be cured.	1	178	23	30	47	-	89	6	2	3							1	7	77	45	35	30	6						2	8	53	42	52	8	34	9
			2	161	20	28	52	-	95	3	1	1							1	3	77	43	30	28	1						1	3	56	39	56	6	36	5
			E	33	100	0	0	-	97	3	0	0							0	6	71	35	39	42	0						0	9	63	37	57	10	43	7
	29	A treatment method that promotes recovery from brain dysfunction, by transplanting stem cells.	1	169	16	34	50	-	86	6	4	4							2	10	78	55	24	28	4						4	12	63	43	37	12	35	8
			2	161	12	35	53	-	90	4	3	3							3	6	80	51	19	27	3						3	6	66	44	34	9	37	5
			E	19	100	0	0	-	95	0	0	5							5	5	89	44	22	39	6						5	11	78	44	33	11	33	6
	30	Treatment of disease by the systemic administration of nucleic acid drugs, such as siRNAs.	1	193	17	33	50	-	78	4	2	16							8	6	68	44	46	26	5						10	6	49	33	52	7	29	4
			2	175	17	29	54	-	82	4	0	14							6	2	70	44	45	25	3						8	3	51	33	58	5	27	5
			E	30	100	0	0	-	87	3	0	10							7	3	61	46	54	50	7						10	3	52	28	69	7	34	7
	31	Technology capable of repairing, within the body, the abnormal genes that cause genetic diseases and other diseases.	1	177	14	33	53	-	85	2	2	11							10	9	79	51	21	25	5						11	12	61	39	32	10	25	8
			2	166	13	28	59	-	87	2	1	10							9	5	82	48	19	21	3						11	6	67	40	31	8	29	5
			E	21	100	0	0	-	90	0	0	10							10	10	80	30	20	25	5						19	10	60	25	35	5	25	5
Regenerative medicine	32	Technology for constructing artificial cells and tissues with all sorts of channels and receptors, that substitutes functions such as cell membrane transport, material exchange, and energy conversion and reduces animal testing.	1	188	16	34	50	-	69	10	2	19							8	8	75	45	31	26	6						10	11	60	45	41	7	28	7
			2	168	15	33	52	-	76	7	0	17							6	4	78	45	28	23	2						6	6	65	44	37	7	30	3
			E	25	100	0	0	-	88	4	0	8							8	4	67	33	33	33	4						8	4	58	33	38	13	33	4

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Regenerative medicine	33	Artificial organs (such as artificial pancreases, artificial kidneys, and artificial livers) which include human cells or tissues derived from iPS cells.	1	202	15	35	50	-	81	12	2	5							4	6	79	56	34	29	4							5	8	56	49	42	16	38	6
			2	185	14	31	55	-	86	9	1	4							3	4	81	55	31	27	3							3	6	61	50	45	12	41	3
			E	25	100	0	0	-	76	16	0	8							8	8	88	54	21	33	4							8	8	63	46	33	8	38	4
	34	Technology for regenerative medicine using iPS cells.	1	208	17	30	53	-	81	12	1	6							3	5	80	52	30	28	4							3	6	56	50	41	15	37	7
			2	190	14	28	58	-	84	10	1	5							2	4	79	55	28	28	3							2	5	60	53	43	11	42	5
			E	27	100	0	0	-	78	15	0	7							7	7	85	58	31	38	8							7	7	65	46	46	8	42	8
	35	Therapeutic technology using functional cells induced from stem cells, including iPS cells, without risks of carcinogenesis.	1	195	18	32	50	-	79	14	2	5							3	5	79	53	30	30	3							4	6	57	48	39	16	38	6
			2	176	15	31	54	-	84	10	1	5							2	2	78	52	23	29	2							2	4	60	49	38	12	42	5
			E	27	100	0	0	-	74	19	0	7							7	7	92	64	28	32	4							8	8	68	44	32	12	44	4
	36	Long-term culture and preservation techniques for the transplantation of organs (including autologous tissues).	1	169	15	30	55	-	82	11	2	5							2	7	69	49	35	31	2							1	7	50	50	44	13	34	6
			2	162	12	30	58	-	85	9	3	3							1	3	71	51	32	26	1							0	4	52	47	45	12	39	5
			E	19	100	0	0	-	95	5	0	0							0	0	74	63	37	37	5							0	0	68	74	47	16	37	11
	37	Equipment or system that gives alternative functions for sight or hearing to visually and hearing impaired people in their daily lives.	1	108	8	18	74	-	85	8	1	6							3	10	68	50	40	34	4							2	10	51	48	53	11	31	9
			2	108	6	17	77	-	90	6	0	4							3	7	73	50	37	25	3							2	7	55	45	57	8	32	7
			E	7	100	0	0	-	100	0	0	0							0	0	67	50	17	17	0							0	0	17	33	50	0	33	0
Industrial bio-nanotechnology related to agricultural, forestry and fisheries (including	38	Technology for crop production and green technology in deserts achieved by improving the crop's adaptability (salt tolerance, drought tolerance, cold tolerance) and controlling its growth.	1	155	23	30	47	-	66	3	30	1							2	3	66	62	35	34	11							3	7	42	47	43	22	38	19
			2	149	24	21	55	-	65	4	30	1							2	1	67	67	30	30	10							3	4	48	54	41	19	35	17
			E	36	100	0	0	-	80	3	17	0							0	0	80	63	31	23	11							0	6	55	52	48	15	21	21
	39	Production technology for the useful compounds obtained by the creation of artificial cells consisting of a minimum gene set necessary for the production of compounds.	1	161	19	29	52	-	61	19	1	19							4	9	76	48	33	23	2							3	10	53	44	48	9	27	3
			2	153	20	27	53	-	63	17	1	19							3	7	78	52	35	20	2							3	7	57	48	52	10	25	5
			E	31	100	0	0	-	67	23	0	10							0	6	83	50	60	17	0							0	6	58	42	71	16	26	6
	40	Robotic technology that fully automates farm work.	1	104	6	26	68	-	32	47	4	17							6	7	32	49	65	25	4							5	10	21	33	70	15	30	3
			2	98	5	26	69	-	28	51	4	17							4	6	34	55	64	19	1							3	8	18	36	73	11	27	1
			E	5	100	0	0	-	20	60	0	20							0	20	80	40	40	40	0							0	20	60	20	60	20	40	0

Area	Topic number	Topic	Round	Responses	Degree of expertise (%)				Importance (%)				Forecasted time of technological realization (to be realized somewhere in the world) (%)							Sectors that will pave the way to technological realization (%)					Forecasted time of social realization (to become applicable/widely used in Japan) (%)							Sectors that will pave the way to social realization (%)					
					High	Moderate	Low	None	Important for Japan and the rest of the world	Especially important for Japan	especially important for the world	Low importance/priority	Already realized	2011-2015	2016-2020	2021-2030	2031-2040	2041-	will not be realized	don't know	University	Public research organization	Private enterprise	Collaboration of multiple sectors	Others	2011-2015	2016-2020	2021-2030	2031-2040	2041-	will not be realized	don't know	University	Public research organization	Private enterprise	Government	Collaboration of multiple sectors	Others
Industrial bio-nanotechnology related to agricultural, forestry and fisheries (including functional foods)	41	Technology of introducing favorable characteristics for breeding marketable aquacultured species (that have disease tolerance and high growth potential, and are allergen free).	1	103	10	30	60	-	31	47	3	19							1	7	58	69	30	22	1						4	8	40	55	46	15	33	0
			2	107	9	25	66	-	30	50	3	17							0	5	59	76	30	17	0						2	6	40	65	47	10	27	1
			E	10	100	0	0	-	30	50	10	10							0	0	80	90	10	0	0						0	0	70	80	50	20	10	0
	42	Functional foods tailored to individual physical characteristics to prevent lifestyle disease.	1	191	14	28	58	-	45	25	3	27							6	11	50	42	67	22	2						7	13	27	29	74	10	23	2
			2	172	13	26	61	-	49	21	2	28							5	6	48	39	73	20	1						6	8	27	27	78	9	21	1
			E	23	100	0	0	-	61	26	0	13							0	0	64	45	50	27	0						0	0	43	48	61	4	26	0
	43	Disease-preventing foods that reduce the future risks of catching diseases.	1	181	11	31	58	-	54	20	4	22							5	11	49	42	61	27	1						6	12	28	34	67	13	23	2
			2	166	9	28	63	-	56	20	3	21							3	7	49	37	66	23	1						3	8	27	31	75	8	23	1
			E	15	100	0	0	-	87	13	0	0							0	0	79	43	57	36	0						0	0	40	47	60	7	27	0
	44	Production technology for foods and drugs using the physiology of unused microorganisms from the deep sea.	1	169	12	32	56	-	47	28	2	23							2	12	62	56	36	23	4						2	11	43	46	58	7	24	4
			2	158	11	29	60	-	49	30	1	20							1	6	65	60	38	18	2						1	5	41	46	63	3	20	1
			E	18	100	0	0	-	61	22	0	17							6	11	65	59	47	18	0						6	11	41	53	65	0	12	0
	45	Foods and dietary approaches that support a healthy aged society by preventing the decline in antioxidant function, brain function and masticatory function that is typical in elderly persons.	1	154	16	27	57	-	51	38	1	10							3	5	49	47	53	31	1						2	7	32	39	61	18	27	2
			2	142	13	26	61	-	50	42	1	7							1	1	50	44	59	26	1						1	1	32	36	72	8	25	0
			E	18	100	0	0	-	47	47	0	6							0	0	65	35	41	35	0						0	0	56	50	50	11	33	0
	46	Precision taste analysis robots that are capable of detecting and analyzing the constituents and physical properties of agricultural, marine and livestock products before they are placed on the market.	1	106	11	26	63	-	29	41	3	27							0	8	38	49	52	20	2						0	10	19	45	60	10	20	5
			2	101	14	21	65	-	29	46	3	22							0	5	33	54	57	18	0						0	6	14	47	67	11	18	2
			E	14	100	0	0	-	36	36	7	21							0	0	43	50	50	14	0						0	0	29	57	50	21	21	7
	47	Sensor network technology under which foods are monitored continuously from the production site to the dining table, using DNA chips or various sensors such as spectrum sensors, and are prevented from the contamination of harmful substances or bacteria.	1	133	9	24	67	-	33	35	2	30							3	11	37	56	55	21	5						4	11	18	40	59	20	26	6
			2	126	8	24	68	-	34	35	2	29							2	6	31	59	66	16	3						3	7	16	41	71	15	23	2
			E	10	100	0	0	-	30	40	0	30							10	10	33	78	78	22	11						10	10	22	78	67	44	33	11
	48	Production of livestock clones from somatic cells based on the elucidation of epigenetic and other nuclear genetic information reprogramming mechanisms.	1	121	14	22	64	-	56	15	3	26							2	9	58	67	25	18	4						3	11	36	59	34	11	23	7
			2	121	11	23	66	-	55	13	4	28							2	4	57	73	21	11	1						3	7	37	73	31	9	14	1
			E	13	100	0	0	-	50	8	17	25							0	17	67	78	22	11	0						9	18	40	80	10	20	10	0

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Industrial bio-nanotechnology related to agricultural, forestry and fisheries (including functional foods)	49	Growth regulation of crops and trees based on the clarification of the mechanism of biosynthesis, transport, and receptor-mediated signaling by growth regulators in plants.	1	127	28	21	51	-	71	7	6	16							2	5	74	60	27	24	4						1	7	50	55	37	13	27	6
			2	127	26	20	54	-	76	5	4	15							1	3	79	66	23	18	3						1	5	53	62	35	10	25	3
			E	33	100	0	0	-	94	3	0	3							0	0	84	69	25	19	6						0	3	53	70	47	10	20	10
	50	Genetically engineered plants in which artificially introduced genes do not spread over the environment thanks to the utilization of stage- and site- specific expressions of the gene.	1	136	23	32	45	-	64	12	8	16							6	6	68	67	35	19	7						5	9	44	58	39	23	21	10
			2	133	21	28	51	-	72	8	8	12							5	2	73	68	36	15	6						4	8	48	62	38	19	17	7
			E	28	100	0	0	-	86	7	0	7							0	0	79	82	36	7	7						0	4	54	68	39	21	11	11
Industrial bio-nanotechnology related to energy and environment	51	More than half of the chemical polymers made from petroleum become renewable biomass resource-based products.	1	134	19	24	57	-	71	17	5	7							3	8	62	57	53	30	6						3	9	42	48	61	25	27	9
			2	126	18	21	61	-	79	14	2	5							3	2	64	61	54	27	3						3	3	42	50	64	18	24	8
			E	23	100	0	0	-	83	17	0	0							0	0	65	57	57	39	0						4	4	48	52	65	35	30	9
	52	A biocatalyst showing productivity equivalent to or greater than that of a chemical catalyst useable in industrial production.	1	128	21	21	58	-	63	22	5	10							4	11	72	52	43	25	3						4	13	47	43	62	12	22	3
			2	120	18	19	63	-	73	15	3	9							3	6	71	52	45	23	3						3	9	51	48	60	10	23	4
			E	21	100	0	0	-	76	24	0	0							0	0	90	57	62	24	5						0	0	62	67	76	19	24	5
	53	Technology capable of controlling the spread of microorganisms that are capable of breaking down hazardous substances scattered throughout the natural environment.	1	111	11	24	65	-	68	4	7	21							9	10	62	60	23	23	9						7	13	41	52	39	23	24	13
			2	105	14	20	66	-	71	2	7	20							6	7	61	69	19	19	6						8	6	34	67	33	19	31	9
			E	15	100	0	0	-	93	0	0	7							7	0	79	79	36	29	7						7	0	43	79	50	21	29	0
	54	Highly efficient energy conversion technology that utilizes motor proteins (molecular motors) that convert chemical energy to mechanical energy.	1	110	15	20	65	-	50	19	3	28							10	15	77	47	22	14	1						10	19	53	40	41	7	21	2
			2	103	13	16	71	-	52	19	0	29							7	10	78	44	23	14	1						8	15	66	40	40	7	19	3
			E	13	100	0	0	-	47	15	0	38							8	8	85	38	15	15	0						8	8	69	38	23	15	8	0
	55	Development of a nanoscale voltage separating device for an enzyme reaction fuel cell using bio organic substances, and expanding the scale of such fuel cells through integrating them.	1	77	10	25	65	-	47	24	3	26							6	14	73	51	33	17	3						7	19	45	38	49	16	12	3
			2	78	9	17	74	-	49	19	3	29							4	10	76	53	36	16	1						6	13	55	39	54	13	17	3
			E	7	100	0	0	-	72	14	0	14							0	0	86	57	43	29	0						0	0	43	57	71	57	14	0
	56	Achievement of low-cost agriculture/forestry and rural communities oriented towards zero emission by using local agricultural and forestry resources and organic wastes.	1	113	9	31	60	-	45	44	3	8							4	6	36	63	24	41	7						4	8	19	48	24	43	36	7
			2	115	8	30	62	-	48	44	3	5							3	3	39	72	25	39	4						5	5	21	62	27	43	34	3
			E	9	100	0	0	-	56	44	0	0							0	0	56	67	33	56	0						0	0	38	75	50	38	25	0

Area	Topic number	Topic	Round	Responses	Degree of expertise				Importance				Forecasted time of technological realization (to be realized somewhere in the world)							Sectors that will pave the way to technological realization					Forecasted time of social realization (to become applicable/widely used in Japan)							Sectors that will pave the way to social realization						
					High	Moderate	Low	None	Low importance/priority	especially important for the world	Especially important for Japan	Important for Japan and the rest of the world	don't know	will not be realized	2041-	2031-2040	2021-2030	2016-2020	2011-2015	Already realized	Others	Collaboration of multiple sectors	Private enterprise	Public research organization	University	don't know	will not be realized	2041-	2031-2040	2021-2030	2016-2020	2011-2015	Others	Collaboration of multiple sectors	Government	Private enterprise	Public research organization	University
					(%)				(%)				(%)								(%)					(%)							(%)					
Industrial bio-nanotechnology related to energy and	57	Biological crop protection methods (phage, plant activators, natural enemies, pheromones, allelopathy, etc.) that reduce the use of synthetic chemical pesticides and fertilizers by 50%.	1	126	17	24	59	-	65	23	4	8	2	6							8	29	36	70	58	2	9						5	34	24	49	61	39
			2	129	16	21	63	-	74	16	2	8	2	2							3	25	35	73	60	2	5						3	32	20	50	69	36
			E	21	100	0	0	-	100	0	0	0	0	0							0	29	62	81	76	0	10						5	29	24	71	62	48
	58	Sensor networks that monitor environmental and biological data in fields, barns, ponds and so on, on a real-time basis for the early detection of growth retardation and the occurrence of disease and insect damage, and of abnormalities in livestock caused by infectious diseases such as avian influenza.	1	112	11	28	61	-	73	11	4	12	5	5							15	29	24	66	54	4	8						16	28	30	31	57	32
			2	113	10	24	66	-	75	8	2	15	5	3							10	24	23	74	49	4	6						13	27	25	32	66	29
			E	11	100	0	0	-	91	9	0	0	0	0							0	18	18	82	55	0	9						0	27	18	36	64	27

Panel 4:

Medical technology to contribute to healthy lifestyles of the nation's people using IT, etc.

Implementation of the questionnaires

	Sent	Returned (response rate)
<1st Round>	243	191 (79%)
<2nd Round>	191	164 (86%)

Sex	Male	143	Affiliation	Private enterprise	14
	Female	21		University	118
	N.A.	0		Research Institute	18
generation	20's	0		Association	4
	30's	12		Others	10
	40's	23		N.A.	0
	50's	86	Job category	R&D	109
	60's	36		Others	54
	70's and over	7		N.A.	1
	N.A.	0		Total	164

Survey items

A: Medical treatment aiming at safety and security

B: Creation of new medical technology

C: Development of predictive and preventive medicine

D: New regulatory science for medical treatments

E: Expansion of medical treatment to the social system

Time-series tables of topics

<Technological realization>

year	Topic (Leading number represents ID.)
2014	84: Medical safety education for healthcare professionals in which simulation technology is introduced.
2015	68: Management technique for genetic-related personal information.
2016	43: Medical equipment for functional assessment, functional recovery training and functional assistance for elderly persons and persons requiring long-term care.
	67: An intellectual foundation that assists the comprehensive management and advancement of clinical trials.
	75: An information system and practice databases that assist the bridging from basic medical science to clinical treatments.
	85: Industrialization of a consistent medical waste treatment system including recycling.
2017	13: Methods to prevent and treat human infection with highly pathogenic avian influenza.
	14: Reproductive technology in clinical practice (infertility steps).
	23: Effective radiological therapy and assessment methods for cancer treatment.
	36: Hemocatharsis devices that selectively remove target substances from blood.
	50: Medical treatment guidance based on biomarkers accurately reflecting the risks of lifestyle diseases.
	51: Diagnostic methods for the risks of acquiring diseases through genome data.
	60: Technology for predicting the epidemic of emerging infectious diseases at an early stage.
	78: Technology for the systemization of regional medical care based on the seamless cooperation between medical treatment and nursing care.
	79: Ubiquitous biological information monitoring technology for the management of health conditions within daily life.
	80: Integrative medicine in which a lifelong regional electronic health record is introduced and community-based care is possible.
2018	01: Stroke rehabilitation based on the prediction of functional prognosis.
	06: Assay of drug resistance of cancers
	11: Visualization technology for in vivo functions such as signal transmission and metabolism.
	32: Methods for autogenous tissue storage, growth, and transplantation
	34: Drug Delivery System (DDS) by combined devices using magnetic induction and others.
	44: Risk management techniques for humans and robots in applying nursing-care robots.
	46: Predictive medical science based on omics information and past health checkup data (health and disease management based on early diagnosis and long-term prediction of diseases).
	59: Design techniques for medical communities and medical cities (such as the residential area for elderly persons)
	63: Prediction of the risk of infectious disease outbreaks, enabled by the progress in modeling and simulation technology for large-scale systems such as the ecosystem and environment.

year	Topic (Leading number represents ID.)
2018	64: An automatic device to identify pathogens and evaluate their drug susceptibility within an hour.
	73: A clinical trial for evaluation of drug efficiency based on model simulations (*in silico* clinical trials).
2019	07: Immunological therapy with high specificity and long-term effects against the target infections.
	16: Technology to detect a cancerous tissue of the diameter smaller than 1 mm appearing anywhere in the body
	18: Technology for identification of the interactions between various drug-related substances inside and outside a cell.
	19: An early detection method for unanticipated rejection of organ and tissue transplants.
	20: Drugs to cure viral liver disease.
	27: Technology to quantify psychological stress.
	29: Communication techniques that enable young people who cannot communicate normally to develop social skills.
	33: Communication assistive technology using brain activities for persons with deficient communication skills due to disease and other reasons.
	35: A medical device that can be embedded in the human body, monitor health conditions and provide medical treatment by using bioenergy sources such as body temperature or blood flow.
	42: An intelligent communication style living environment system including life support robots for elderly persons and disabled persons.
	47: Technology for predicting the risk of potentially-severe chronic diseases by using omics information.
	61: Elucidation of biological effects of micro-pollutants in the environment.
	76: Elucidation of the pathophysiology of cancer metastasis.
2020	04: Development of pharmacotherapy based on the systematic comprehension of the conditions of chronic diseases (systems for drug discovery)
	08: Technology capable of controlling specific immunological responses following transplantation of hematopoietic stem cells (allografts).
	45: Artificial limbs with sensation.
	49: A treatment method for blood disease by controlling the proliferation and differentiation of hematopoietic stem cells.
	57: Gene therapy for single gene disorders.
	62: Methods to overcome drug resistance in infections.
	65: Systems to almost perfectly detect infected people and carriers of imported pathogens at airports and seaports.
2021	02: Preventive rehabilitation to slow the progression of intractable diseases such as progressive neuromuscular disease.
	48: Gene therapy with confirmed safety.
2022	10: Technology for the regeneration of muscles and organs using stem cells.
	21: Anti-cancer agents and immunosuppressive drugs that drastically reduce iatrogenic opportunistic infections and do not interfere with phylaxis.

year	Topic (Leading number represents ID.)
2022	28: Copying process based on the clarification of the brain mechanism that causes school attendance refusal, classroom disruption and learning disabilities.
	37: Artificial blood with no need for blood donation.
	41: Technology for treatment in body cavities using micro machines
2023	09: Assessment and treatment methods for the recovery from motor paralysis through transplantation of nerve stem cells.
	17: Technology for molecular imaging in the body with the precision of single molecule
	26: Early diagnosis and treatment methods for neuropsychiatric disorder.
	30: A substitution and repair technique for organ functions using a 3D tissue construction technique.
	31: Technology to establish a treatment method based on the treatment simulation which reproduces pathological conditions.
	77: Development of drugs that can prevent cancer metastasis.
2024	12: A treatment that completely cures HIV infection.
	15: Systematic prevention and treatment methods for dementia that inhibits the decline in elderly people's brain functions.
	52: Effective chemopreventive drugs for cancer.
	54: Treatment methods that completely cure atopic dermatitis and other allergic disease.
2025	03: A nano-machine that inactivates viruses at a molecular level.
	53: Methods to prevent the onset of autoimmune diseases.
2026	05: Understanding the mechanisms for human diseases by establishing evolutionary medicine.
	40: Completely implanted artificial endocrine organs.
2027	22: A treatment for prion diseases.
	38: Completely implanted artificial kidneys.
	39: Completely implanted artificial hearts and lungs.
	56: Gene therapy for congenital disorders.
2028	24: Elucidation of individual aging mechanisms.
2029	25: Ttreatment methods for psychological development disorders.
	55: Methods to prevent the onset of severe genetic disorders.
	58: Prevention and treatment of neurodegenerative diseases.

<Social realization>

year	Topic (Leading number represents ID.)
2017	83: Medical ethics education for healthcare professionals.
2018	69: Establishment of ethical guidelines for the clinical application of regenerative medicine
	70: A medical fee system that guarantees the consideration for safe and secure medical treatment.
	81: Family medicine education for preventing and dealing with lifestyle diseases and aging issues.

year	Topic (Leading number represents ID.)
2018	84: Medical safety education for healthcare professionals in which simulation technology is introduced.
2019	71: An original Japan Medical Standard system.
	72: A medical community that allows optimal management of the quality and resources of medical treatment.
	74: Implementation of a multiphase national debate in which many citizens participate, for the harmonization of bioethics and research activities.
2020	82: Health education for the public about personalized medicine using genome data.
	85: Industrialization of a consistent medical waste treatment system including recycling.
2021	66: Regional medical care system that can take prompt actions and correct regional disparities in regard to emergency medical service.
	75: An information system and practice databases that assist the bridging from basic medical science to clinical treatments.
2022	50: Medical treatment guidance based on biomarkers accurately reflecting the risks of lifestyle diseases.
2022	68: Management technique for genetic-related personal information.
	78: Technology for the systemization of regional medical care based on the seamless cooperation between medical treatment and nursing care.
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	55: Methods to prevent the onset of severe genetic disorders.
	58: Prevention and treatment of neurodegenerative diseases.

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Medical treatment aiming at safety and security	1	Stroke rehabilitation based on the prediction of functional prognosis.	1	120	25	27	48	-	58	37	1	4							1	6	57	40	18	47	2						1	8	36	27	27	26	42	2
			2	111	23	24	53	-	66	30	0	4							1	2	58	45	13	48	0						1	3	39	30	28	17	55	0
			E	26	100	0	0	-	88	12	0	0							0	0	58	38	19	65	0						0	0	46	38	19	15	58	0
	2	Preventive rehabilitation to slow the progression of intractable diseases such as progressive neuromuscular disease.	1	103	20	31	49	-	81	10	1	8							2	9	64	55	15	39	6						4	12	42	37	23	27	39	5
			2	96	20	28	52	-	84	8	0	8							1	6	70	51	14	38	3						2	5	51	38	19	17	49	2
			E	19	100	0	0	-	90	5	0	5							0	0	58	47	16	53	5						0	0	47	37	5	21	53	5
	3	A nano-machine that inactivates viruses at a molecular level.	1	90	7	31	62	-	89	2	1	8							6	12	73	51	28	22	11						6	16	42	35	41	17	32	10
			2	84	6	27	67	-	94	0	1	5							4	7	75	41	27	22	7						4	7	56	38	43	12	34	4
			E	5	100	0	0	-	80	0	0	20							20	0	80	20	20	0	0						20	0	20	20	40	20	40	0
	4	Development of pharmacotherapy based on the systematic comprehension of the conditions of chronic diseases (systems for drug discovery).	1	97	11	34	55	-	90	6	1	3							1	11	64	46	45	30	6						2	12	39	34	59	13	33	3
			2	92	11	32	57	-	94	2	1	3							1	9	71	43	40	29	4						2	9	47	34	59	4	33	1
			E	10	100	0	0	-	100	0	0	0							0	0	60	20	30	50	0						0	0	20	20	60	0	20	0
	5	Understanding the mechanisms for human diseases by establishing evolutionary medicine.	1	85	7	32	61	-	81	0	4	15							0	22	79	52	6	15	12												
			2	83	7	24	69	-	74	3	3	20							1	17	85	44	4	16	10												
			E	6	100	0	0	-	100	0	0	0							0	0	83	17	0	17	0												
	6	Assay of drug resistance of cancers.	1	95	14	34	52	-	90	1	5	4							1	5	63	54	39	26	9						1	8	45	42	49	14	24	9
			2	89	11	35	54	-	97	1	1	1							1	2	73	53	41	22	3						1	3	52	45	56	9	24	6
			E	10	100	0	0	-	90	0	0	10							10	0	70	40	50	20	0						10	0	40	60	60	0	10	0
	7	Immunological therapy with high specificity and long-term effects against the target infections.	1	92	12	34	54	-	89	1	8	2							0	7	68	57	37	22	12						1	8	47	42	43	16	24	10
			2	85	9	39	52	-	95	0	4	1							0	4	73	56	42	21	7						1	6	57	42	57	8	19	7
			E	8	100	0	0	-	100	0	0	0							0	0	38	38	38	25	0						0	0	25	38	50	0	38	0
	8	Technology capable of controlling specific immunological responses following transplantation of hematopoietic stem cells (allografts).	1	81	9	30	61	-	90	3	1	6							1	8	85	53	23	16	9						3	8	67	41	34	8	27	6
			2	77	8	34	58	-	95	1	0	4							0	3	88	49	24	14	5						1	3	76	41	37	5	20	4
			E	6	100	0	0	-	80	0	0	20							0	0	100	83	17	0	0						0	0	83	83	33	0	17	0

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Medical treatment aiming at safety and security	9	Assessment and treatment methods for the recovery from motor paralysis through transplantation of nerve stem cells.	1	114	11	30	59	-	92	6	1	1							3	6	79	55	15	26	7						3	6	67	47	26	18	25	5
			2	109	11	29	60	-	96	4	0	0							2	3	81	51	11	20	5						2	3	71	45	21	12	27	4
			E	12	100	0	0	-	100	0	0	0							0	0	92	50	8	17	17						0	0	91	64	9	18	27	18
	10	Technology for the regeneration of muscles and organs using stem cells.	1	117	9	38	53	-	94	3	2	1							1	8	75	46	18	25	9						2	8	63	44	29	12	31	8
			2	105	7	37	56	-	96	2	1	1							1	3	83	46	15	20	4						2	3	72	46	23	5	28	4
			E	7	100	0	0	-	100	0	0	0							0	0	57	29	43	29	14						0	0	33	33	33	0	33	17
	11	Visualization technology for in vivo functions such as signal transmission and metabolism.	1	118	15	33	52	-	86	3	2	9							1	5	80	50	27	22	3						1	8	66	46	37	7	25	4
			2	112	15	31	54	-	89	1	1	9							1	4	86	47	19	16	2						1	5	72	43	31	5	23	3
			E	17	100	0	0	-	88	0	0	12							0	0	75	50	25	19	0						0	0	54	31	8	8	38	0
	12	A treatment that completely cures HIV infection.	1	81	11	28	61	-	73	0	23	4							1	9	58	56	43	31	21						1	9	44	41	50	23	36	24
			2	78	9	23	68	-	77	1	18	4							1	4	66	58	39	32	16						1	5	43	43	57	17	32	17
			E	7	100	0	0	-	72	14	14	0							0	0	71	14	29	29	0						0	0	33	17	50	0	33	0
	13	Methods to prevent and treat human infection with highly pathogenic avian influenza.	1	85	12	31	57	-	93	0	5	2							1	7	54	68	33	33	27						1	8	43	49	39	31	34	28
			2	84	7	30	63	-	94	0	4	2							1	4	56	68	33	32	16						1	4	47	59	40	25	35	17
			E	6	100	0	0	-	83	0	17	0							0	17	83	50	50	0	0						0	0	40	60	60	40	0	20
	14	Reproductive technology in clinical practice (infertility steps).	1	64	8	17	75	-	38	44	2	16							0	5	61	40	27	23	8						2	5	50	38	30	13	35	8
			2	67	6	16	78	-	37	47	1	15							0	2	73	45	22	23	0						2	2	63	48	27	11	33	2
			E	4	100	0	0	-	25	25	25	25							0	0	50	50	25	25	0						0	0	33	67	0	0	33	33
	15	Systematic prevention and treatment methods for dementia that inhibits the decline in elderly people's brain functions.	1	113	21	27	52	-	78	20	0	2							4	8	70	59	29	30	10						5	8	55	49	39	28	34	8
			2	109	20	24	56	-	83	14	0	3							1	6	74	57	26	28	6						3	6	63	51	34	24	33	5
			E	22	100	0	0	-	77	23	0	0							0	0	75	40	30	30	0						0	0	65	40	35	10	40	0
	16	Technology to detect a cancerous tissue of the diameter smaller than 1 mm appearing anywhere in the body.	1	101	21	29	50	-	81	9	1	9							3	6	70	53	32	25	9						3	7	48	40	46	13	32	8
			2	91	23	26	51	-	82	6	1	11							1	1	80	47	31	20	4						1	0	59	40	50	9	29	1
			E	21	100	0	0	-	81	5	0	14							5	0	81	33	29	19	0						5	0	50	20	35	5	30	0

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Medical treatment aiming at safety and security	17	Technology for molecular imaging in the body with the precision of single molecule.	1	83	13	36	51	-	72	6	0	22							2	15	74	46	32	22	4						2	17	54	44	40	9	26	4
			2	82	13	32	55	-	71	4	0	25							4	11	80	51	27	20	3						2	12	63	45	43	6	23	0
			E	11	100	0	0	-	82	9	0	9							9	0	80	50	30	20	0						0	9	27	27	55	18	18	0
	18	Technology for identification of the interactions between various drug-related substances inside and outside a cell.	1	70	11	33	56	-	87	3	1	9							0	13	67	49	36	21	6						0	12	50	38	50	8	27	2
			2	64	9	33	58	-	89	2	0	9							0	3	75	52	34	20	2						0	3	62	42	50	2	30	0
			E	6	100	0	0	-	83	0	0	17							0	0	60	40	40	40	0						0	0	20	20	40	0	20	0
	19	An early detection method for unanticipated rejection of organ and tissue transplants.	1	69	10	25	65	-	83	3	3	11							0	6	75	46	23	18	9						2	6	58	40	40	12	26	6
			2	67	9	22	69	-	86	2	0	12							0	2	84	45	20	19	8						2	2	74	49	38	8	20	5
			E	6	100	0	0	-	60	0	0	40							0	0	50	0	17	33	0						0	0	40	40	20	20	20	0
	20	Drugs to cure viral liver disease.	1	76	13	21	66	-	67	25	5	3							0	7	64	46	56	25	8						0	8	47	33	68	15	28	7
			2	73	12	18	70	-	68	23	6	3							0	3	72	41	59	20	3						0	4	51	32	67	9	22	4
			E	9	100	0	0	-	67	33	0	0							0	11	56	0	44	22	0						0	11	11	11	78	11	11	0
	21	Anti-cancer agents and immunosuppressive drugs that drastically reduce iatrogenic opportunistic infections and do not interfere with phylaxis.	1	69	16	26	58	-	86	7	0	7							4	10	61	45	48	28	8						3	9	48	38	66	9	31	6
			2	67	12	28	60	-	90	4	0	6							5	5	75	44	49	22	5						3	5	56	38	67	3	26	7
			E	8	100	0	0	-	74	13	0	13							0	13	63	25	63	25	0						0	13	38	38	50	0	25	0
	22	A treatment for prion diseases.	1	63	3	22	75	-	72	0	18	10							2	15	76	53	22	22	14						0	17	60	48	43	14	31	14
			2	61	3	28	69	-	74	2	12	12							0	10	79	53	14	22	7						0	10	68	51	35	9	25	9
			E	2	100	0	0	-	100	0	0	0							0	0	50	50	0	50	0						0	0	50	50	50	50	50	0
	23	Effective radiological therapy and assessment methods for cancer treatment.	1	81	20	23	57	-	86	6	0	8							1	3	64	56	24	23	4						0	3	55	53	34	18	23	3
			2	78	14	29	57	-	90	4	0	6							0	0	76	63	28	23	3						0	0	69	60	29	14	20	3
			E	11	100	0	0	-	73	9	0	18							0	0	50	40	30	20	0						0	0	36	36	9	18	9	0
	24	Elucidation of individual aging mechanisms.	1	99	13	26	61	-	76	12	0	12							3	12	78	57	18	21	6												
			2	94	11	27	62	-	81	11	0	8							1	9	80	53	18	24	3												
			E	10	100	0	0	-	80	20	0	0							10	10	50	38	0	38	0												

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Medical treatment aiming at safety and security	25	Ttreatment methods for psychological development disorders.	1	62	3	37	60	-	73	13	2	12							5	34	67	68	16	28	9						5	32	61	59	18	23	27	7
			2	64	5	34	61	-	81	6	0	13							3	19	76	69	15	26	6						2	19	65	62	17	22	27	5
			E	3	100	0	0	-	100	0	0	0							0	0	67	33	0	33	0						0	0	33	33	33	0	67	0
	26	Early diagnosis and treatment methods for neuropsychiatric disorder.	1	70	11	26	63	-	86	10	0	4							0	10	75	60	21	24	7						2	8	64	53	26	18	32	6
			2	69	13	26	61	-	90	7	0	3							1	1	76	63	16	18	4						3	1	66	58	20	14	28	5
			E	9	100	0	0	-	89	11	0	0							0	0	56	33	0	33	0						0	0	50	38	13	0	38	0
	27	Technology to quantify psychological stress.	1	75	11	23	66	-	66	27	0	7							1	7	68	53	19	35	6						1	4	59	51	31	16	33	4
			2	74	11	23	66	-	73	22	0	5							1	3	76	51	17	34	3						1	1	63	51	26	10	29	3
			E	8	100	0	0	-	75	25	0	0							0	0	50	25	25	50	0						0	0	43	14	43	14	43	0
	28	Copying process based on the clarification of the brain mechanism that causes school attendance refusal, classroom disruption and learning disabilities.	1	58	9	33	58	-	40	58	0	2							7	12	67	67	11	42	7						6	9	56	48	20	37	46	6
			2	56	9	32	59	-	34	64	0	2							5	9	81	65	8	35	6						2	8	64	44	16	34	44	6
			E	5	100	0	0	-	60	40	0	0							40	0	75	75	0	25	0						0	0	50	50	0	0	50	0
	29	Communication techniques that enable young people who cannot communicate normally to develop social skills.	1	71	6	28	66	-	38	59	0	3							1	17	51	59	21	44	4						1	15	43	49	25	39	42	4
			2	62	5	35	60	-	26	72	0	2							0	12	61	64	16	44	5						2	10	47	56	23	35	44	5
			E	3	100	0	0	-	33	67	0	0							0	0	67	67	33	33	0						0	0	33	33	33	67	67	0
Creation of new medical technology	30	A substitution and repair technique for organ functions using a 3D tissue construction technique.	1	84	13	29	58	-	88	4	1	7							2	6	77	54	21	28	4						2	7	65	47	36	6	33	3
			2	76	9	25	66	-	90	3	0	7							1	3	82	47	16	20	4						1	4	67	41	34	3	33	1
			E	7	100	0	0	-	72	14	0	14							0	0	86	43	14	14	0						0	0	50	33	33	17	50	0
	31	Technology to establish a treatment method based on the treatment simulation which reproduces pathological conditions.	1	80	16	31	53	-	76	6	0	18							3	12	76	51	24	24	4						3	12	58	45	39	8	36	3
			2	79	11	28	61	-	83	3	0	14							1	6	78	51	23	21	3						1	8	64	46	34	5	34	3
			E	9	100	0	0	-	89	11	0	0							0	11	67	44	67	22	0						0	11	38	38	63	0	25	0
	32	Methods for autogenous tissue storage, growth, and transplantation.	1	83	12	34	54	-	84	12	0	4							1	2	77	51	28	33	5						0	1	59	42	43	13	35	3
			2	77	13	26	61	-	92	5	0	3							0	0	83	51	28	30	3						0	0	67	47	48	9	33	3
			E	10	100	0	0	-	90	0	0	10							0	0	70	30	50	20	0						0	0	22	22	56	0	33	0

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Creation of new medical technology	33	Communication assistive technology using brain activities for persons with deficient communication skills due to disease and other reasons.	1	103	20	30	50	-	77	14	0	9							2	4	71	53	30	30	6						3	3	61	44	39	18	33	4
			2	97	21	28	51	-	87	7	0	6							1	1	75	57	31	29	3						2	1	60	47	44	18	38	2
			E	20	100	0	0	-	95	5	0	0							0	0	70	55	40	15	0						0	0	47	47	47	32	26	0
	34	Drug Delivery System (DDS) by combined devices using magnetic induction and others.	1	78	17	31	52	-	73	9	0	18							0	1	66	47	39	30	3						0	0	48	43	47	8	37	0
			2	71	14	27	59	-	77	4	0	19							0	0	73	47	40	29	1						0	0	55	39	51	9	30	0
			E	10	100	0	0	-	90	0	0	10							0	0	90	60	40	10	0						0	0	67	56	56	0	44	0
	35	A medical device that can be embedded in the human body, monitor health conditions and provide medical treatment by using bioenergy sources such as body temperature or blood flow.	1	96	21	20	59	-	71	11	0	18							2	7	65	39	45	33	4						3	8	50	40	59	10	33	2
			2	89	17	22	61	-	74	8	0	18							1	3	74	46	53	24	2						2	3	53	41	69	8	30	1
			E	15	100	0	0	-	79	0	0	21							0	0	64	21	43	29	0						7	0	15	23	54	8	31	0
	36	Hemocatharsis devices that selectively remove target substances from blood.	1	66	15	18	67	-	79	9	0	12							2	8	56	44	46	30	5						2	7	40	32	60	5	35	2
			2	66	12	20	68	-	84	5	0	11							2	2	68	43	56	24	2						2	0	48	37	73	3	31	0
			E	8	100	0	0	-	87	0	0	13							0	0	75	25	25	38	0						0	0	50	25	38	0	50	0
	37	Artificial blood with no need for blood donation.	1	70	14	24	62	-	85	7	4	4							6	9	58	49	42	32	6						6	7	44	46	54	7	35	1
			2	69	12	25	63	-	91	4	4	1							3	4	64	52	46	28	4						3	4	53	45	59	2	32	3
			E	8	100	0	0	-	74	0	13	13							13	13	50	25	13	25	13						13	13	25	25	25	0	63	13
	38	Completely implanted artificial kidneys.	1	64	16	27	57	-	79	16	0	5							5	11	62	49	38	33	5						7	8	53	42	51	17	32	2
			2	61	11	26	63	-	87	8	0	5							3	3	70	53	40	27	2						7	2	59	40	59	9	29	0
			E	7	100	0	0	-	57	14	0	29							14	0	86	29	14	14	0						14	0	57	29	29	29	29	0
	39	Completely implanted artificial hearts and lungs.	1	68	19	25	56	-	78	15	1	6							6	7	68	51	42	31	5						9	8	53	44	53	16	30	3
			2	61	13	25	62	-	85	8	0	7							5	2	77	50	43	25	2						8	3	59	41	60	5	26	0
			E	8	100	0	0	-	62	13	0	25							13	0	88	13	25	13	0						13	0	29	29	57	14	29	0
	40	Completely implanted artificial endocrine organs.	1	65	14	23	63	-	76	14	2	8							2	8	60	48	34	35	5						3	5	48	41	50	9	36	3
			2	61	11	25	64	-	79	12	2	7							3	3	72	46	34	31	2						5	2	53	38	60	5	33	0
			E	7	100	0	0	-	72	14	0	14							0	0	86	14	0	14	0						0	0	29	29	29	0	29	0

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Creation of new medical technology	41	Technology for treatment in body cavities using micro machines.	1	81	22	25	53	-	82	11	1	6							2	6	75	45	43	29	4						1	5	55	40	59	9	32	3
			2	76	16	30	54	-	88	7	0	5							1	4	80	49	43	24	1						1	4	59	44	63	4	27	0
			E	12	100	0	0	-	92	8	0	0							0	0	67	42	33	33	0						0	0	50	50	42	8	33	0
	42	An intelligent communication style living environment system including life support robots for elderly persons and disabled persons.	1	111	24	32	44	-	53	41	0	6							1	4	51	40	52	45	4						2	6	35	32	65	20	39	3
			2	104	24	34	42	-	53	39	0	8							1	1	54	39	55	41	3						1	2	37	32	64	17	42	2
			E	25	100	0	0	-	40	60	0	0							0	0	44	20	44	40	4						0	0	24	16	60	16	40	4
	43	Medical equipment for functional assessment, functional recovery training and functional assistance for elderly persons and persons requiring long-term care.	1	110	33	33	34	-	55	44	0	1							0	2	53	53	47	46	4						1	2	39	45	58	28	43	3
			2	108	29	31	40	-	51	47	0	2							0	1	51	51	51	46	2						0	2	35	40	61	19	49	2
			E	31	100	0	0	-	52	48	0	0							0	0	52	48	39	48	6						0	0	26	29	45	19	58	6
	44	Risk management techniques for humans and robots in applying nursing-care robots.	1	96	24	33	43	-	52	43	0	5							1	3	52	43	45	42	3						1	4	38	35	55	20	40	2
			2	94	24	31	45	-	56	38	0	6							1	1	57	43	51	38	2						1	3	31	36	57	16	42	2
			E	23	100	0	0	-	59	41	0	0							0	0	57	39	43	43	4						0	0	39	35	43	22	43	4
	45	Artificial limbs with sensation.	1	100	29	28	43	-	77	11	1	11							2	6	68	43	45	34	5						1	6	50	42	58	18	33	3
			2	93	28	25	47	-	79	7	0	14							1	4	69	43	55	32	3						1	4	51	41	60	9	36	2
			E	26	100	0	0	-	81	0	0	19							0	0	69	31	42	31	4						0	0	38	27	46	4	42	4
Development of predictive and preventive medicine	46	Predictive medical science based on omics information and past health checkup data (health and disease management based on early diagnosis and long-term prediction of diseases).	1	80	20	35	45	-	76	18	0	6							3	6	66	44	31	34	4						3	6	44	42	49	21	36	1
			2	78	12	37	51	-	85	9	0	6							1	4	71	50	29	29	3						1	5	41	37	55	17	37	1
			E	9	100	0	0	-	100	0	0	0							0	0	67	44	33	22	11						0	0	22	11	56	11	56	11
	47	Technology for predicting the risk of potentially-severe chronic diseases by using omics information.	1	73	14	42	44	-	78	14	0	8							1	6	69	49	30	30	4						3	4	49	44	42	17	37	3
			2	68	12	38	50	-	87	9	0	4							0	2	76	47	26	30	2						0	1	54	43	48	10	36	3
			E	8	100	0	0	-	100	0	0	0							0	0	75	38	13	38	0						0	0	38	38	50	13	63	25
	48	Gene therapy with confirmed safety.	1	81	10	35	55	-	91	5	1	3							3	6	71	63	32	26	3						5	6	60	59	37	17	31	3
			2	80	14	28	58	-	92	3	0	5							1	5	84	60	21	19	3						4	6	68	54	30	12	29	3
			E	11	100	0	0	-	100	0	0	0							0	0	82	36	27	36	9						0	0	73	18	45	9	45	9

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Development of predictive and preventive medicine	49	A treatment method for blood disease by controlling the proliferation and differentiation of hematopoietic stem cells.	1	60	10	22	68	-	93	2	0	5							0	5	80	58	24	22	5							2	3	66	55	43	12	33	3
			2	60	7	23	70	-	93	0	0	7							0	0	84	55	22	16	3							2	0	78	50	45	5	28	2
			E	4	100	0	0	-	75	0	0	25							0	0	75	25	25	25	25							0	0	50	25	25	25	50	25
	50	Medical treatment guidance based on biomarkers accurately reflecting the risks of lifestyle diseases.	1	94	16	38	46	-	72	23	0	5							2	2	66	48	36	30	3							2	1	51	42	40	19	37	0
			2	91	13	37	50	-	80	15	0	5							0	1	69	47	31	28	1							0	1	53	43	43	13	39	0
			E	12	100	0	0	-	83	17	0	0							0	0	67	25	25	17	0							0	0	50	33	33	17	25	0
	51	Diagnostic methods for the risks of acquiring diseases through genome data.	1	95	18	27	55	-	89	4	2	5							3	2	72	52	34	29	6							4	2	58	43	41	16	37	4
			2	86	15	28	57	-	91	2	1	6							2	2	75	53	28	25	5							4	4	60	43	40	9	33	3
			E	13	100	0	0	-	100	0	0	0							8	8	85	31	23	23	8							8	8	69	15	38	0	38	8
	52	Effective chemopreventive drugs for cancer.	1	75	16	32	52	-	87	5	0	8							8	16	64	53	40	30	7							7	12	52	48	49	16	33	1
			2	74	9	35	56	-	91	1	0	8							6	8	76	49	39	25	4							6	8	62	49	48	7	30	3
			E	7	100	0	0	-	86	14	0	0							0	14	57	14	29	29	0							0	14	29	29	29	0	43	0
	53	Methods to prevent the onset of autoimmune diseases.	1	70	10	20	70	-	89	7	0	4							4	17	77	55	23	28	6							4	16	66	53	43	12	28	1
			2	70	10	20	70	-	92	4	0	4							3	4	86	55	20	17	3							4	6	72	52	33	4	22	1
			E	7	100	0	0	-	100	0	0	0							14	0	86	29	0	14	0							14	0	71	43	14	0	14	0
	54	Treatment methods that completely cure atopic dermatitis and other allergic disease.	1	73	10	26	64	-	82	14	0	4							3	11	72	46	46	23	4							3	9	59	42	55	12	22	1
			2	73	10	26	64	-	88	8	0	4							1	6	82	44	51	19	3							1	7	69	40	60	6	25	1
			E	7	100	0	0	-	86	14	0	0							0	0	71	57	57	29	0							0	0	86	57	57	0	29	0
	55	Methods to prevent the onset of severe genetic disorders.	1	52	12	23	65	-	86	6	0	8							2	16	74	56	12	20	10							2	14	67	54	27	13	29	4
			2	54	11	20	69	-	86	6	0	8							2	4	87	56	8	13	6							6	4	81	60	21	6	21	2
			E	6	100	0	0	-	83	17	0	0							0	0	83	33	17	17	17							0	0	83	50	17	0	50	0
	56	Gene therapy for congenital disorders.	1	62	11	19	70	-	90	7	0	3							0	18	75	57	18	28	8							2	20	67	57	31	16	31	3
			2	59	14	20	66	-	90	5	0	5							2	5	88	55	14	17	9							4	9	78	57	26	9	21	3
			E	8	100	0	0	-	87	13	0	0							0	13	88	38	25	38	13							0	14	88	50	38	0	50	0

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Development of predictive and preventive medicine	57	Gene therapy for single gene disorders.	1	67	13	19	68	-	84	6	2	8							0	3	79	52	11	24	6						2	6	61	44	29	19	32	7
			2	62	15	18	67	-	90	5	0	5							0	3	87	52	13	13	6						2	7	73	57	25	8	23	7
			E	9	100	0	0	-	100	0	0	0							0	11	89	33	11	33	0						0	11	57	43	14	0	86	0
	58	Prevention and treatment of neurodegenerative diseases.	1	72	17	21	62	-	89	4	0	7							4	7	74	57	20	36	4						6	9	66	51	35	22	42	5
			2	71	15	24	61	-	90	7	0	3							4	3	85	48	15	28	6						6	4	73	50	30	16	39	4
			E	11	100	0	0	-	100	0	0	0							9	0	82	55	9	27	9						9	0	70	60	30	20	40	10
	59	Design techniques for medical communities and medical cities (such as the residential area for elderly persons)	1	72	17	31	52	-	41	49	0	10							1	6	38	45	50	61	6						3	6	33	31	53	44	52	3
			2	72	15	33	52	-	37	52	0	11							1	4	31	41	56	51	3						3	6	30	29	54	39	47	3
			E	11	100	0	0	-	36	55	0	9							0	0	36	45	55	64	0						9	0	18	27	55	45	55	0
	60	Technology for predicting the epidemic of emerging infectious diseases at an early stage.	1	62	15	21	64	-	86	3	6	5							2	5	62	57	10	36	28						0	5	48	53	21	31	40	31
			2	59	12	25	63	-	92	3	3	2							2	2	68	53	14	30	23						0	2	55	55	16	27	34	23
			E	7	100	0	0	-	100	0	0	0							14	0	67	33	0	67	17						0	0	50	33	0	17	67	0
	61	Elucidation of biological effects of micro-pollutants in the environment.	1	55	9	22	69	-	70	17	4	9							2	6	69	65	14	31	16												
			2	63	6	16	78	-	78	11	5	6							3	3	73	67	12	27	15												
			E	4	100	0	0	-	75	25	0	0							0	0	75	50	25	75	25												
	62	Methods to overcome drug resistance in infections.	1	68	9	28	63	-	90	3	3	4							6	13	66	52	42	34	12						6	12	58	42	54	12	34	12
			2	67	10	24	66	-	95	3	0	2							7	7	72	51	40	34	9						6	8	68	43	48	11	32	8
			E	7	100	0	0	-	100	0	0	0							0	0	71	14	29	14	0						0	0	57	0	29	0	14	0
	63	Prediction of the risk of infectious disease outbreaks, enabled by the progress in modeling and simulation technology for large-scale systems such as the ecosystem and environment.	1	53	13	21	66	-	77	2	8	13							6	4	59	53	8	39	18						4	4	41	45	14	24	41	16
			2	56	14	18	68	-	78	2	7	13							5	2	64	56	13	42	13						4	2	50	52	22	19	50	9
			E	8	100	0	0	-	62	0	13	25							13	0	75	50	25	50	0						13	0	63	50	25	13	50	0
	64	An automatic device to identify pathogens and evaluate their drug susceptibility within an hour.	1	70	9	21	70	-	85	4	4	7							1	6	55	38	58	38	6						1	4	44	32	64	14	39	6
			2	69	9	19	72	-	93	3	0	4							1	3	61	36	57	30	6						1	3	51	30	68	6	32	3
			E	6	100	0	0	-	100	0	0	0							0	0	33	17	67	17	17						0	0	17	0	83	0	33	17

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Development of predictive and preventive medicine	65	Systems to almost perfectly detect infected people and carriers of imported pathogens at airports and seaports.	1	62	13	23	64	-	79	13	2	6							15	16	36	51	36	42	25						14	19	28	37	35	41	54	33
			2	69	12	23	65	-	83	9	1	7							15	6	44	59	36	39	23						14	8	30	48	37	40	52	30
			E	8	100	0	0	-	100	0	0	0							25	13	38	38	13	38	50						25	13	13	25	25	38	63	50
New regulatory science for medical treatments	66	Regional medical care system that can take prompt actions and correct regional disparities in regard to emergency medical service.	1	74	22	30	48	-	19	81	0	0																			10	6	22	29	22	74	36	3
			2	71	20	24	56	-	17	82	0	1																			7	4	26	35	20	78	37	3
			E	14	100	0	0	-	7	93	0	0																			0	8	33	42	8	75	33	0
	67	An intellectual foundation that assists the comprehensive management and advancement of clinical trials.	1	81	15	38	47	-	32	61	1	6							0	4	36	53	27	51	12						0	5	32	47	33	41	45	11
			2	76	14	33	53	-	28	66	1	5							0	3	38	54	24	53	8						0	3	36	46	32	36	51	7
			E	11	100	0	0	-	27	73	0	0							0	9	36	45	27	64	18						0	9	30	30	60	50	50	20
	68	Management technique for genetic-related personal information.	1	75	13	31	56	-	62	33	0	5							1	5	42	62	24	34	17						0	8	38	58	22	47	31	14
			2	72	13	28	59	-	60	32	0	8							1	6	46	59	15	34	12						0	7	38	59	13	41	34	10
			E	9	100	0	0	-	56	33	0	11							0	0	44	44	11	44	22						0	0	38	25	25	63	50	38
	69	Establishment of ethical guidelines for the clinical application of regenerative medicine.	1	79	8	34	58	-	55	40	1	4																			0	1	41	47	8	53	35	20
			2	76	8	33	59	-	59	34	0	7																			0	1	41	47	4	63	29	11
			E	6	100	0	0	-	66	17	0	17																			0	0	20	20	20	60	40	20
	70	A medical fee system that guarantees the consideration for safe and secure medical treatment.	1	82	20	34	46	-	13	85	1	1																			5	12	21	32	10	83	29	3
			2	77	18	31	51	-	13	86	0	1																			4	13	15	26	8	85	25	4
			E	14	100	0	0	-	14	86	0	0																			7	21	8	25	8	92	33	0
	71	An original Japan Medical Standard system.	1	83	13	33	54	-	6	86	0	8																			5	9	33	44	11	75	38	5
			2	79	14	27	59	-	7	82	0	11																			9	10	31	39	11	71	32	4
			E	11	100	0	0	-	9	82	0	9																			9	9	10	30	20	80	50	20
	72	A medical community that allows optimal management of the quality and resources of medical treatment.	1	82	16	30	54	-	16	83	1	0																			5	15	33	41	14	70	41	0
			2	78	15	29	56	-	12	88	0	0																			6	14	27	36	9	71	35	0
			E	12	100	0	0	-	17	83	0	0																			0	8	18	36	18	82	55	0

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New regulatory science for medical treatments	73	A clinical trial for evaluation of drug efficiency based on model simulations (in silico clinical trials).	1	56	14	34	52	-	76	13	2	9							4	6	56	34	36	26	8						4	4	45	39	47	16	27	8
			2	56	13	27	60	-	78	11	4	7							4	2	62	31	33	33	0						4	2	54	35	43	11	30	0
			E	7	100	0	0	-	100	0	0	0							0	0	71	14	57	43	0						0	0	43	14	71	14	29	0
	74	Implementation of a multiphase national debate in which many citizens participate, for the harmonization of bioethics and research activities.	1	72	15	32	53	-	34	57	3	6																			4	13	28	33	17	68	35	13
			2	72	17	25	58	-	27	66	3	4																			4	7	24	28	15	68	37	13
			E	12	100	0	0	-	33	67	0	0																			17	17	0	27	9	91	36	27
	75	An information system and practice databases that assist the bridging from basic medical science to clinical treatments.	1	89	18	30	52	-	49	46	1	4							0	3	60	62	21	37	6						0	4	47	51	25	41	41	7
			2	86	17	26	57	-	46	47	2	5							0	2	64	58	19	41	6						0	5	48	55	18	37	46	4
			E	15	100	0	0	-	33	60	7	0							0	7	73	47	27	40	13						0	7	60	47	13	40	67	7
	76	Elucidation of the pathophysiology of cancer metastasis.	1	82	21	28	51	-	96	3	0	1							0	9	75	57	19	31	9												
			2	79	15	25	60	-	99	0	0	1							0	4	83	56	14	23	6												
			E	12	100	0	0	-	92	0	0	8							0	8	83	67	0	33	8												
	77	Development of drugs that can prevent cancer metastasis.	1	80	18	28	54	-	95	3	1	1							0	5	59	53	46	32	9						0	5	49	36	60	10	34	5
			2	79	13	28	59	-	96	1	0	3							0	3	75	48	51	23	8						0	3	59	33	65	6	28	3
			E	10	100	0	0	-	89	0	0	11							0	0	70	50	70	10	0						0	0	60	30	50	0	40	0
Expansion of medical treatment to the social system	78	Technology for the systemization of regional medical care based on the seamless cooperation between medical treatment and nursing care.	1	88	19	42	39	-	15	83	0	2							0	2	35	48	32	59	2						0	5	27	37	33	52	47	1
			2	87	21	36	43	-	16	80	1	3							0	1	33	43	29	64	2						1	2	26	34	29	51	58	1
			E	18	100	0	0	-	22	72	0	6							0	0	28	39	22	72	0						0	6	22	28	22	56	72	0
	79	Ubiquitous biological information monitoring technology for the management of health conditions within daily life.	1	78	27	26	47	-	44	47	0	9							1	4	53	43	44	39	1						1	4	35	36	51	35	40	1
			2	81	22	27	51	-	37	53	0	10							0	3	54	43	44	39	1						0	3	34	34	56	28	44	0
			E	18	100	0	0	-	55	39	0	6							0	0	50	33	56	33	6						0	0	22	33	56	28	44	0
	80	Integrative medicine in which a lifelong regional electronic health record is introduced and community-based care is possible.	1	73	25	30	45	-	28	65	0	7							3	6	41	51	38	56	1						3	7	29	41	38	51	46	3
			2	72	21	29	50	-	19	73	0	8							1	3	40	47	34	64	1						1	3	30	34	43	49	47	1
			E	15	100	0	0	-	13	80	0	7							0	0	40	33	40	73	0						0	0	27	20	27	67	60	7

Area	Topic number	Topic	Round	Responses	Degree of expertise (%)				Importance (%)				Forecasted time of technological realization (to be realized somewhere in the world) (%)							Sectors that will pave the way to technological realization (%)					Forecasted time of social realization (To become applicable/widely used in Japan) (%)							Sectors that will pave the way to social realization (%)					
					High	Moderate	Low	None	Important for Japan and the rest of the world	Especially important for Japan	Especially important for the world	Low importance/priority	Already realized	2011-2015	2016-2020	2021-2030	2031-2040	2041-	don't know will not be realized	University	Public research organization	Private enterprise	Collaboration of multiple sectors	Others	2011-2015	2016-2020	2021-2030	2031-2040	2041-	don't know will not be realized	University	Public research organization	Private enterprise	Government	Collaboration of multiple sectors	Others
Expansion of medical treatment to the social system	81	Family medicine education for preventing and dealing with lifestyle diseases and aging issues.	1	105	23	32	45	-	38	56	1	5																	1	4	43	45	29	61	37	5
			2	99	22	28	50	-	32	62	1	5																	1	3	36	45	21	61	38	1
			E	22	100	0	0	-	36	54	5	5																	0	5	32	45	23	55	32	0
	82	Health education for the public about personalized medicine using genome data.	1	79	16	30	54	-	36	51	0	13																	3	7	44	45	25	51	39	7
			2	77	14	30	56	-	28	59	0	13																	0	5	41	47	19	60	40	5
			E	11	100	0	0	-	36	55	0	9																	0	0	36	45	9	64	64	9
	83	Medical ethics education for healthcare professionals.	1	93	13	35	52	-	33	58	0	9																	1	11	67	29	9	36	28	6
			2	93	12	35	53	-	28	66	0	6																	1	9	76	30	7	42	26	2
			E	11	100	0	0	-	18	73	0	9																	0	18	82	18	0	73	27	9
	84	Medical safety education for healthcare professionals in which simulation technology is introduced.	1	106	21	31	48	-	49	49	0	2						0	3	66	45	23	44	4						0	3	55	39	30	33	41	4
			2	97	19	33	48	-	43	56	0	1						0	0	70	33	18	51	2						0	0	66	41	29	33	44	2
			E	18	100	0	0	-	50	50	0	0						0	0	53	18	18	53	6						0	0	50	22	28	44	50	6
	85	Industrialization of a consistent medical waste treatment system including recycling.	1	48	15	35	50	-	45	49	0	6						0	0	42	51	51	44	9						0	0	26	30	53	51	43	2
			2	54	19	24	57	-	46	50	0	4						0	2	40	50	54	54	4						0	2	30	33	61	52	46	2
			E	10	100	0	0	-	50	50	0	0						0	0	30	40	80	60	0						0	0	30	40	70	60	60	10

Panel 5:

Understanding of dynamics of space, earth, and life, and science and technology which expand the region of human activity

Implementation of the questionnaires

	Sent	Returned (response rate)
<1st Round>	328	272 (83%)
<2nd Round>	272	237 (87%)

Sex	Male	227	Affiliation	Private enterprise	32
	Female	10		University	112
	N.A.	0		Research Institute	70
generation	20’s	1		Association	6
	30’s	19		Others	17
	40’s	57		N.A.	0
	50’s	83	Job category	R&D	191
	60’s	63		Others	45
	70’s and over	12		N.A.	1
	N.A.	0		Total	237

Survey items

A: Geo-diagnosis technology

B: Space and ocean management technology (including observations)

C: A frontier leading future science and technology

D: Organism and life (origins)

E: Cosmological elementary particles (including space science)

F: Artificial structures (large system technology)

G: Space technologies (including space medicine)

Time-series tables of topics

<Technological realization>

year	Topic (Leading number represents ID.)
2015	15: Telemetry technology for underwater activities by Autonomous Underwater vehicles, etc. via satellite and unmanned buoys.
2016	11: Technology for the utilization of ocean energies such as the wind, waves and tides on a commercial basis.
	21: Broadband communication technology that can be used anywhere on the ocean within Japan's EEZ at the same cost as that on land.
	23: Technology for the observation and prediction of strong tidal currents and tidal waves that may damage fishery facilities.
	24: Technology of breeding biological resources by artificially producing a large-scale upwelling.
	45: A three-dimensional image analysis system that can distinguish tiny ocean organisms (microorganisms and plankton).
	56: Construction of prototype offshore platforms (transportation, communications, production, and active base) that are fixed-type or have a floating structure as the core.
2017	19: Large but light-weight pressure vessels that can be used for survey equipment under waters more than 6000 m deep.
	57: Japanese-made highly reliable (high robustness) and competitive (cost-minimization, microminiaturization, and weight-minimization) space equipment (for space transportation and spacecraft, etc.)
	58: Planetary exploration and interstellar flight technology using micro space explorers.
2018	14: Research techniques of past hydrothermal activities that have ended, for the purpose of discovering ocean floor mineral resources and researching the reserves thereof.
	16: Autonomous observation technology for wide areas by multiple AUVs (multiple cooperating autonomous underwater vehicles) for observations under the ocean floor.
	17: A seafloor observation network connected to submarine cables for real-time observation of various phenomena in the deep ocean and on the ocean floor in the area of the EEZ of Japan.
	20: Acoustic photography techniques with at least 10 cm resolution for photographs taken 100 m or more under water.
	25: Development of seamless land and sea observation data.
	27: Technology for the observation of the surface and core of Mercury, Venus and Mars by the orbiters for each planet.
	32: Establishment of technology capable of dissolving CO_2 in water or fixing CO_2 under the ocean floor.
	39: Technology capable of observing the process of various chemical reactions by using quantum beams such as x-rays, neutron beams, and muon beams, for the development of a new storage media or a new high-temperature superconductor.
	47: Establishment of a numerical model for marine ecosystems.

year	Topic (Leading number represents ID.)
2019	06: A comprehensive water management system with the purpose of disaster prevention in which refined coupled modeling of cloud cover and the precipitation system is combined with constant monitoring technology by using a 10 × 10 × 2.5km mesh on land and waters, within 20 km from the seashore of Japan. 29: Autonomous robots for heavy work in deep seas. 31: A drilling system using a drill bit and Logging While Drilling (LWD) technology enabling depths of up to 15 km to be reached under extreme drilling environments including temperatures as high as 400° C. 33: Marine farms that carry out optimal environmental management by adopting biological technology as well as a broad range of engineering technology. 35: Experimental facilities for recreating the Extremobiosphere. 38: X-ray technology that enables analysis using femtosecond time resolution and nanometer position resolution, with the purpose of the elucidation of biological phenomena such as the transcription process of DNA, and of new drug development. 40: Technology that conducts neuron mapping and the observation of neuron behavior by using externally weak introduced radiation, for the elucidation of the phenomena of human thought. 46: Technology for the maintenance of environmental stability of large-scale space (exceeding 1000 liters) for the culture and breeding of living organisms in an environment of 100 MPa (which is 1000 hectopascals), 300 degrees, and Ph 1-7 (strong acid) (supposing an environment 1km below hot-spring areas). 48: Technology making use of various space observatories for ultra-high precision space measurements and observations of dark matter, gravity waves, submillimeter waves, far infrared rays, radiant energies, x-rays, gamma rays, etc. 50: Particle accelerator technology leading to breakthroughs in human understanding of the natural world (the origin of the universe, the asymmetric diversity between matter and antimatter, the origin of elements, etc.). 54: A large-scale system of spacecraft that takes full advantage of the large number of formation flights.
2020	01: Future modeling over the next 50 to 100 years for the purpose of grasping the CO_2 balance in the global atmospheric layer including the ecosystem and living environments of human beings as well as the changes of water circulation. 02: Global Earth Observation System that is capable of identifying greenhouse gasses and the density of air pollutants within a 5 × 5 × 1km frame over land, and a 20 × 20 × 4km frame over water. 03: Global Earth Observation System that is capable of identifying the vapor content of the atmosphere, the wind vector, and the amount of cloud cover arising thereby within a 5 × 5 × 1km frame over land, and a 20 × 20 × 4km frame over water. 08: A crustal activity monitoring system with the purpose of earthquake prediction with better accuracy under which regional changes in stress in the deep crust of 1000 m or more under the ocean floor are measured at multiple points within 50 km from the source areas of past earthquakes above level 6, in areas east of the Japan Trench to the Sanriku and Tohoku areas and in the area around the Nankai Trough to the Tokai, Tonankai and Shikoku area. 12: Technology for mining ocean floor resources such as hydrothermal deposits on a commercial basis. 13: Technology for acquiring topography data of 1m horizontal resolution that measures the entire ocean floor.

year	Topic (Leading number represents ID.)
2020	26: Technology for the development of cobalt-rich manganese crust that is present under the top of a guyot as rare metals and rare earth element resources, on a commercial basis.
	49: Technology to explore difficult-to-detect particles, such as cosmic neutrinos, ultra high energy gamma rays, and dark matter particles, contributing to achievements in space science.
	52: Technology for the construction of ultra high speed and ultra high capacity computers improved by a factor of several hundred in terms of performance in comparison with the supercomputer called PETA-CON currently under construction, with the purpose of remarkable improvements of human knowledge on elementary particles and the atomic nucleus, and on the origin of the universe and stellar evolution .
	61: Earth-orbiting space tourism (including educational cultural activities)
2021	07: Technology that enables predicting 5-years of sea surface temperatures at an accuracy of ± 1K in association with seasonal to decadal climate variables in the Pacific and Indian Oceans.
	18: Technology capable of measuring ocean floor movements smaller than 1cm per year.
	28: Direct photography techniques for terrestrial planets located around the stars near the solar system, by using techniques such as destructive interferometer and coronagraphs.
	53: Construction technology for large-scale (100 m when deployed), ultra-light deployable space antennas with a high packing rate and high accuracy precision.
2022	22: Wide-area observation techniques for ocean floors to clarify the global balance of heat and CO_2.
	30: Technology capable of assessing the energy and material contribution in detail from the deep sea chemosynthetic ecosystem to the ocean.
	43: Fuel cells composed of a closed system (no atmospheric exposure), portable, and capable of providing 10 kw output for one year on a single fueling.
	55: Construction technology for a manned, three-dimensional structure with high rigidity for lunar and planetary exploration.
2023	09: Technology for estimating geological structure 100 m or more below the surface of land from data acquired from airplanes and/or spacecraft.
	10: A system capable of monitoring changes in temperature and salinity of full layers in deep areas of ocean around the globe in each 100 × 100 km area with acoustic tomography and an automatic water sampler system, every 3 hours.
	36: Autonomous robots for deep-sea biosphere that can dig to 5 km below land or the sea floor.
	59: Technology for searching for extraterrestrial life on other planets.
	63: Self-repair technology for spacecraft and self-planning space exploration technology, leading to an autonomous space system.
	64: Radical technical measures to counter the debris problem (development of debris-free space systems, collection or disposal by injection into the atmosphere of debris already remaining, etc.)
2024	04: A high resolution and high frequency observation system that is capable of measuring global land surface, sea level, and gravity distribution within a 1 × 1km area of land and a 10 × 10 km area of water at an accuracy of 10 mm elevation and 10 mgal free air gravity, every 10 days.
	51: A particle accelerator based on a new acceleration principle such as laser-acceleration, that would be the means for the research on ultra high energy phenomena and elementary particles.

year	Topic (Leading number represents ID.)
2024	60:Japan's own manned space system (manned launch vehicle, manned spacecraft)
2025	37: Simulation methods for the ecosystem of the planets in the solar system for research on the origin of life.
2026	34: A seawater engine that takes oxygen and hydrogen out of seawater and generates energy.
2027	05: An autonomous, global ocean observation system at 1m intervals between the sea surface and the sea floor for each 20 × 20km area on the open ocean and for each 5 × 5 km area along coasts, at an uncertainty of 0.01% of full scale for the observation of depth, temperature, salinity, dissolved oxygen and nutrients, and at an uncertainty of 0.1% of full scale for pH and total dissolved carbon, every ten years.
	44: Solar photoelectric power generation plants in space that transmit electricity to the ground via microwaves or lasers.
2028	41: Quantum communications technology that is 1million times as fast as the current optical communications, for high-capacity communications with planetary exploration spacecraft and so on.
	42: A system that enables communication with persons or devices located deep under land or the sea floor by adopting new principles such as extremely high frequency vibration waves and gravity waves, for the purpose of resource exploration and environmental research deep under the sea or underground.
2032	62: A permanent manned lunar base (scientific observations from the moon, lunar science, and development of resource utilization technology, etc.).

<Social realization>

year	Topic (Leading number represents ID.)
2021	15: Telemetry technology for underwater activities by Autonomous Underwater vehicles, etc. via satellite and unmanned buoys.
2021	21: Broadband communication technology that can be used anywhere on the ocean within Japan's EEZ at the same cost as that on land.
2021	45: A three-dimensional image analysis system that can distinguish tiny ocean organisms (microorganisms and plankton).
2022	23: Technology for the observation and prediction of strong tidal currents and tidal waves that may damage fishery facilities.
2022	56: Construction of prototype offshore platforms (transportation, communications, production, and active base) that are fixed-type or have a floating structure as the core.
2022	57: Japanese-made highly reliable (high robustness) and competitive (cost-minimization, microminiaturization, and weight-minimization) space equipment (for space transportation and spacecraft, etc.)
2023	14: Research techniques of past hydrothermal activities that have ended, for the purpose of discovering ocean floor mineral resources and researching the reserves thereof.
2023	19: Large but light-weight pressure vessels that can be used for survey equipment under waters more than 6000 m deep.
2024	11: Technology for the utilization of ocean energies such as the wind, waves and tides on a commercial basis.
2024	24: Technology of breeding biological resources by artificially producing a large-scale upwelling.
2024	58: Planetary exploration and interstellar flight technology using micro space explorers .

year	Topic (Leading number represents ID.)
2025	17: A seafloor observation network connected to submarine cables for real-time observation of various phenomena in the deep ocean and on the ocean floor in the area of the EEZ of Japan.
2025	20: Acoustic photography techniques with at least 10 cm resolution for photographs taken 100 m or more under water.
2025	39: Technology capable of observing the process of various chemical reactions by using quantum beams such as x-rays, neutron beams, and muon beams, for the development of a new storage media or a new high-temperature superconductor.
2026	16: Autonomous observation technology for wide areas by multiple AUVs (multiple cooperating autonomous underwater vehicles) for observations under the ocean floor.
2026	25: Development of seamless land and sea observation data.
2026	31: A drilling system using a drill bit and Logging While Drilling (LWD) technology enabling depths of up to 15 km to be reached under extreme drilling environments including temperatures as high as 400° C.
2026	32: Establishment of technology capable of dissolving CO_2 in water or fixing CO_2 under the ocean floor.
2027	01: Future modeling over the next 50 to 100 years for the purpose of grasping the CO_2 balance in the global atmospheric layer including the ecosystem and living environments of human beings as well as the changes of water circulation.
2027	02: Global Earth Observation System that is capable of identifying greenhouse gasses and the density of air pollutants within a 5 × 5 × 1km frame over land, and a 20 × 20 × 4km frame over water.
2027	03: Global Earth Observation System that is capable of identifying the vapor content of the atmosphere, the wind vector, and the amount of cloud cover arising thereby within a 5 × 5 × 1km frame over land, and a 20 × 20 × 4km frame over water.
2027	06: A comprehensive water management system with the purpose of disaster prevention in which refined coupled modeling of cloud cover and the precipitation system is combined with constant monitoring technology by using a 10 × 10 × 2.5km mesh on land and waters, within 20 km from the seashore of Japan.
2027	12: Technology for mining ocean floor resources such as hydrothermal deposits on a commercial basis.
2027	27: Technology for the observation of the surface and core of Mercury, Venus and Mars by the orbiters for each planet.
2027	29: Autonomous robots for heavy work in deep seas.
2027	48: Technology making use of various space observatories for ultra-high precision space measurements and observations of dark matter, gravity waves, submillimeter waves, far infrared rays, radiant energies, x-rays, gamma rays, etc.
2027	49: Technology to explore difficult-to-detect particles, such as cosmic neutrinos, ultra high energy gamma rays, and dark matter particles, contributing to achievements in space science.
2027	54: A large-scale system of spacecraft that takes full advantage of the large number of formation flights.
2028	08: A crustal activity monitoring system with the purpose of earthquake prediction with better accuracy under which regional changes in stress in the deep crust of 1000 m or more under the ocean floor are measured at multiple points within 50 km from the source areas of past earthquakes above level 6, in areas east of the Japan Trench to the Sanriku and Tohoku areas and in the area around the Nankai Trough to the Tokai, Tonankai and Shikoku area.
2028	18: Technology capable of measuring ocean floor movements smaller than 1cm per year.

year	Topic (Leading number represents ID.)
2028	26: Technology for the development of cobalt-rich manganese crust that is present under the top of a guyot as rare metals and rare earth element resources, on a commercial basis.
2028	28: Direct photography techniques for terrestrial planets located around the stars near the solar system, by using techniques such as destructive interferometer and coronagraphs.
2028	33: Marine farms that carry out optimal environmental management by adopting biological technology as well as a broad range of engineering technology.
2028	38: X-ray technology that enables analysis using femtosecond time resolution and nanometer position resolution, with the purpose of the elucidation of biological phenomena such as the transcription process of DNA, and of new drug development.
2028	46: Technology for the maintenance of environmental stability of large-scale space (exceeding 1000 liters) for the culture and breeding of living organisms in an environment of 100 MPa (which is 1000 hectopascals), 300 degrees, and Ph 1-7 (strong acid) (supposing an environment 1km below hot-spring areas).
2028	50: Particle accelerator technology leading to breakthroughs in human understanding of the natural world (the origin of the universe, the asymmetric diversity between matter and antimatter, the origin of elements, etc.).
2028	52: Technology for the construction of ultra high speed and ultra high capacity computers improved by a factor of several hundred in terms of performance in comparison with the supercomputer called PETA-CON currently under construction, with the purpose of remarkable improvements of human knowledge on elementary particles and the atomic nucleus, and on the origin of the universe and stellar evolution .
2029	13: Technology for acquiring topography data of 1m horizontal resolution that measures the entire ocean floor.
2029	22: Wide-area observation techniques for ocean floors to clarify the global balance of heat and CO_2.
2029	35: Experimental facilities for recreating the Extremobiosphere.
2029	40: Technology that conducts neuron mapping and the observation of neuron behavior by using externally weak introduced radiation, for the elucidation of the phenomena of human thought.
2029	53: Construction technology for large-scale (100 m when deployed), ultra-light deployable space antennas with a high packing rate and high accuracy precision.
2030	07: Technology that enables predicting 5-years of sea surface temperatures at an accuracy of ± 1K in association with seasonal to decadal climate variables in the Pacific and Indian Oceans.
2031	09: Technology for estimating geological structure 100 m or more below the surface of land from data acquired from airplanes and/or spacecraft.
2031	43: Fuel cells composed of a closed system (no atmospheric exposure), portable, and capable of providing 10 kw output for one year on a single fueling.
2031	55: Construction technology for a manned, three-dimensional structure with high rigidity for lunar and planetary exploration.
2031	61: Earth-orbiting space tourism (including educational cultural activities)
2031	63: Self-repair technology for spacecraft and self-planning space exploration technology, leading to an autonomous space system.
2032	04: A high resolution and high frequency observation system that is capable of measuring global land surface, sea level, and gravity distribution within a 1 × 1km area of land and a 10 × 10 km area of water at an accuracy of 10 mm elevation and 10 mgal free air gravity, every 10 days.

year	Topic (Leading number represents ID.)
2032	10: A system capable of monitoring changes in temperature and salinity of full layers in deep areas of ocean around the globe in each 100 × 100 km area with acoustic tomography and an automatic water sampler system, every 3 hours.
2032	36: Autonomous robots for deep-sea biosphere that can dig to 5 km below land or the sea floor.
2032	64: Radical technical measures to counter the debris problem (development of debris-free space systems, collection or disposal by injection into the atmosphere of debris already remaining, etc.)
2033	59: Technology for searching for extraterrestrial life on other planets.
2033	60:Japan's own manned space system (manned launch vehicle, manned spacecraft)
2034	05: An autonomous, global ocean observation system at 1m intervals between the sea surface and the sea floor for each 20 × 20km area on the open ocean and for each 5 × 5 km area along coasts, at an uncertainty of 0.01% of full scale for the observation of depth, temperature, salinity, dissolved oxygen and nutrients, and at an uncertainty of 0.1% of full scale for pH and total dissolved carbon, every ten years.
2034	51: A particle accelerator based on a new acceleration principle such as laser-acceleration, that would be the means for the research on ultra high energy phenomena and elementary particles.
2035	34: A seawater engine that takes oxygen and hydrogen out of seawater and generates energy.
2036	41: Quantum communications technology that is 1million times as fast as the current optical communications, for high-capacity communications with planetary exploration spacecraft and so on.
2037	42: A system that enables communication with persons or devices located deep under land or the sea floor by adopting new principles such as extremely high frequency vibration waves and gravity waves, for the purpose of resource exploration and environmental research deep under the sea or underground.
2037	44: Solar photoelectric power generation plants in space that transmit electricity to the ground via microwaves or lasers.
2040	62: A permanent manned lunar base (scientific observations from the moon, lunar science, and development of resource utilization technology, etc.).

Area	Topic number	Topic	Round	Responses	Degree of expertise (%)				Importance (%)				Forecasted time of technological realization (to be realized somewhere in the world)						Sectors that will pave the way to technological realization (%)					Forecasted time of social realization (To become applicable/widely used in Japan)						Sectors that will pave the way to social realization (%)					
					High	Moderate	Low	None	Important for Japan and the rest of the world	Especially important for Japan	Especially important for the world	Low importance/priority	Already realized	2011-2015	2016-2020	2021-2030	2031-2040	2041-	don't know will not be realized		University	Public research organization	Private enterprise	Cooperation	Others	2011-2015	2016-2020	2021-2030	2031-2040	2041-	I don't know will not be realized		University	Public research organization	Private enterprise	Government	Cooperation	Others
Geo-diagnosis technology	1	Future modeling over the next 50 to 100 years for the purpose of grasping the CO2 balance in the global atmospheric layer including the ecosystem and living environments of human beings as well as the changes of water circulation.	1	158	14	26	60	-	86	0	11	3							3	6	51	73	2	26	25						2	10	28	55	9	33	23	30
			2	140	11	27	62	-	89	0	9	2							2	4	48	76	2	27	22						1	7	22	69	5	27	24	27
			E	16	100	0	0	-	94	0	6	0							0	0	73	80	7	40	33						0	0	50	79	29	29	36	43
	2	Global Earth Observation System that is capable of identifying greenhouse gasses and the density of air pollutants within a 5 × 5 × 1km frame over land, and a 20 × 20 × 4km frame over water.	1	149	15	29	56	-	78	5	9	8							3	6	37	78	7	21	31						3	8	21	67	12	31	21	31
			2	132	12	29	59	-	85	2	8	5							1	5	36	85	6	18	28						3	6	16	79	7	30	14	32
			E	16	100	0	0	-	94	0	6	0							0	0	63	94	13	31	25						0	0	40	87	13	27	27	33
	3	Global Earth Observation System that is capable of identifying the vapor content of the atmosphere, the wind vector, and the amount of cloud cover arising thereby within a 5 × 5 × 1km frame over land, and a 20 × 20 × 4km frame over water.	1	143	15	26	59	-	80	3	6	11							3	6	34	82	7	20	29						3	6	20	70	10	26	18	29
			2	124	14	24	62	-	85	2	7	6							1	3	34	91	3	17	26						2	4	16	79	6	25	14	26
			E	17	100	0	0	-	88	0	12	0							6	0	44	94	13	31	25						6	0	50	94	19	19	19	31
	4	A high resolution and high frequency observation system that is capable of measuring global land surface, sea level, and gravity distribution within a 1 × 1km area of land and a 10 × 10 km area of water at an accuracy of 10 mm elevation and 10 mgal free air gravity, every 10 days.	1	123	7	24	69	-	53	4	12	31							6	17	38	79	4	19	20						6	20	25	73	6	14	14	23
			2	108	7	20	73	-	56	5	8	31							6	12	37	85	0	14	16						4	15	24	75	2	13	13	24
			E	8	100	0	0	-	87	13	0	0							0	0	29	71	0	14	43						0	14	57	57	0	14	29	43
	5	An autonomous, global ocean observation system at 1m intervals between the sea surface and the sea floor for each 20 × 20km area on the open ocean and for each 5 × 5 km area along coasts, at an uncertainty of 0.01% of full scale for the observation of depth, temperature, salinity, dissolved oxygen and nutrients, and at an uncertainty of 0.1% of full scale for pH and total dissolved carbon, every ten years.	1	129	11	29	60	-	65	6	10	19							9	10	36	77	3	20	31						10	15	24	66	4	22	21	31
			2	117	11	26	63	-	72	5	9	14							7	5	34	86	1	15	28						8	11	23	76	2	16	16	30
			E	13	100	0	0	-	100	0	0	0							15	0	38	62	0	31	15						15	8	31	46	0	8	38	15
	6	A comprehensive water management system with the purpose of disaster prevention in which refined coupled modeling of cloud cover and the precipitation system is combined with constant monitoring technology by using a 10 × 10 × 2.5km mesh on land and waters, within 20 km from the seashore of Japan.	1	137	12	28	60	-	32	57	1	10							2	5	41	83	11	27	12						3	5	23	69	12	35	21	9
			2	118	11	26	63	-	21	70	0	9							2	3	35	90	8	20	7						3	3	15	77	7	36	15	6
			E	13	100	0	0	-	23	69	0	8							8	0	33	92	17	25	17						8	0	10	70	20	40	10	10
	7	Technology that enables predicting 5-years of sea surface temperatures at an accuracy of ± 1K in association with seasonal to decadal climate variables in the Pacific and Indian Oceans.	1	125	11	28	61	-	70	5	13	12							4	8	46	79	5	22	27						6	10	31	67	5	23	20	30
			2	113	10	26	64	-	74	5	11	10							4	5	47	86	2	13	21						5	6	28	75	1	17	14	25
			E	11	100	0	0	-	82	0	9	9							9	0	90	80	0	20	30						9	0	55	82	0	18	18	18
	8	A crustal activity monitoring system with the purpose of earthquake prediction with better accuracy under which regional changes in stress in the deep crust of 1000 m or more under the ocean floor are measured at multiple points within 50 km from the source areas of past earthquakes above level 6, in areas east of the Japan Trench to the Sanriku and Tohoku areas and in the area around the Nankai Trough to the Tokai, Tonankai and Shikoku area.	1	112	13	29	58	-	11	82	0	7							5	9	43	84	4	26	3						6	8	23	70	3	33	29	3
			2	102	13	25	62	-	12	83	0	5							2	8	36	86	1	23	4						3	7	15	74	1	28	26	5
			E	13	100	0	0	-	15	85	0	0							8	0	25	75	8	25	0						0	0	0	55	9	18	27	0

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Geo-diagnosis technology	9	Technology for estimating geological structure 100 m or more below the surface of land from data acquired from airplanes and/or spacecraft.	1	119	13	34	53	-	58	21	3	18							12 16	41	74	11	21	14						12 15	25	69	19	17	16	16
			2	102	12	29	59	-	65	18	1	16							7 14	41	82	10	18	9						6 13	21	82	16	12	13	15
			E	12	100	0	0	-	91	9	0	0							8 0	27	73	18	18	9						0 0	9	64	27	9	9	9
	10	A system capable of monitoring changes in temperature and salinity of full layers in deep areas of ocean around the globe in each 100 × 100 km area with acoustic tomography and an automatic water sampler system, every 3 hours.	1	113	11	26	63	-	56	8	6	30							12 11	35	77	6	23	27						14 14	21	67	14	16	22	28
			2	99	11	24	65	-	69	6	3	22							10 10	35	83	3	16	18						12 13	22	76	10	8	19	25
			E	11	100	0	0	-	64	0	9	27							27 0	40	80	0	10	20						20 0	30	60	10	0	30	20
Space and ocean management technology (including observations)	11	Technology for the utilization of ocean energies such as the wind, waves and tides on a commercial basis.	1	159	15	26	59	-	64	31	2	3							1 6	21	47	59	38	3						1 7	11	27	62	36	34	4
			2	144	15	28	57	-	75	22	2	1							0 5	15	44	68	39	1						0 5	6	24	68	37	33	2
			E	21	100	0	0	-	80	20	0	0							0 0	24	24	57	62	0						0 0	10	10	67	43	38	0
	12	Technology for mining ocean floor resources such as hydrothermal deposits on a commercial basis.	1	132	11	37	52	-	28	69	0	3							2 9	20	63	47	39	2						2 9	12	45	55	30	35	2
			2	122	9	36	55	-	22	75	0	3							2 3	9	64	51	36	0						1 6	8	48	59	28	37	0
			E	11	100	0	0	-	9	91	0	0							0 0	0	60	50	40	0						0 0	10	60	60	50	50	0
	13	Technology for acquiring topography data of 1m horizontal resolution that measures the entire ocean floor.	1	118	9	30	61	-	43	32	1	24							6 11	37	71	16	19	7						8 12	21	63	23	23	21	9
			2	102	10	28	62	-	50	26	0	24							1 8	37	80	10	15	4						2 8	22	70	22	22	19	5
			E	10	100	0	0	-	70	20	0	10							0 0	33	67	11	11	11						0 0	11	33	11	33	22	11
	14	Research techniques of past hydrothermal activities that have ended, for the purpose of discovering ocean floor mineral resources and researching the reserves thereof.	1	109	15	29	56	-	31	58	0	11							2 7	41	75	19	28	4						3 10	23	64	38	20	31	3
			2	100	14	28	58	-	24	66	1	9							2 5	34	83	11	23	0						3 6	18	74	29	17	27	1
			E	14	100	0	0	-	29	71	0	0							0 0	54	62	15	23	0						0 0	54	46	23	15	31	0
	15	Telemetry technology for underwater activities by Autonomous Underwater vehicles, etc. via satellite and unmanned buoys.	1	146	11	31	58	-	51	37	1	11							0 7	41	78	21	20	4						0 7	29	70	27	17	20	4
			2	124	10	29	61	-	59	34	1	6							0 5	41	85	20	15	4						0 4	30	80	30	14	13	3
			E	13	100	0	0	-	85	15	0	0							0 0	46	85	15	23	8						0 0	45	73	45	0	18	9
	16	Autonomous observation technology for wide areas by multiple AUVs (multiple cooperating autonomous underwater vehicles) for observations under the ocean floor.	1	124	12	24	64	-	43	44	0	13							1 9	49	76	18	22	4						0 9	30	70	30	17	23	3
			2	110	10	25	65	-	47	43	0	10							0 7	48	82	16	14	1						0 6	30	78	28	12	18	1
			E	11	100	0	0	-	82	18	0	0							0 0	82	82	9	18	0						0 0	36	73	45	0	18	9

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Space and ocean management technology (including observations)	17	A seafloor observation network connected to submarine cables for real-time observation of various phenomena in the deep ocean and on the ocean floor in the area of the EEZ of Japan.	1	118	13	23	64	-	15	70	0	15							3	9	30	78	23	29	6						5	11	16	69	25	35	24	2
			2	110	12	23	65	-	13	74	0	13							1	7	24	84	19	24	5						4	8	10	78	22	32	20	2
			E	13	100	0	0	-	38	54	0	8							0	0	25	92	8	25	17						9	0	10	70	10	60	10	10
	18	Technology capable of measuring ocean floor movements smaller than 1cm per year.	1	104	13	28	59	-	37	43	0	20							5	13	53	78	6	17	6						6	14	32	69	11	22	19	6
			2	93	10	30	60	-	38	46	0	16							3	12	43	82	6	12	4						3	13	24	78	7	20	15	4
			E	9	100	0	0	-	22	78	0	0							0	0	50	100	13	0	0						0	0	43	57	14	29	0	0
	19	Large but light-weight pressure vessels that can be used for survey equipment under waters more than 6000 m deep.	1	105	11	24	65	-	52	37	0	11							0	11	27	73	44	19	2						1	12	17	66	43	14	24	4
			2	90	11	24	65	-	61	32	0	7							0	8	23	78	51	16	0						0	8	16	75	47	6	18	0
			E	10	100	0	0	-	90	10	0	0							0	0	25	75	63	13	0						0	0	25	75	75	0	0	0
	20	Acoustic photography techniques with at least 10 cm resolution for photographs taken 100 m or more under water.	1	86	6	26	68	-	51	27	1	21							2	13	47	69	41	13	4						2	14	31	66	42	12	21	3
			2	79	8	23	69	-	63	20	0	17							1	11	44	72	42	14	1						1	10	31	76	43	7	13	1
			E	6	100	0	0	-	100	0	0	0							17	0	80	100	40	0	0						17	0	75	100	50	0	0	0
	21	Broadband communication technology that can be used anywhere on the ocean within Japan's EEZ at the same cost as that on land.	1	109	12	31	57	-	26	55	0	19							6	10	13	57	60	27	7						4	10	8	36	62	37	21	5
			2	98	10	36	54	-	23	60	0	17							3	8	9	58	69	19	4						5	5	6	32	70	36	18	2
			E	10	100	0	0	-	50	50	0	0							10	0	0	50	70	40	20						10	0	0	13	75	63	25	13
	22	Wide-area observation techniques for ocean floors to clarify the global balance of heat and CO_2.	1	108	4	26	70	-	74	7	9	10							5	12	47	79	14	19	19						6	10	26	69	15	31	22	23
			2	99	4	26	70	-	86	1	6	7							3	8	44	82	9	13	12						4	7	27	81	9	25	16	20
			E	4	100	0	0	-	100	0	0	0							0	0	50	75	0	50	25						0	0	25	75	0	25	50	25
	23	Technology for the observation and prediction of strong tidal currents and tidal waves that may damage fishery facilities.	1	117	14	26	60	-	37	54	1	8							0	3	51	81	18	20	5						0	5	22	74	18	45	23	5
			2	107	11	29	60	-	37	59	0	4							0	3	45	87	10	13	2						0	3	15	83	14	47	17	1
			E	12	100	0	0	-	25	75	0	0							0	0	42	92	25	8	0						0	0	8	75	33	67	17	0
	24	Technology of breeding biological resources by artificially producing a large-scale upwelling.	1	93	13	20	67	-	35	43	1	21							7	13	31	70	31	33	2						8	17	17	55	37	30	35	2
			2	91	11	23	66	-	39	43	1	17							2	11	25	75	28	30	4						5	12	15	60	34	33	36	1
			E	10	100	0	0	-	40	30	0	30							10	0	13	50	50	50	13						10	0	13	38	50	25	75	0

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Space and ocean management technology (including observations)	25	Development of seamless land and sea observation data.	1	113	13	35	52	-	72	19	2	7							1 7	38	78	8	27	25						2 8	27	70	16	28	26	26
			2	110	13	34	53	-	86	10	0	4							1 6	31	83	6	24	21						1 5	20	76	8	25	23	25
			E	14	100	0	0	-	93	7	0	0							0 0	17	75	8	50	8						0 0	17	67	17	17	33	25
	26	Technology for the development of cobalt-rich manganese crust that is present under the top of a guyot as rare metals and rare earth element resources, on a commercial basis.	1	95	13	27	60	-	28	66	0	6							1 10	23	65	55	35	1						1 10	15	49	57	31	31	1
			2	90	11	29	60	-	20	74	0	6							1 9	16	73	57	33	1						0 10	13	60	64	26	27	1
			E	10	100	0	0	-	30	70	0	0							0 0	56	67	78	56	0						0 0	44	67	67	56	56	0
	27	Technology for the observation of the surface and core of Mercury, Venus and Mars by the orbiters for each planet.	1	147	22	35	43	-	61	5	13	21							1 7	38	88	6	15	14						4 13	33	77	7	16	16	17
			2	128	15	40	45	-	69	4	7	20							1 6	38	90	3	15	6						2 13	33	80	3	17	13	13
			E	19	100	0	0	-	90	5	0	5							0 0	26	95	5	16	0						0 0	21	89	5	5	21	0
	28	Direct photography techniques for terrestrial planets located around the stars near the solar system, by using techniques such as destructive interferometer and coronagraphs.	1	103	13	32	55	-	63	3	11	23							1 7	56	81	3	11	14						2 14	46	76	6	7	12	19
			2	83	10	34	56	-	70	3	8	19							0 7	57	82	3	6	6						0 16	51	82	3	7	7	8
			E	8	100	0	0	-	87	0	13	0							0 0	63	63	0	25	0						0 0	63	88	0	0	13	0
	29	Autonomous robots for heavy work in deep seas.	1	115	15	23	62	-	45	48	0	7							0 5	37	75	49	22	2						0 7	23	73	53	14	25	2
			2	105	15	21	64	-	41	52	0	7							0 4	34	85	52	13	1						0 6	26	78	52	10	18	2
			E	16	100	0	0	-	47	40	0	13							0 6	40	93	67	7	0						0 7	27	87	73	20	13	0
	30	Technology capable of assessing the energy and material contribution in detail from the deep sea chemosynthetic ecosystem to the ocean.	1	66	9	17	74	-	57	16	4	23							2 15	54	69	7	17	7												
			2	64	8	11	81	-	73	7	0	20							2 10	60	72	5	16	0												
			E	5	100	0	0	-	75	25	0	0							0 0	25	75	25	25	0												
	31	A drilling system using a drill bit and Logging While Drilling (LWD) technology enabling depths of up to 15 km to be reached under extreme drilling environments including temperatures as high as 400 degrees C.	1	69	10	26	64	-	65	24	2	9							1 7	18	64	42	27	4						2 8	17	63	43	11	28	11
			2	66	11	21	68	-	77	15	0	8							0 9	14	70	44	22	2						0 7	13	66	44	10	28	7
			E	7	100	0	0	-	100	0	0	0							0 0	17	67	33	33	0						0 0	17	67	17	17	33	0
	32	Establishment of technology capable of dissolving CO_2 in water or fixing CO_2 under the ocean floor.	1	131	8	24	68	-	75	9	5	11							4 6	32	76	28	29	8						6 10	21	54	32	30	30	14
			2	121	8	22	70	-	78	8	1	13							3 4	30	81	24	23	8						7 7	15	65	35	30	27	8
			E	10	100	0	0	-	70	20	0	10							10 0	33	67	22	33	22						10 10	10	50	30	40	40	20

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Space and ocean management technology (including observations)	33	Marine farms that carry out optimal environmental management by adopting biological technology as well as a broad range of engineering technology.	1	89	7	24	69	-	46	47	1	6							3	8	43	70	42	36	4						2	8	25	56	55	32	42	5
			2	78	8	27	65	-	52	41	0	7							1	7	37	73	51	31	3						3	8	20	57	59	33	39	3
			E	6	100	0	0	-	67	33	0	0							0	0	33	100	67	17	0						0	0	17	83	67	67	50	0
	34	A seawater engine that takes oxygen and hydrogen out of seawater and generates energy.	1	74	3	15	82	-	47	20	3	30							17	11	50	63	36	11	3						15	15	25	56	44	11	19	6
			2	69	3	14	83	-	55	12	0	33							19	8	55	60	29	7	3						16	15	28	60	45	9	12	5
			E	2	100	0	0	-	50	0	0	50							50	0	100	100	100	0	0						0	0	0	100	100	0	0	0
A frontier leading future science and technology	35	Experimental facilities for recreating the Extremobiosphere.	1	66	8	18	74	-	51	5	6	38							5	10	46	73	5	10	8						10	10	38	69	9	10	10	9
			2	59	10	15	75	-	54	5	4	37							4	5	42	72	4	9	6						6	11	31	77	6	10	8	6
			E	6	100	0	0	-	67	33	0	0							0	0	40	60	0	20	0						0	0	20	80	0	0	20	0
	36	Autonomous robots for deep-sea biosphere that can dig to 5 km below land or the sea floor.	1	89	6	21	73	-	48	21	2	29							10	16	46	71	18	15	9						10	19	35	68	21	14	19	9
			2	80	5	19	76	-	57	16	0	27							7	13	48	73	16	10	7						8	15	34	73	21	10	15	5
			E	4	100	0	0	-	100	0	0	0							25	0	67	100	33	0	0						0	0	33	100	33	0	0	0
	37	Simulation methods for the ecosystem of the planets in the solar system for research on the origin of life.	1	89	10	18	72	-	60	1	9	30							8	17	74	46	6	10	11												
			2	76	9	13	78	-	65	1	5	29							5	12	78	43	4	4	12												
			E	7	100	0	0	-	86	0	0	14							14	0	86	43	14	0	14												
	38	X-ray technology that enables analysis using femtosecond time resolution and nanometer position resolution, with the purpose of the elucidation of biological phenomena such as the transcription process of DNA, and of new drug development.	1	48	13	31	56	-	88	6	2	4							2	11	60	71	29	16	7						2	11	44	65	40	7	14	7
			2	46	11	24	65	-	88	5	0	7							2	5	66	59	22	10	0						0	7	54	66	32	5	7	0
			E	5	100	0	0	-	100	0	0	0							0	0	20	100	20	0	0						0	0	40	80	40	0	0	0
	39	Technology capable of observing the process of various chemical reactions by using quantum beams such as x-rays, neutron beams, and muon beams, for the development of a new storage media or a new high-temperature superconductor.	1	50	12	34	54	-	82	12	4	2							0	12	57	78	20	10	4						0	14	38	74	28	2	19	6
			2	47	15	28	57	-	85	9	2	4							0	7	60	77	16	5	2						0	9	47	72	28	2	12	2
			E	7	100	0	0	-	100	0	0	0							0	0	57	71	29	14	0						0	0	57	71	29	0	14	0
	40	Technology that conducts neuron mapping and the observation of neuron behavior by using externally weak introduced radiation, for the elucidation of the phenomena of human thought.	1	46	4	22	74	-	71	9	7	13							7	13	76	67	21	14	12						9	11	59	63	32	5	17	7
			2	42	10	19	71	-	79	5	3	13							3	5	76	66	16	8	0						5	5	62	69	28	5	10	3
			E	4	100	0	0	-	75	0	0	25							25	0	100	67	0	0	0						25	0	100	67	0	0	0	0

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A frontier leading future science and technology	41	Quantum communications technology that is 1million times as fast as the current optical communications, for high-capacity communications with planetary exploration spacecraft and so on.	1	91	7	22	71	-	69	10	5	16							9 18	52	67	20	15	12						8 18	33	61	36	8	16	11
			2	83	5	23	72	-	70	7	2	21							11 12	58	68	12	9	7						12 12	35	69	28	8	7	6
			E	4	100	0	0	-	67	33	0	0							0 0	25	75	0	25	0						25 25	25	100	0	0	0	0
	42	A system that enables communication with persons or devices located deep under land or the sea floor by adopting new principles such as extremely high frequency vibration waves and gravity waves, for the purpose of resource exploration and environmental research deep under the sea or underground.	1	85	5	21	74	-	65	11	6	18							13 24	65	65	18	10	6						11 25	49	64	26	8	17	6
			2	77	5	21	74	-	74	7	3	16							11 22	71	73	13	7	3						10 22	57	75	22	7	16	1
			E	4	100	0	0	-	100	0	0	0							25 0	50	50	0	25	0						25 0	25	75	0	0	25	0
	43	Fuel cells composed of a closed system (no atmospheric exposure), portable, and capable of providing 10 kw output for one year on a single fueling.	1	80	5	16	79	-	67	22	1	10							13 18	38	63	49	15	7						11 18	29	54	57	11	18	7
			2	70	6	19	75	-	76	15	0	9							10 16	39	71	47	10	6						11 14	31	65	52	8	11	5
			E	4	100	0	0	-	75	25	0	0							25 0	33	67	33	33	0						25 0	25	75	25	50	50	0
	44	Solar photoelectric power generation plants in space that transmit electricity to the ground via microwaves or lasers.	1	153	19	40	41	-	61	16	1	22							9 9	36	73	20	25	15						14 12	25	56	33	26	22	15
			2	129	17	40	43	-	65	9	2	24							12 7	37	72	15	22	9						14 9	23	67	26	27	18	9
			E	22	100	0	0	-	77	9	5	9							0 0	35	75	10	35	10						5 0	25	70	30	30	30	10
Organism and life (origins)	45	A three-dimensional image analysis system that can distinguish tiny ocean organisms (microorganisms and plankton).	1	77	6	27	67	-	70	7	0	23							3 8	52	54	39	17	6						6 11	41	50	40	9	16	3
			2	75	5	28	67	-	70	4	0	26							1 7	65	62	34	9	4						1 10	55	58	42	5	9	2
			E	4	100	0	0	-	75	0	0	25							0 0	75	50	25	0	0						0 25	25	50	50	0	0	0
	46	Technology for the maintenance of environmental stability of large-scale space (exceeding 1000 liters) for the culture and breeding of living organisms in an environment of 100 MPa (which is 1000 hectopascals), 300 degrees, and Ph 1-7 (strong acid) (supposing an environment 1km below hot-spring areas).	1	42	7	14	79	-	54	0	3	43							10 15	57	73	8	19	11						11 16	49	69	9	9	23	9
			2	42	7	14	79	-	44	3	3	50							8 10	56	83	6	8	6						8 11	54	86	6	6	20	3
			E	3	100	0	0	-	33	0	0	67							33 0	33	67	0	33	0						33 0	0	67	0	33	33	0
	47	Establishment of a numerical model for marine ecosystems.	1	83	12	30	58	-	91	1	3	5							0 11	81	69	8	22	19												
			2	80	11	28	61	-	95	0	1	4							0 10	78	74	5	18	15												
			E	9	100	0	0	-	100	0	0	0							0 0	100	67	0	11	33												
Cosmological elementary particles (including space	48	Technology making use of various space observatories for ultra-high precision space measurements and observations of dark matter, gravity waves, submillimeter waves, far infrared rays, radiant energies, x-rays, gamma rays, etc.	1	112	24	29	47	-	74	5	8	13							0 6	68	79	4	11	11						3 11	61	75	5	8	12	17
			2	93	23	27	50	-	85	2	2	11							0 5	73	74	3	8	7						2 9	60	72	5	9	8	14
			E	21	100	0	0	-	100	0	0	0							0 5	71	62	10	14	14						0 10	57	71	10	5	14	14

Area	Topic number	Topic	Round	Responses	Degree of expertise (%)				Importance (%)				Forecasted time of technological realization (to be realized somewhere in the world) (%)						Sectors that will pave the way to technological realization (%)					Forecasted time of social realization (To become applicable/widely used in Japan) (%)						Sectors that will pave the way to social realization (%)					
					High	Moderate	Low	None	Important for Japan and the rest of the world	Especially important for Japan	Especially important for the world	Low importance/priority	Already realized	2011-2015	2016-2020	2021-2030	2031-2040	2041-	will not be realized	don't know	University	Public research organization	Private enterprise	Cooperation	Others	2011-2015	2016-2020	2021-2030	2031-2040	2041-	I don't know will not be realized	University	Public research organization	Private enterprise	Government	Cooperation	Others
Cosmological elementary particles (including space science)	49	Technology to explore difficult-to-detect particles, such as cosmic neutrinos, ultra high energy gamma rays, and dark matter particles, contributing to achievements in space science.	1	80	19	30	51	-	75	6	9	10							0	10	84	72	1	5	13						3	14	70	69	3	6	13	17
			2	71	20	24	56	-	81	3	3	13							0	7	82	62	2	3	6						2	12	71	67	2	5	8	13
			E	14	100	0	0	-	100	0	0	0							0	0	93	50	0	0	0						0	0	71	64	7	0	7	0
	50	Particle accelerator technology leading to breakthroughs in human understanding of the natural world (the origin of the universe, the asymmetric diversity between matter and antimatter, the origin of elements, etc.).	1	80	16	23	61	-	78	3	8	11							3	15	68	70	1	11	31						5	19	61	64	3	7	14	34
			2	74	18	18	64	-	83	0	3	14							1	13	63	70	0	6	22						3	22	58	67	2	9	9	31
			E	13	100	0	0	-	92	0	0	8							8	0	58	83	0	17	17						8	8	58	75	8	8	17	25
	51	A particle accelerator based on a new acceleration principle such as laser-acceleration, that would be the means for the research on ultra high energy phenomena and elementary particles.	1	63	16	27	57	-	69	10	10	11							5	16	70	72	2	9	19						3	17	63	67	4	6	9	26
			2	59	15	22	63	-	76	2	4	18							2	18	71	65	2	4	14						2	18	65	67	2	8	8	22
			E	9	100	0	0	-	89	0	0	11							11	0	100	75	0	13	13						11	0	88	88	0	0	25	13
	52	Technology for the construction of ultra high speed and ultra high capacity computers improved by a factor of several hundred in terms of performance in comparison with the supercomputer called PETA-CON currently under construction, with the purpose of remarkable improvements of human knowledge on elementary particles and the atomic nucleus, and on the origin of the universe and stellar evolution.	1	85	7	34	59	-	69	14	4	13							0	7	40	77	28	20	14						0	11	34	66	28	19	16	15
			2	77	5	31	64	-	73	8	3	16							0	8	37	79	29	15	8						0	11	33	70	26	18	14	14
			E	4	100	0	0	-	75	0	0	25							0	0	50	75	0	0	0						0	0	25	100	0	0	0	0
Artificial structures (large system technology)	53	Construction technology for large-scale (100 m when deployed), ultra-light deployable space antennas with a high packing rate and high accuracy precision.	1	139	23	34	43	-	64	20	5	11							2	5	28	80	30	18	11						4	6	21	73	37	18	21	12
			2	121	18	36	46	-	74	16	2	8							0	7	19	80	29	11	12						3	7	13	79	34	15	14	12
			E	22	100	0	0	-	90	5	0	5							0	0	27	82	41	18	9						0	0	27	82	41	23	23	5
	54	A large-scale system of spacecraft that takes full advantage of the large number of formation flights.	1	142	25	37	38	-	63	15	6	16							4	6	29	76	23	15	18						4	7	24	73	29	18	19	12
			2	118	24	32	44	-	73	8	2	17							3	6	20	83	20	9	15						3	6	15	84	23	15	15	14
			E	28	100	0	0	-	89	7	0	4							0	0	33	78	22	19	11						0	0	35	85	23	27	15	8
	55	Construction technology for a manned, three-dimensional structure with high rigidity for lunar and planetary exploration.	1	118	21	35	44	-	64	10	9	17							2	7	31	79	21	16	14						5	8	22	69	30	20	19	18
			2	97	18	31	51	-	67	6	5	22							2	8	26	82	17	12	16						4	10	21	82	24	14	12	18
			E	17	100	0	0	-	94	0	0	6							0	6	41	82	12	18	18						6	6	38	81	13	13	31	13
	56	Construction of prototype offshore platforms (transportation, communications, production, and active base) that are fixed-type or have a floating structure as the core.	1	110	20	27	53	-	33	54	2	11							2	2	27	62	52	29	3						5	5	17	50	51	33	33	3
			2	95	22	26	52	-	31	57	0	12							1	4	23	70	56	27	2						2	4	12	59	52	23	29	4
			E	21	100	0	0	-	42	53	0	5							0	5	32	63	47	37	0						5	5	21	58	58	21	37	5

Area	Topic number	Topic	Round	Responses	Degree of expertise (%)				Importance (%)				Forecasted time of technological realization (to be realized somewhere in the world) (%)						Sectors that will pave the way to technological realization (%)					Forecasted time of social realization (To become applicable/widely used in Japan) (%)						Sectors that will pave the way to social realization (%)					
					High	Moderate	Low	None	Important for Japan and the rest of the world	Especially important for Japan	Especially important for the world	Low importance/priority	Already realized	2011-2015	2016-2020	2021-2030	2031-2040	2041-	don't know will not be realized	University	Public research organization	Private enterprise	Cooperation	Others	2011-2015	2016-2020	2021-2030	2031-2040	2041-	I don't know will not be realized	University	Public research organization	Private enterprise	Government	Cooperation	Others
Space technologies (including space medicine)	57	Japanese-made highly reliable (high robustness) and competitive (cost-minimization, microminiaturization, and weight-minimization) space equipment (for space transportation and spacecraft, etc.)	1	161	34	29	37	-	22	75	1	2							2	7	25	66	56	19	2						3	9	17	61	59	24	21	3
			2	135	33	29	38	-	23	74	1	2							2	5	20	69	54	16	2						1	7	11	65	62	20	17	3
			E	44	100	0	0	-	20	80	0	0							0	2	19	71	55	10	0						0	0	14	65	77	26	9	5
	58	Planetary exploration and interstellar flight technology using micro space explorers.	1	146	32	29	39	-	49	37	3	11							2	7	41	77	28	11	10						3	11	29	73	35	17	12	10
			2	126	33	24	43	-	58	30	0	12							2	5	40	78	23	8	9						2	6	28	81	31	9	7	7
			E	41	100	0	0	-	58	38	0	5							2	2	39	82	16	8	5						3	0	32	84	24	16	3	3
	59	Technology for searching for extraterrestrial life on other planets.	1	120	8	33	59	-	57	3	13	27							4	17	51	74	5	10	18						7	22	40	68	4	11	12	23
			2	105	10	27	63	-	64	2	9	25							5	13	53	78	2	7	14						6	21	47	74	4	7	8	14
			E	11	100	0	0	-	73	0	18	9							0	0	64	100	9	9	9						9	9	33	89	0	11	0	11
	60	Japan's own manned space system (manned launch vehicle, manned spacecraft).	1	156	26	27	47	-	17	64	0	19							4	8	10	79	36	21	9						5	11	6	64	37	35	20	7
			2	134	28	22	50	-	15	64	0	21							5	8	9	84	34	18	5						2	10	6	71	37	34	14	4
			E	37	100	0	0	-	22	73	0	5							6	3	13	84	34	19	3						3	3	11	74	43	37	11	0
	61	Earth-orbiting space tourism (including educational cultural activities)	1	152	20	27	53	-	44	7	5	44							3	6	5	34	72	22	9						5	12	3	22	79	12	18	8
			2	126	21	25	54	-	53	2	4	41							2	6	4	34	75	18	6						4	8	3	26	79	9	16	4
			E	26	100	0	0	-	88	8	0	4							0	0	8	32	72	8	4						0	4	8	25	79	21	8	4
	62	A permanent manned lunar base (scientific observations from the moon, lunar science, and development of resource utilization technology, etc.).	1	160	22	30	48	-	60	11	9	20							5	11	20	71	22	25	27						6	13	14	60	22	39	23	29
			2	135	18	31	51	-	69	8	5	18							5	12	19	78	16	20	23						7	14	14	69	15	37	20	25
			E	24	100	0	0	-	84	0	8	8							0	0	26	91	9	26	13						4	4	23	68	5	55	18	9
	63	Self-repair technology for spacecraft and self-planning space exploration technology, leading to an autonomous space system.	1	132	23	23	54	-	59	25	5	11							4	12	38	75	29	15	9						4	11	23	69	35	16	15	9
			2	110	23	22	55	-	70	20	2	8							2	9	37	82	27	9	5						4	7	21	79	32	11	12	7
			E	25	100	0	0	-	72	24	4	0							0	0	46	88	25	13	8						0	0	21	88	42	17	8	4
	64	Radical technical measures to counter the debris problem (development of debris-free space systems, collection or disposal by injection into the atmosphere of debris already remaining, etc.)	1	139	24	35	41	-	89	2	7	2							4	7	23	75	17	14	31						4	7	13	63	23	22	19	33
			2	114	25	30	45	-	93	2	2	3							3	6	25	79	13	10	25						2	5	10	71	22	23	10	33
			E	28	100	0	0	-	89	0	7	4							0	4	41	78	7	15	26						0	0	11	78	15	26	11	37

Panel No.6:

Promotion of diverse energy technology innovations

Implementation of the questionnaires

	Sent	Returned (response rate)
<1st Round>	543	468 (86%)
<2nd Round>	467	418 (90%)

Sex	Male	401	Affiliation	Private enterprise	197
	Female	17		University	113
	N.A.	0		Research Institute	61
generation	20’s	5		Association	32
	30’s	49		Others	15
	40’s	110		N.A.	0
	50’s	150	Job category	R&D	313
	60’s	88		Others	105
	70’s and over	16		N.A.	0
	N.A.	0		Total	418

Survey items

A: Nuclear energy

B: Nuclear fusion energy

C: Fossil energy

D: Renewable energy

E: Hydrogen

F: Fuel cells

G: Energy transportation

H: Efficient power storage system

I: Low-carbon transportation

J: Energy management

K: Low-carbon production technology and co-production

L: Energy saving

M: Assessment tools for technology development

Time-series tables of topics

<Technological realization>

year	Topic (First number represents topic ID.)
2013	51: System monitoring the indoor conditions and operation situation of the facilities by using various sensors and measuring instruments, and managing energies and environmental burdens within the building (Building Energy Management System [BEMS]) (various BEMS are diffused to small buildings, where energy saving is automatically implemented.)
	69: Construction technology for energy-autonomous buildings enabling the use of natural energies, natural ventilation, natural lighting, rainwater, groundwater and other natural resources.
2014	18: Concentrated solar power (central tower, solar trough, and solar heat chemical system, etc.).
	52: A home energy management system where electric appliances, solar power devices, and storage cells are integratedly controlled via an inhouse communications network to reduce CO_2 emission.
	55: An energy management system for small factories. (Factory Energy Management System: FEMS)
	72: A quantitative assessment method for the policy effectiveness of the tax system, legal system, emissions trading system, and green certificate system.
2015	22: Technology to foresee wind power outputs.
	71: A social and economic model and tool for an energy system capable of analyzing consumer psychology, security, risks, and policy effectiveness that would have an impact on both the demander and supplier.
2016	49: A demand and supply control system for customers and a distribution system by using batteries for Plug-in Hybrid Electric Vehicles (V2G).
	50: Remarkable energy saving in IT fields (effectiveness doubles) through various technologies, such as low-power Central Processing Units (CPUs), liquid cooling, the integration and virtualization of servers, and Green IT for IT devices and data centers such as power control for air conditioning equipments.
	59: Biomass plantations for energy on idle land with high plant production capacity in sunbelts in the tropics and in other areas that receive much sunlight.
2017	09: Effective utilization technology, such as fuel processing of extra-heavy crude oil and unconventional petroleum resources (oil shales and oil sands)
	10: Processing technology for the co-production of electricity, synthetic fuel, and chemical materials from various raw materials such as coal, biomass and waste (co-production and co-processing).
	33: SOFCs (Solid oxide fuel cells) for stationary use.
	39: A floating liquefied natural gas platform for small and medium gas fields (FLNG).
	54: A system for integrated use of energy and water in block units of urban areas and residential areas, making use of natural- and unused energies and recycled materials. (Such system eases the heat island phenomenon in urban areas and contributes to the creation of low-carbon communities in urban and suburban areas.)
	63: LCDs (Liquid Crystal Displays), PDPs (Plasma Display Panels), advanced organic electroluminescent displays and other materials derived from new principles exceed 10 lm/W in luminous efficiency.

year	Topic (First number represents topic ID.)
2017	64: A high efficiency micro power generator for IC tags, using heat, vibration and other energy sources.
	65: Industrial heat pumps capable of generating steam exceeding 150 degrees C.
	66: Ultra-efficient civil heat pumps (COP≧8 for air conditioners; COP 6 for hot water supply system; including exhaust heat recovery).
2018	15: Large-scaled combined-cycle power generation using gas turbines with large capacity and high efficiency (1700° C or higher temperature at turbine inlet).
	38: A high quality electricity supply system where natural energies are sufficiently utilized and there are no blackouts due to lightning.
	53: Next generation energy transmission and distribution network technology enabling stable, low-cost and low-carbon power supply through the optimum management of the entire demand and supply balance of large power supplies such as nuclear power, distributed power supplies such as solar energies and power demand equipment, by utilizing information and communications technology (ICT).
	56: A co-production process for bio fuels and hydrogen through biomass fermentation and gasification.
	58: Fuel cells using hydrogen and methane derived from biomasses (low-carbon resources).
	67: A micro turbine cogeneration system featuring ultra-lean combustion for high efficiency, enhanced pressure ratio for high power and downsizing, and low-NOx combustors.
	68: Next generation high-efficiency lighting over 150 lm/W (high-efficiency elements of LEDs and organic electroluminescence, etc. and improvement of materials), and highly-efficient, high-color-rendering white light resources, such as microcavities and cluster luminescence.
	70: A power recovery system based on a stirling engine using CO_2-free unused heat sources.
2019	16: Ceramic micro gas turbines with 40% efficiency.
	20: A large-scale thin-film solar cell with a conversion efficiency of 20% or higher.
	21: Power generation technology based on ONE of ocean energy resources (waves, ebbs and flows, tides, or ocean thermal energy) with 1MW capacity or more.
	32: 1kW-class PEFCs (polymer electrolyte fuel cells) for stationary use that cost half-a-million yen or less.
	41: Low-cost secondary cells for vehicles (such as cars) (specific energy: 100 Wh/kg or more, specific power: 2000 W/kg, and specific cost: 30-thousand yen per 1kWh or less).
	48: Technology to lower the friction drag of ships, reducing horsepower demand by 20%.
	57: A co-production system of chemicals and energies under biorefinery.
	61: Low-cost agriculture and forestry aiming at zero emission using local resources, such as biomass and organic wastes.
2020	04: Safe and effective dismantlement technology for decommissioned commercial nuclear power plants.
	08: Advanced Ultra Super Critical pressure power generation (A-USC) using 750 degrees C-class steam turbines.
	13: CO_2 underground sequestration technology accompanying a long-term monitoring technique.
	17: Highly efficient power generation technology combining coal gasification and fuel cells. (Integrated coal Gasification Fuel Cell combined cycle: IGFC)

year	Topic (First number represents topic ID.)
2020	27: A hydrogen production process that uses solar energy to decompose water.
	34: A combined system based on fuel cells (Molten Carbonate Fuel Cells and solid oxide fuel cells).
	45: A hydrogen supply infrastructure network for fuel cell powered vehicles (hydrogen stations in 5000 sites)
	47: FC-powered ships and railcars
	60: Technology for a 25% reduction of CO_2 emission through the optimum combination of non-fossil energy.
2021	19: New material technology for solar cells leading to higher efficiency than silicon or GaAs.
	24: Technology to produce CO_2-free hydrogen from fossil fuels in combination with carbon dioxide capture and storage (CCS) technology.
	29: Hydrogen transfer- and storage technology that enables a low-cost hydrogen supply within Japan.
	42: Megawatt-scale low-cost secondary cells for the stabilization of transmission lines (cycle life: 20 years or more, cost: 15 thousand yen per 1kWh or less).
2022	06: Geological disposal technology for high level radioactive waste.
	12: Low cost carbon separation technology with low energy consumption (up to 1000 yen per ton of CO_2).
	14: Technology to utilize physically, chemically or biologically fixed CO_2 effectively
	31: A semi-gigawatt scaled, MCFC (Molten Carbonate Fuel Cell) based power station.
	37: Techniques for handling methane hydrates as the means for natural gas transportation.
	46: Polymer electrolyte fuel cells for automobiles (cycle life: 15 years or more, cost: four-thousand yen per kilowatt or less, a million cases per year, without external humidification and capable of operating at temperatures from -40 to 120 degrees C.)
	62: Simultaneous water purification and fuel production in an aquatic biomass plantation.
2023	03: Micro nuclear reactors for cogeneration.
	11: Technology to extract and utilize methane hydrates.
2024	44: 50 kWh and 1 MW-class superconducting flywheels for an energy storage system.
2025	36: An international power transmission network including Japan.
	43: A semi-megawatt-scale superconducting magnetic energy storage (SMES) system to maintain power quality (cost of 50 to 70-thousand yen per kilowatt).
2026	01: Next generation light water reactor standard technology with such merits as the capability for enriched fuel over 5%, 80-year durability, and no location restrictions thanks to the adoption of seismic technology.
	25: Innovative hydrogen storage material technology (hydrogen storage capacity of more than 10 wt%, and desorption temperature of 100 degrees C).
	26: Hydrogen production technology at ultra high temperatures using nuclear power, solar heat and geothermic heat, etc.
	28: International trading network of CO_2-free hydrogen produced by renewable energies (such as wind power and solar energy, etc.)
2027	40: A superconducting power grid.
2029	02: Fast breeder reactor cycle technology.

year	Topic (First number represents topic ID.)
2033	05: Technology to reduce waste dramatically through the nuclear transformation of radionuclides in high level waste.
2035	23: A solar power generation system in space (a system of generating power from sunlight in space and transmitting the electricity to the ground).
2041-	07: Nuclear fusion power generation.

<Social realization>

year	Topic (First number represents topic ID.)
2018	51: System monitoring the indoor conditions and operation situation of the facilities by using various sensors and measuring instruments, and managing energies and environmental burdens within the building (Building Energy Management System [BEMS]) (various BEMS are diffused to small buildings, where energy saving is automatically implemented.)
2019	22: Technology to foresee wind power outputs.
	30: Dissemination of portable fuel cells for mobile devices.
	35: Spread of a residential energy system integrating renewable energies such as solar cells, and fuel cells.
	52: A home energy management system where electric appliances, solar power devices, and storage cells are integratedly controlled via an inhouse communications network to reduce CO_2 emission.
	55: An energy management system for small factories. (Factory Energy Management System: FEMS)
	72: A quantitative assessment method for the policy effectiveness of the tax system, legal system, emissions trading system, and green certificate system.
2020	50: Remarkable energy saving in IT fields (effectiveness doubles) through various technologies, such as low-power Central Processing Units (CPUs), liquid cooling, the integration and virtualization of servers, and Green IT for IT devices and data centers such as power control for air conditioning equipments.
	69: Construction technology for energy-autonomous buildings enabling the use of natural energies, natural ventilation, natural lighting, rainwater, groundwater and other natural resources.
	71: A social and economic model and tool for an energy system capable of analyzing consumer psychology, security, risks, and policy effectiveness that would have an impact on both the demander and supplier.
2022	49: A demand and supply control system for customers and a distribution system by using batteries for Plug-in Hybrid Electric Vehicles (V2G).
	66: Ultra-efficient civil heat pumps (COP 8 for air conditioners; COP$\geqq$6 for hot water supply system; including exhaust heat recovery).
2023	18: Concentrated solar power (central tower, solar trough, and solar heat chemical system, etc.).
	39: A floating liquefied natural gas platform for small and medium gas fields (FLNG).
	63: LCDs (Liquid Crystal Displays), PDPs (Plasma Display Panels), advanced organic electroluminescent displays and other materials derived from new principles exceed 10 lm/W in luminous efficiency.
	64: A high efficiency micro power generator for IC tags, using heat, vibration and other energy sources.

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2023	65: Industrial heat pumps capable of generating steam exceeding 150 degrees C.
	67: A micro turbine cogeneration system featuring ultra-lean combustion for high efficiency, enhanced pressure ratio for high power and downsizing, and low-NOx combustors.
	68: Next generation high-efficiency lighting over 150 lm/W (high-efficiency elements of LEDs and organic electroluminescence, etc. and improvement of materials), and highly-efficient, high-color-rendering white light resources, such as microcavities and cluster luminescence.
2024	10: Processing technology for the co-production of electricity, synthetic fuel, and chemical materials from various raw materials such as coal, biomass and waste (co-production and co-processing).
	32: 1kW-class PEFCs (polymer electrolyte fuel cells) for stationary use that cost half-a-million yen or less.
	33: SOFCs (Solid oxide fuel cells) for stationary use.
2025	09: Effective utilization technology, such as fuel processing of extra-heavy crude oil and unconventional petroleum resources (oil shales and oil sands)
	15: Large-scaled combined-cycle power generation using gas turbines with large capacity and high efficiency (1700° C or higher temperature at turbine inlet).
	41: Low-cost secondary cells for vehicles (such as cars) (specific energy: 100 Wh/kg or more, specific power: 2000 W/kg, and specific cost: 30-thousand yen per 1kWh or less).
	53: Next generation energy transmission and distribution network technology enabling stable, low-cost and low-carbon power supply through the optimum management of the entire demand and supply balance of large power supplies such as nuclear power, distributed power supplies such as solar energies and power demand equipment, by utilizing information and communications technology (ICT).
	54: A system for integrated use of energy and water in block units of urban areas and residential areas, making use of natural- and unused energies and recycled materials. (Such system eases the heat island phenomenon in urban areas and contributes to the creation of low-carbon communities in urban and suburban areas.)
	56: A co-production process for bio fuels and hydrogen through biomass fermentation and gasification.
2026	38: A high quality electricity supply system where natural energies are sufficiently utilized and there are no blackouts due to lightning.
	58: Fuel cells using hydrogen and methane derived from biomasses (low-carbon resources).
	59: Biomass plantations for energy on idle land with high plant production capacity in sunbelts in the tropics and in other areas that receive much sunlight.
2027	08: Advanced Ultra Super Critical pressure power generation (A-USC) using 750 degrees C-class steam turbines.
	16: Ceramic micro gas turbines with 40% efficiency.
	20: A large-scale thin-film solar cell with a conversion efficiency of 20% or higher.
	48: Technology to lower the friction drag of ships, reducing horsepower demand by 20%.
	61: Low-cost agriculture and forestry aiming at zero emission using local resources, such as biomass and organic wastes.
	70: A power recovery system based on a stirling engine using CO_2-free unused heat sources.
2028	04: Safe and effective dismantlement technology for decommissioned commercial nuclear power plants.

year	Topic (First number represents topic ID.)
2028	34: A combined system based on fuel cells (Molten Carbonate Fuel Cells and solid oxide fuel cells).
	57: A co-production system of chemicals and energies under biorefinery.
2029	12: Low cost carbon separation technology with low energy consumption (up to 1000 yen per ton of CO_2).
	13: CO_2 underground sequestration technology accompanying a long-term monitoring technique.
	17: Highly efficient power generation technology combining coal gasification and fuel cells. (Integrated coal Gasification Fuel Cell combined cycle: IGFC)
	19: New material technology for solar cells leading to higher efficiency than silicon or GaAs.
	24: Technology to produce CO_2-free hydrogen from fossil fuels in combination with carbon dioxide capture and storage (CCS) technology.
	42: Megawatt-scale low-cost secondary cells for the stabilization of transmission lines (cycle life: 20 years or more, cost: 15 thousand yen per 1kWh or less).
	47: FC-powered ships and railcars
	60: Technology for a 25% reduction of CO_2 emission through the optimum combination of non-fossil energy.
2030	21: Power generation technology based on ONE of ocean energy resources (waves, ebbs and flows, tides, or ocean thermal energy) with 1MW capacity or more .
	45: A hydrogen supply infrastructure network for fuel cell powered vehicles (hydrogen stations in 5000 sites)
	62: Simultaneous water purification and fuel production in an aquatic biomass plantation.
2031	11: Technology to extract and utilize methane hydrates.
	14: Technology to utilize physically, chemically or biologically fixed CO_2 effectively
	29: Hydrogen transfer- and storage technology that enables a low-cost hydrogen supply within Japan.
	31: A semi-gigawatt scaled, MCFC (Molten Carbonate Fuel Cell) based power station.
	46: Polymer electrolyte fuel cells for automobiles (cycle life: 15 years or more, cost: four-thousand yen per kilowatt or less, a million cases per year, without external humidification and capable of operating at temperatures from -40 to 120 degrees C.)
2032	27: A hydrogen production process that uses solar energy to decompose water.
	37: Techniques for handling methane hydrates as the means for natural gas transportation.
2033	03: Micro nuclear reactors for cogeneration.
	44: 50 kWh and 1 MW-class superconducting flywheels for an energy storage system.
2034	01: Next generation light water reactor standard technology with such merits as the capability for enriched fuel over 5%, 80-year durability, and no location restrictions thanks to the adoption of seismic technology.
	06: Geological disposal technology for high level radioactive waste.
	25: Innovative hydrogen storage material technology (hydrogen storage capacity of more than 10 wt%, and desorption temperature of 100 degrees C).
2035	28: International trading network of CO_2-free hydrogen produced by renewable energies (such as wind power and solar energy, etc.)
	36: An international power transmission network including Japan.

year	Topic (First number represents topic ID.)
2035	43: A semi-megawatt-scale superconducting magnetic energy storage (SMES) system to maintain power quality (cost of 50 to 70-thousand yen per kilowatt).
2036	26: Hydrogen production technology at ultra high temperatures using nuclear power, solar heat and geothermic heat, etc.
2037	40: A superconducting power grid.
2038	02: Fast breeder reactor cycle technology.
2040	05: Technology to reduce waste dramatically through the nuclear transformation of radionuclides in high level waste.
2041-	23: A solar power generation system in space (a system of generating power from sunlight in space and transmitting the electricity to the ground).
	07: Nuclear fusion power generation.

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Nuclear energy	1	Next generation light water reactor standard technology with such merits as the capability for enriched fuel over 5%, 80-year durability, and no location restrictions thanks to the adoption of seismic technology.	1	205	12	21	67	-	55	36	3	6							2	10	9	41	56	39	7						4	9	5	23	59	30	25	8
			2	188	12	18	70	-	60	34	3	3							2	9	7	37	61	39	3						3	7	2	20	68	24	26	4
			E	23	100	0	0	-	65	22	0	13							4	0	4	35	83	26	0						9	0	4	17	83	30	22	0
	2	Fast breeder reactor cycle technology.	1	233	15	16	69	-	57	37	2	4							2	6	13	72	27	32	11						2	7	5	44	39	41	29	8
			2	218	14	16	70	-	62	34	2	2							1	2	9	74	27	34	5						2	5	4	48	38	39	29	4
			E	30	100	0	0	-	70	27	0	3							0	0	10	80	27	43	7						10	0	7	63	43	33	30	3
	3	Micro nuclear reactors for cogeneration.	1	185	12	17	71	-	36	13	18	33							11	10	13	47	50	28	7						21	14	9	24	55	24	23	11
			2	177	10	16	74	-	43	11	14	32							7	8	9	48	56	24	5						13	9	3	21	66	20	19	6
			E	18	100	0	0	-	39	6	33	22							6	0	6	50	56	28	0						33	0	0	25	75	0	13	6
	4	Safe and effective dismantlement technology for decommissioned commercial nuclear power plants.	1	207	8	23	69	-	85	12	3	0							0	6	4	47	54	37	6						0	5	5	29	63	27	31	5
			2	194	8	19	73	-	89	9	2	0							0	4	4	48	53	39	4						1	2	3	29	67	24	30	3
			E	16	100	0	0	-	87	13	0	0							0	0	6	38	75	38	0						0	0	13	27	80	20	27	0
	5	Technology to reduce waste dramatically through the nuclear transformation of radionuclides in high level waste.	1	181	15	18	67	-	74	13	2	11							7	14	30	75	13	25	7						9	16	17	61	24	31	25	9
			2	168	14	16	70	-	77	10	2	11							6	13	28	74	12	25	5						7	16	13	61	20	27	22	7
			E	23	100	0	0	-	68	5	0	27							18	0	17	83	17	17	9						17	0	17	74	13	22	17	9
	6	Geological disposal technology for high level radioactive waste.	1	217	10	24	66	-	77	17	3	3							2	6	12	64	25	40	7						3	9	7	43	33	46	33	7
			2	198	11	23	66	-	85	10	2	3							2	4	9	71	24	38	3						1	5	5	44	27	48	30	5
			E	21	100	0	0	-	95	5	0	0							0	0	5	70	30	40	0						0	5	0	58	26	53	32	5
Nuclear fusion energy	7	Nuclear fusion power generation.	1	242	9	16	75	-	73	7	3	17							13	17	33	63	8	23	30						14	23	17	48	17	29	27	28
			2	232	7	17	76	-	77	6	2	15							10	13	27	70	5	20	25						13	21	15	57	13	28	22	26
			E	17	100	0	0	-	88	0	0	12							12	0	19	81	0	0	19						24	6	13	81	0	6	19	0
Fossil energy	8	Advanced Ultra Super Critical pressure power generation (A-USC) using 750°-C-class steam turbines.	1	214	8	25	67	-	58	17	13	12							1	6	9	27	76	25	4						2	9	4	15	83	15	19	5
			2	198	8	24	68	-	67	14	10	9							1	5	7	22	82	17	2						0	7	2	14	91	10	13	3
			E	15	100	0	0	-	73	13	7	7							0	0	20	27	80	33	7						0	0	0	14	93	21	7	7

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Fossil energy	9	Effective utilization technology, such as fuel processing of extra-heavy crude oil and unconventional petroleum resources (oil shales and oil sands).	1	229	12	29	59	-	57	15	18	10							1	4	12	34	65	28	7						8	10	7	20	67	17	25	6
			2	211	11	27	62	-	63	10	19	8							0	2	10	29	78	21	3						4	7	3	16	78	11	21	3
			E	23	100	0	0	-	73	9	18	0							0	0	27	36	95	9	0						4	4	0	19	86	24	19	0
	10	Processing technology for the co-production of electricity, synthetic fuel, and chemical materials from various raw materials such as coal, biomass and waste (co-production and co-processing).	1	263	17	25	58	-	70	18	4	8							1	4	26	38	59	39	2						2	6	11	20	68	22	30	3
			2	246	13	26	61	-	73	16	4	7							1	2	20	33	68	33	2						1	3	7	17	76	17	25	2
			E	33	100	0	0	-	75	13	3	9							0	0	15	36	55	48	3						0	0	6	18	76	30	36	3
	11	Technology to extract and utilize methane hydrates.	1	240	9	23	68	-	35	53	2	10							3	6	19	62	38	40	8						6	9	13	35	42	35	39	9
			2	234	8	20	72	-	32	59	1	8							1	3	15	66	36	39	4						2	7	8	36	45	32	39	5
			E	18	100	0	0	-	44	50	0	6							0	6	33	67	56	44	22						0	6	28	50	50	56	50	22
	12	Low cost carbon separation technology with low energy consumption (up to 1000 yen per ton of CO_2).	1	298	14	29	57	-	81	7	5	7							7	9	28	50	49	37	6						7	10	14	30	56	31	34	6
			2	275	13	27	60	-	88	3	4	5							5	7	21	57	51	33	4						5	7	8	32	64	24	33	5
			E	37	100	0	0	-	97	0	3	0							3	0	19	57	54	35	8						6	3	3	24	58	33	36	9
	13	CO_2 underground sequestration technology accompanying a long-term monitoring technique.	1	269	9	28	63	-	69	7	9	15							7	6	17	55	34	39	12						11	8	11	40	36	38	34	11
			2	251	9	24	67	-	77	5	5	13							5	4	13	60	35	39	7						7	9	7	43	37	33	35	7
			E	22	100	0	0	-	86	14	0	0							0	0	14	50	50	45	5						0	0	10	38	33	33	43	10
	14	Technology to utilize physically, chemically or biologically fixed CO_2 effectively.	1	265	12	28	60	-	76	7	4	13							6	9	53	55	28	29	7						7	12	27	40	43	24	33	7
			2	245	10	24	66	-	82	4	3	11							6	7	52	63	22	24	5						5	10	23	45	46	18	30	5
			E	24	100	0	0	-	83	0	4	13							8	8	71	48	48	29	10						9	13	41	32	50	23	32	9
	15	Large-scaled combined-cycle power generation using gas turbines with large capacity and high efficiency (1700 degrees C or higher temperature at turbine inlet).	1	262	10	30	60	-	68	23	3	6							2	5	11	24	83	19	1						2	5	7	14	86	12	17	2
			2	240	9	31	60	-	74	21	2	3							2	3	6	20	91	12	1						2	3	3	14	90	7	13	1
			E	21	100	0	0	-	52	43	0	5							0	0	5	24	95	14	0						0	0	5	14	76	19	24	0
	16	Ceramic micro gas turbines with 40% efficiency.	1	200	5	34	61	-	43	23	3	31							8	16	18	33	72	15	1						9	17	9	20	81	11	15	1
			2	197	5	28	67	-	46	20	3	31							5	11	13	28	81	9	1						6	10	9	19	86	6	10	1
			E	10	100	0	0	-	40	20	0	40							10	0	20	30	70	20	0						10	10	20	20	90	10	10	0

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																					University	Public research organization	Private enterprise	Collaboration of multiple sectors	Others																		
Fossil energy	17	Highly efficient power generation technology combining coal gasification and fuel cells. (Integrated coal Gasification Fuel Cell combined cycle: IGFC)	1	260	18	30	52	-	62	21	6	11							3	9	17	41	59	36	4						5	9	9	26	72	20	32	3
			2	246	16	29	55	-	68	17	5	10							2	4	10	38	64	33	2						4	6	5	24	76	16	26	2
			E	39	100	0	0	-	74	13	3	10							3	0	15	28	56	59	3						10	0	11	18	74	21	39	0
Renewable energy	18	Concentrated solar power (central tower, solar trough, and solar heat chemical system, etc.).	1	303	11	31	58	-	45	5	38	12							1	2	16	38	54	32	7						14	7	11	24	55	24	30	7
			2	290	7	31	62	-	49	3	40	8							1	2	12	32	64	30	5						11	5	6	19	68	19	24	4
			E	19	100	0	0	-	48	5	47	0							0	0	11	21	74	11	0						11	5	5	16	68	5	26	0
	19	New material technology for solar cells leading to higher efficiency than silicon or GaAs.	1	263	11	28	61	-	78	16	2	4							4	10	58	47	50	18	2						5	11	24	29	66	17	19	2
			2	251	8	26	66	-	83	13	1	3							3	9	57	46	59	13	1						4	9	23	29	75	12	15	1
			E	19	100	0	0	-	79	16	0	5							0	11	83	44	61	11	0						6	11	17	28	72	17	11	0
	20	A large-scale thin-film solar cell with a conversion efficiency of 20% or higher.	1	291	11	30	59	-	79	17	3	1							1	6	39	40	67	21	1						1	6	16	23	79	18	19	2
			2	278	8	28	64	-	84	13	2	1							0	4	38	39	72	17	1						1	4	15	19	84	12	15	1
			E	21	100	0	0	-	89	11	0	0							0	0	63	42	63	16	0						0	0	16	26	79	5	11	0
	21	Power generation technology based on ONE of ocean energy resources (waves, ebbs and flows, tides, or ocean thermal energy) with 1MW capacity or more.	1	263	7	22	71	-	42	26	9	23							8	8	29	54	30	34	6						12	13	15	35	39	25	35	5
			2	253	6	19	75	-	50	24	6	20							7	7	25	60	28	34	4						11	11	14	37	44	20	34	3
			E	16	100	0	0	-	88	6	0	6							0	0	56	69	56	38	0						6	0	38	63	63	38	31	0
	22	Technology to foresee wind power outputs.	1	271	8	25	67	-	52	16	14	18							7	8	35	47	41	24	2						6	9	21	37	51	13	24	2
			2	251	8	23	69	-	62	13	11	14							5	5	33	52	47	16	2						4	6	18	38	61	9	16	2
			E	19	100	0	0	-	76	6	18	0							0	0	47	47	47	16	0						0	0	39	50	67	11	17	0
	23	A solar power generation system in space (a system of generating power from sunlight in space and transmitting the electricity to the ground).	1	253	5	22	73	-	42	5	8	45							25	16	34	61	11	22	20						29	19	21	38	17	30	24	23
			2	243	3	19	78	-	44	4	5	47							25	13	35	69	8	16	16						29	15	19	48	11	29	19	19
			E	8	100	0	0	-	49	13	0	38							25	25	38	63	0	25	13						50	13	25	38	13	38	25	25
Hydrogen	24	Technology to produce CO_2-free hydrogen from fossil fuels in combination with carbon dioxide capture and storage (CCS) technology.	1	258	22	30	48	-	61	13	6	20							8	6	26	48	44	41	6						14	8	13	29	48	29	35	6
			2	242	19	31	50	-	64	10	6	20							8	4	19	52	45	36	5						11	7	10	29	56	22	32	5
			E	46	100	0	0	-	64	9	7	20							4	0	23	34	52	57	11						11	4	12	16	65	30	47	9

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Hydrogen	25	Innovative hydrogen storage material technology (hydrogen storage capacity of more than 10 wt%, and desorption temperature of 100 degrees C).	1	201	17	20	63	-	72	9	3	16							9	9	55	59	30	25	4						9	9	28	36	52	18	30	5
			2	184	16	20	64	-	79	3	2	16							8	8	51	64	30	24	3						9	9	22	37	58	12	27	4
			E	29	100	0	0	-	85	4	0	11							14	10	64	68	21	25	0						17	10	30	30	52	11	33	0
	26	Hydrogen production technology at ultra high temperatures using nuclear power, solar heat and geothermic heat, etc.	1	228	14	25	61	-	59	14	6	21							8	9	31	70	26	27	6						12	11	18	45	36	25	35	5
			2	208	10	27	63	-	64	11	5	20							6	8	33	78	23	22	5						10	8	14	53	41	19	35	3
			E	21	100	0	0	-	57	5	0	38							14	5	33	76	14	33	5						16	5	16	37	42	21	32	0
	27	A hydrogen production process that uses solar energy to decompose water.	1	234	17	28	55	-	64	8	7	21							4	12	55	55	27	22	5						11	16	29	41	43	21	30	5
			2	223	13	29	58	-	71	6	4	19							5	8	53	62	25	17	3						11	11	21	49	48	11	25	3
			E	28	100	0	0	-	71	4	4	21							14	0	71	64	18	25	4						18	11	32	50	32	7	29	0
	28	International trading network of CO_2-free hydrogen produced by renewable energies (such as wind power and solar energy, etc.)	1	251	16	29	55	-	58	7	8	27							13	9	26	48	25	45	25						17	14	17	27	27	36	44	26
			2	238	12	27	61	-	64	5	6	25							13	9	19	54	21	48	20						15	12	11	28	30	33	52	22
			E	29	100	0	0	-	80	3	10	7							0	3	28	55	24	66	28						3	7	14	28	41	45	59	31
	29	Hydrogen transfer- and storage technology that enables a low-cost hydrogen supply within Japan.	1	253	19	27	54	-	43	37	3	17							6	7	27	43	47	44	3						7	10	14	27	56	31	38	3
			2	226	16	26	58	-	50	32	2	16							3	5	20	46	52	43	2						6	8	9	26	60	26	39	2
			E	37	100	0	0	-	58	36	0	6							0	0	24	43	57	65	3						5	5	11	22	75	47	47	3
Fuel cells	30	Dissemination of portable fuel cells for mobile devices.	1	288	16	27	57	-	48	15	3	34																			10	7	9	11	88	10	9	1
			2	264	13	26	61	-	52	10	2	36																			7	6	5	7	94	5	6	2
			E	34	100	0	0	-	55	12	3	30																			12	0	9	6	94	0	13	0
	31	A semi-gigawatt scaled, MCFC (Molten Carbonate Fuel Cell) based power station.	1	241	16	28	56	-	49	16	5	30							16	11	13	42	63	33	4						20	14	9	30	63	21	28	5
			2	225	15	26	59	-	52	12	3	33							13	8	9	42	69	27	2						17	11	6	27	73	12	27	4
			E	33	100	0	0	-	52	3	0	45							30	3	0	33	63	40	10						40	3	0	26	63	19	44	11
	32	1kW-class PEFCs (polymer electrolyte fuel cells) for stationary use that cost half-a-million yen or less.	1	273	26	29	45	-	49	34	3	14							5	3	20	32	83	25	2						6	4	12	22	84	19	17	2
			2	256	22	28	50	-	50	34	2	14							4	3	12	27	87	20	2						5	3	6	18	91	12	13	2
			E	57	100	0	0	-	54	37	0	9							2	2	16	28	89	28	4						5	2	11	24	98	26	17	4

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Fuel cells	33	SOFCs (Solid oxide fuel cells) for stationary use.	1	268	26	29	45	-	63	27	2	8							1	3	30	42	77	27	3						2	4	14	26	80	21	22	4
			2	250	24	28	48	-	70	21	1	8							1	1	21	37	81	22	2						2	2	8	24	85	16	18	2
			E	61	100	0	0	-	83	15	0	2							0	0	31	39	89	31	7						0	0	17	28	93	25	22	5
	34	A combined system based on fuel cells (Molten Carbonate Fuel Cells and solid oxide fuel cells).	1	238	19	30	51	-	61	22	3	14							2	6	22	40	72	30	4						3	7	10	25	77	20	23	3
			2	225	18	30	52	-	67	18	2	13							2	5	13	37	77	25	3						2	5	5	22	83	12	24	3
			E	40	100	0	0	-	82	3	0	15							0	3	18	31	82	28	5						3	0	8	16	86	24	27	3
	35	Spread of a residential energy system integrating renewable energies such as solar cells, and fuel cells.	1	345	20	33	47	-	49	35	1	15																			6	4	7	14	82	36	17	2
			2	317	20	32	48	-	55	29	1	15																			4	2	3	9	88	29	15	1
			E	64	100	0	0	-	60	29	0	11																			3	2	6	18	79	34	23	3
Energy transportation	36	An international power transmission network including Japan.	1	231	13	25	62	-	45	12	10	33							17	13	10	27	32	35	31						24	20	8	17	37	36	27	28
			2	211	13	23	64	-	51	12	8	29							14	7	6	24	31	44	29						20	14	5	15	40	38	25	27
			E	27	100	0	0	-	69	8	0	23							19	8	8	25	46	42	33						17	13	9	13	57	30	30	30
	37	Techniques for handling methane hydrates as the means for natural gas transportation.	1	181	9	21	70	-	32	43	4	21							6	7	16	49	52	28	5						9	10	8	27	61	23	31	5
			2	175	9	21	70	-	32	46	3	19							5	4	9	51	58	25	2						9	7	5	23	73	18	28	3
			E	16	100	0	0	-	31	25	0	44							6	0	13	40	87	20	27						19	0	7	29	100	29	43	21
	38	A high quality electricity supply system where natural energies are sufficiently utilized and there are no blackouts due to lightning.	1	254	21	31	48	-	56	25	6	13							4	4	18	32	62	38	3						5	6	11	22	64	23	33	3
			2	236	19	28	53	-	67	16	3	14							4	1	10	25	67	34	1						3	4	6	16	73	17	28	1
			E	44	100	0	0	-	73	14	2	11							7	0	12	16	79	28	0						5	5	12	5	79	12	23	0
	39	A floating liquefied natural gas platform for small and medium gas fields (FLNG).	1	143	12	26	62	-	45	33	5	17							3	7	10	25	74	23	6						4	9	3	20	72	22	21	4
			2	142	11	21	68	-	48	35	4	13							2	4	6	20	84	19	1						2	7	1	16	86	15	16	1
			E	16	100	0	0	-	62	38	0	0							0	0	13	25	88	13	6						0	0	0	13	100	19	6	0
	40	A superconducting power grid.	1	237	13	24	63	-	54	10	10	26							14	9	29	49	43	30	7						18	12	17	30	54	25	29	6
			2	216	11	24	65	-	58	9	8	25							13	8	23	52	43	31	4						16	13	13	28	63	19	28	5
			E	23	100	0	0	-	70	9	4	17							13	0	23	36	45	41	5						17	9	18	14	77	5	23	5

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Efficient power storage system	41	Low-cost secondary cells for vehicles (such as cars) (specific energy: 100 Wh/kg or more, specific power: 2000 W/kg, and specific cost: 30-thousand yen per 1kWh or less).	1	233	18	29	53	-	82	15	1	2							3	6	33	37	78	24	2						3	6	14	22	83	19	18	2
			2	214	17	27	56	-	89	9	0	2							3	4	24	33	84	20	0						3	4	9	17	88	14	15	1
			E	36	100	0	0	-	94	6	0	0							8	3	26	34	77	29	0						8	3	12	15	79	15	24	0
	42	Megawatt-scale low-cost secondary cells for the stabilization of transmission lines (cycle life: 20 years or more, cost: 15 thousand yen per 1kWh or less).	1	215	20	29	51	-	67	24	1	8							5	8	27	39	72	25	1						5	8	13	24	79	19	21	3
			2	199	19	27	54	-	72	19	1	8							3	4	18	34	82	18	1						3	4	8	18	85	13	16	1
			E	38	100	0	0	-	81	8	0	11							5	3	19	28	78	28	0						5	3	11	19	69	17	28	0
	43	A semi-megawatt-scale superconducting magnetic energy storage (SMES) system to maintain power quality (cost of 50 to 70-thousand yen per kilowatt).	1	170	10	32	58	-	36	19	2	43							11	10	31	48	45	23	4						16	11	12	35	58	18	21	3
			2	157	10	31	59	-	41	11	3	45							10	11	22	54	46	22	1						14	11	9	32	64	12	20	1
			E	15	100	0	0	-	46	7	0	47							7	0	20	33	67	27	0						7	0	13	7	80	7	20	0
	44	50 kWh and 1 MW-class superconducting flywheels for an energy storage system.	1	166	8	28	64	-	34	19	2	45							9	13	28	46	48	24	5						14	14	15	32	56	19	22	4
			2	159	7	26	67	-	33	15	2	50							10	11	19	48	52	22	1						16	13	10	30	63	13	22	1
			E	11	100	0	0	-	27	18	9	46							9	0	10	30	60	30	0						20	0	9	9	73	9	27	0
Low-carbon transportation	45	A hydrogen supply infrastructure network for fuel cell powered vehicles (hydrogen stations in 5000 sites)	1	290	19	29	52	-	47	25	2	26							12	5	9	27	57	50	5						15	8	6	16	58	48	39	3
			2	262	18	27	55	-	57	19	1	23							9	3	4	22	61	53	3						13	6	2	11	63	44	38	2
			E	47	100	0	0	-	74	15	2	9							4	0	2	23	70	66	11						4	0	0	15	68	66	38	6
	46	Polymer electrolyte fuel cells for automobiles (cycle life: 15 years or more, cost: four-thousand yen per kilowatt or less, a million cases per year, without external humidification and capable of operating at temperatures from -40 to 120 dgrees C.)	1	246	24	26	50	-	59	12	4	25							8	7	29	37	76	26	4						12	8	13	23	78	25	23	4
			2	235	20	26	54	-	66	9	2	23							7	4	18	30	84	20	3						9	7	6	17	84	19	19	3
			E	47	100	0	0	-	85	4	0	11							6	0	24	33	87	31	2						9	2	9	20	87	20	29	2
	47	FC-powered ships and railcars	1	250	17	27	56	-	54	13	6	27							8	8	14	38	70	29	4						10	10	7	21	72	21	26	3
			2	231	15	25	60	-	61	9	4	26							7	6	8	30	76	25	3						8	7	3	15	82	15	25	3
			E	35	100	0	0	-	77	0	6	17							3	0	11	26	83	29	3						6	0	6	12	88	15	26	3
	48	Technology to lower the friction drag of ships, reducing horsepower demand by 20%.	1	115	8	22	70	-	67	22	2	9							2	8	38	50	61	22	3						4	8	15	26	78	13	15	3
			2	113	7	21	72	-	75	16	2	7							3	4	27	48	63	20	0						3	5	13	23	81	6	14	0
			E	8	100	0	0	-	74	13	0	13							25	0	25	63	63	25	0						25	0	0	38	63	25	25	0

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Energy management	49	A demand and supply control system for customers and a distribution system by using batteries for Plug-in Hybrid Electric Vehicles (V2G).	1	298	18	30	52	-	60	23	3	14							3	3	16	27	72	37	3						5	5	9	15	71	30	35	3
			2	275	16	31	53	-	68	17	2	13							2	3	9	22	79	33	1						4	3	3	11	78	22	34	1
			E	45	100	0	0	-	72	14	5	9							5	2	24	31	79	38	5						10	2	7	14	76	31	38	5
	50	Remarkable energy saving in IT fields (effectiveness doubles) through various technologies, such as low-power Central Processing Units (CPUs), liquid cooling, the integration and virtualization of servers, and Green IT for IT devices and data centers such as power control for air conditioning equipments.	1	217	11	28	61	-	77	14	3	6							0	1	16	22	82	21	0						1	1	9	13	83	14	20	1
			2	197	11	26	63	-	84	10	2	4							1	1	11	22	85	17	0						2	0	6	11	88	10	18	0
			E	22	100	0	0	-	90	10	0	0							0	0	19	19	71	19	0						0	0	10	10	95	10	19	0
	51	System monitoring the indoor conditions and operation situation of the facilities by using various sensors and measuring instruments, and managing energies and environmental burdens within the building (Building Energy Management System [BEMS]) (various BEMS are diffused to small buildings, where energy saving is automatically implemented.)	1	262	20	31	49	-	72	20	2	6							0	0	14	19	82	25	2						0	0	7	12	80	23	24	2
			2	242	19	29	52	-	78	15	2	5							0	0	10	12	88	20	3						0	0	4	8	87	16	22	2
			E	47	100	0	0	-	85	11	2	2							0	0	9	7	87	24	7						2	0	4	7	85	15	22	4
	52	A home energy management system where electric appliances, solar power devices, and storage cells are integratedly controlled via an inhouse communications network to reduce CO_2 emission.	1	289	18	31	51	-	59	27	2	12							1	1	13	23	80	27	2						2	2	7	13	78	26	26	2
			2	262	18	31	51	-	66	22	2	10							0	1	8	17	86	25	1						2	2	4	7	86	21	23	1
			E	46	100	0	0	-	73	16	2	9							2	0	11	18	82	31	4						7	2	9	9	79	23	30	5
	53	Next generation energy transmission and distribution network technology enabling stable, low-cost and low-carbon power supply through the optimum management of the entire demand and supply balance of large power supplies such as nuclear power, distributed power supplies such as solar energies and power demand equipment, by utilizing information and communications technology (ICT).	1	281	18	26	56	-	68	21	6	5							3	3	22	40	61	43	3						3	3	12	27	64	33	36	4
			2	260	16	26	58	-	75	17	4	4							2	2	16	37	64	41	2						3	2	8	18	70	26	38	2
			E	42	100	0	0	-	76	12	7	5							5	0	33	38	68	45	3						5	0	16	14	76	32	41	3
	54	A system for integrated use of energy and water in block units of urban areas and residential areas, making use of natural- and unused energies and recycled materials. (Such system eases the heat island phenomenon in urban areas and contributes to the creation of low-carbon communities in urban and suburban areas.)	1	257	21	31	48	-	53	31	3	13							3	3	23	33	49	48	2						4	5	13	21	54	37	44	2
			2	239	20	31	49	-	58	28	2	12							2	4	15	29	56	54	2						3	5	6	17	61	39	46	2
			E	47	100	0	0	-	71	19	5	5							0	0	29	22	64	58	7						4	2	11	16	69	36	47	7
	55	An energy management system for small factories. (Factory Energy Management System: FEMS)	1	229	15	30	55	-	56	36	2	6							0	1	12	17	80	24	2						1	1	4	10	75	26	23	2
			2	220	14	28	58	-	60	33	1	6							0	1	5	10	85	21	1						0	1	2	7	83	23	20	1
			E	30	100	0	0	-	75	21	4	0							0	0	7	7	85	30	7						0	0	4	4	92	19	23	8
Low-carbon production technology and co-production	56	A co-production process for bio fuels and hydrogen through biomass fermentation and gasification.	1	204	17	25	58	-	61	12	11	16							4	3	29	49	52	40	3						8	4	14	28	58	30	38	4
			2	193	13	24	63	-	68	11	6	15							4	1	23	47	53	38	2						6	3	9	25	67	22	38	2
			E	26	100	0	0	-	72	12	4	12							4	0	27	50	42	62	0						0	8	4	29	58	25	50	0

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Low-carbon production technology and co-production	57	A co-production system of chemicals and energies under biorefinery.	1	135	16	22	62	-	60	17	9	14							1	5	36	45	49	37	5						5	5	12	28	60	26	36	5
			2	130	12	24	64	-	67	14	5	14							1	2	35	44	57	37	2						5	3	10	26	66	22	40	3
			E	16	100	0	0	-	81	13	6	0							0	0	25	50	63	44	6						6	0	0	15	77	31	46	0
	58	Fuel cells using hydrogen and methane derived from biomasses (low-carbon resources).	1	201	20	30	50	-	48	17	10	25							5	8	38	44	58	24	4						8	11	19	28	66	27	27	4
			2	190	17	29	54	-	59	10	8	23							4	6	29	43	62	22	3						8	10	12	24	75	23	22	2
			E	32	100	0	0	-	66	3	3	28							0	3	31	41	66	19	3						6	13	14	21	86	38	7	0
	59	Biomass plantations for energy on idle land with high plant production capacity in sunbelts in the tropics and in other areas that receive much sunlight.	1	145	8	23	69	-	46	6	37	11							2	4	18	36	41	36	21						7	8	12	23	47	29	32	23
			2	141	6	24	70	-	50	5	36	9							4	3	11	36	42	39	20						5	7	7	19	54	19	34	19
			E	8	100	0	0	-	61	13	13	13							0	0	25	50	38	50	0						0	13	0	14	71	43	43	0
	60	Technology for a 25% reduction of CO_2 emission through the optimum combination of non-fossil energy.	1	206	17	32	51	-	68	25	3	4							3	9	29	47	42	50	9						5	10	15	29	39	37	46	9
			2	191	15	30	55	-	75	16	4	5							3	4	18	48	42	52	5						4	5	7	25	48	32	45	5
			E	29	100	0	0	-	76	14	0	10							7	3	23	46	42	62	19						4	4	4	20	40	48	56	16
	61	Low-cost agriculture and forestry aiming at zero emission using local resources, such as biomass and organic wastes.	1	163	10	28	62	-	49	34	7	10							3	7	24	47	31	46	5						4	9	10	24	32	45	41	5
			2	148	8	23	69	-	51	34	5	10							3	5	18	48	30	50	4						5	7	6	19	37	45	38	4
			E	12	100	0	0	-	75	25	0	0							0	0	8	50	50	58	0						0	0	0	18	55	45	36	9
	62	Simultaneous water purification and fuel production in an aquatic biomass plantation.	1	114	8	27	65	-	51	19	11	19							4	11	31	53	39	37	5						7	9	16	28	49	27	40	6
			2	112	4	25	71	-	55	13	10	22							4	8	26	58	33	36	5						7	7	14	25	51	19	42	5
			E	5	100	0	0	-	40	40	0	20							0	0	40	40	60	40	0						0	0	25	25	75	50	25	0
Energy saving	63	LCDs (Liquid Crystal Displays), PDPs (Plasma Display Panels), advanced organic electroluminescent displays and other materials derived from new principles exceed 10 lm/W in luminous efficiency.	1	155	7	23	70	-	68	26	3	3							0	3	36	36	82	16	1						0	2	19	21	91	12	10	2
			2	141	5	23	72	-	75	20	1	4							0	2	30	32	84	11	0						0	1	13	18	93	7	8	0
			E	7	100	0	0	-	43	57	0	0							0	0	57	71	71	14	0						0	0	33	33	100	0	0	0
	64	A high efficiency micro power generator for IC tags, using heat, vibration and other energy sources.	1	157	4	17	79	-	41	28	1	30							9	5	40	39	68	13	3						11	5	20	23	81	6	14	3
			2	147	3	15	82	-	43	22	1	34							8	5	37	30	77	8	2						8	4	13	18	88	3	11	1
			E	5	100	0	0	-	80	20	0	0							0	0	80	100	80	20	0						0	0	50	75	100	0	0	0

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Energy saving	65	Industrial heat pumps capable of generating steam exceeding 150 dgrees C.	1	168	13	32	55	-	60	27	0	13							2	8	18	38	76	21	1						4	8	9	28	85	12	15	3
			2	167	12	31	57	-	67	21	0	12							2	4	15	34	80	14	1						3	4	5	20	90	7	10	2
			E	20	100	0	0	-	73	11	0	16							5	0	21	26	84	21	0						11	0	11	11	89	16	16	11
	66	Ultra-efficient civil heat pumps (COP≧8 for air conditioners; COP≧6 for hot water supply system; including exhaust heat recovery).	1	198	20	29	51	-	64	34	0	2							1	5	17	29	85	16	1						1	5	9	21	88	13	15	1
			2	197	17	29	54	-	69	27	1	3							1	4	12	20	87	12	0						1	4	5	15	95	6	8	0
			E	33	100	0	0	-	81	13	3	3							3	0	16	16	94	10	0						0	0	6	10	100	10	3	0
	67	A micro turbine cogeneration system featuring ultra-lean combustion for high efficiency, enhanced pressure ratio for high power and downsizing, and low-NOx combustors.	1	199	14	32	54	-	38	32	3	27							6	8	16	23	77	14	2						10	9	9	16	82	14	14	2
			2	190	13	33	54	-	41	30	2	27							4	6	11	19	87	9	0						6	6	4	11	91	5	13	0
			E	24	100	0	0	-	39	44	0	17							4	0	13	17	87	17	0						4	0	4	9	91	9	13	0
	68	Next generation high-efficiency lighting over 150 lm/W (high-efficiency elements of LEDs and organic electroluminescence, etc. and improvement of materials), and highly-efficient, high-color-rendering white light resources, such as microcavities and cluster luminescence.	1	150	5	25	70	-	64	30	1	5							0	5	33	35	84	15	0						1	5	15	19	89	9	8	1
			2	141	4	27	69	-	77	22	0	1							0	2	28	26	87	11	0						0	1	12	11	95	3	5	1
			E	5	100	0	0	-	80	20	0	0							0	0	60	40	80	0	0						0	0	40	40	100	0	0	0
	69	Construction technology for energy-autonomous buildings enabling the use of natural energies, natural ventilation, natural lighting, rainwater, groundwater and other natural resources.	1	219	18	20	62	-	56	31	3	10							3	5	18	25	69	30	2						4	4	10	15	72	27	24	2
			2	207	18	21	61	-	62	25	3	10							3	3	11	22	77	23	1						4	4	5	9	77	24	24	3
			E	37	100	0	0	-	81	19	0	0							3	0	19	28	78	25	3						6	0	11	11	75	36	22	3
	70	A power recovery system based on a stirling engine using CO_2-free unused heat sources.	1	141	11	31	58	-	47	13	5	35							9	9	29	35	62	16	3						16	9	13	25	67	14	19	4
			2	133	10	27	63	-	53	8	5	34							9	6	24	31	68	13	2						15	9	13	16	75	8	17	3
			E	13	100	0	0	-	41	17	0	42							17	0	17	17	58	25	0						25	0	25	8	67	8	17	0
Assessment tools for technology development	71	A social and economic model and tool for an energy system capable of analyzing consumer psychology, security, risks, and policy effectiveness that would have an impact on both the demander and supplier.	1	149	8	22	70	-	52	28	1	19							4	7	61	59	25	21	4						6	9	34	50	24	36	25	6
			2	149	6	21	73	-	63	19	1	17							2	6	60	61	19	14	1						4	8	31	62	15	31	18	3
			E	9	100	0	0	-	78	11	0	11							0	0	89	33	22	22	0						0	0	56	44	22	56	11	0
	72	A quantitative assessment method for the policy effectiveness of the tax system, legal system, emissions trading system, and green certificate system.	1	164	9	25	66	-	55	34	2	9							3	4	50	63	19	25	9						3	7	31	47	16	48	27	7
			2	161	7	24	69	-	65	26	1	8							3	3	45	71	12	17	6						3	5	25	51	8	49	18	8
			E	12	100	0	0	-	92	8	0	0							0	0	67	67	8	25	17						0	0	50	58	17	67	33	17

Panel No.7:

Necessary resources, including water, food, minerals

Implementation of the questionnaires

	Sent	Returned (response rate)
<1st Round>	286	251 (88%)
<2nd Round>	251	223 (89%)

Sex	Male	216	Affiliation	Private enterprise	78
	Female	7		University	85
	N.A.	0		Research Institute	38
generation	20’s	4		Association	15
	30’s	12		Others	7
	40’s	45		N.A.	0
	50’s	100	Job category	R&D	177
	60’s	54		Others	46
	70’s and over	8		N.A.	0
	N.A.	0		Total	223

Survey items

A: Unused resources

B: Agriculture, forestry, and fisheries resources (including forest conservation, and biohazards)

C: Water resources

D: Environment, recyclable resources, recycling (converting hazardous substances into resources), LCA

E: Hydrocarbon resources, mineral resources, and CCS (conventional and unconventional fossil fuels, biomass resources, mineral resources and CCS)

F: Solar use, space radiation (sunspot prediction, sunbelts)

G: Resource based technology (database), fusion of humanity and sociology in relation to resources (search for a reasonable common ground), appropriate distribution of profits that generates resources, and human resources development.

Time-series tables of topics

<Technological realization>

year	Topic (Leading number represents ID.)
2014	23: Establishment of a regional water reclamation system dealing with the uneven distribution of water by utilizing an economical and practical seawater desalination technology using reverse osmosis membrane, and purification and recycling technology for contaminated water.
2015	04: Technology utilizing medium and low temperature geothermal sources by binary power generation and heat pumps.
	28: Financially viable selective separation and recovery of rare metals from Waste Electrical and Electronic Equipment (WEEE) and incineration ash.
	52: Ascertaining the quality and resources of coking coal on a world-wide basis.
2016	14: Wide-area monitoring system for agriculture, forestry and fisheries resources such as forests, seaweeds and sea grasses, by utilizing remote sensing technology and networks.
	27: Water treatment system capable of monitoring, removing, or controlling the occurrence of algae and pathogenic bacteria in urban rivers, moats, and parks, for the creation of safe waterfront space.
	32: Technology to reduce the total amount of mercury in the waste gas produced by combustion boilers for coal, biomass, and waste to an amount that would not have an impact on the atmosphere, water, soil and other parts of the environment.
2017	05: Monitoring technology for geothermal resources by using gravity measurement and geodetic technique.
	22: Technology for distributed ecological waste water treatment technology that ensures water quality control, the nutrient cycle and the maintenance of sanitation.
	25: Water cycle (purification and recycling) system in coastal areas for fish farming and maintenance of fishery resources.
	26: Coastal environment restoration technology for seaweed beds and mudflats, based on the elucidation of the material cycle system linking continental areas, rivers, and coastal areas.
	31: System capable of rendering coal ashes harmless and reasonable use of ashes in Japan.
	34: Technology for separating useful components such as rare metals from metal scraps and non-ferrous metal waste.
2018	03: Technology for the formation of a material cycle by utilizing natural and unused energies by a community unit.
	20: Proper management technique for groundwater through the development of observation and estimation technology for groundwater quality and flow, and groundwater recharge technology.
	21: New detection and removal technology in the clean water supply system, based on the continuous monitoring of traces of hazardous chemical substances and the Noro virus.
	30: Technology that can be diffused on a financial basis in emerging countries for zero emissions of NOx and SOx from exhaust gasses.
	33: Recovery system capable of supporting the Design for the Environment (DFE) production.
2019	02: Volcanic energy monitoring and utilization technology aiming for the future utilization of geothermal resources.

year	Topic (Leading number represents ID.)
2019	08: Technology for comprehensive utilization of highly migratory fish stocks such as tuna, that would contribute to the conservation of biological diversity. 10: Technology for breeding and farming fisheries with favorable characteristics (environmental tolerance, disease tolerance, etc.), by applying the analysis technique for genome data, such as DNA markers. 16: Technology for production of fuels and bio-chemicals on a commercial base by using plants and microorganisms as biomass cascading. 18: Global-scale observations of the actual conditions of water use and water contamination (establishment of acquisition of global 1-km mesh data: including rivers, lakes and marshes, seawater, groundwater, extraction, drainage, siltation in dams, urban pollution, industrial pollution and natural chemical substances such as arsenic). 19: Technology for the integration of hydrology (basin water cycle) and meteorology under the hydrology prediction model and global simulation. 29: Waste storage system for products containing rare metals that have been separated and metal-containing materials that can be recovered at the time of price hike for rare metals or the occurrence of supply risk, at a scale that can rival natural resources (mineral deposits) in financial terms. 37: Economic purification technique for low-grade rare metal materials not used in the past. 39: Technology that gives economic incentives to geologic sequestration of CO_2, such as the development of energy resources from oil layers, gas pools, and coal beds by CO_2 injection, and recycling of sequestrated CO_2. 40：Technology for reforming low-grade coal such as lignite, which is an abundant resource, into fine carbon materials for iron manufacturing. 47: Economic concentration technology for low-concentration methane discharged from the ventilation of coal mines. 57: Methodology for building international consensus on the cooperation in and transfer of technologies related to the environment, such as energy savings between developed countries, emerging countries and developing countries, so as to bring national interests, regional interests, and global interests to fruition.
2020	11: Production technologies for foods and medical supplies using the physiology of deep-sea microbes, which has not yet been utilized. 15: Commercial production technology for herbaceous biomass that enables high yields and crop rotation that could be established in mid-latitude temperate zones. 24: Massive water transportation system for solving the problem of uneven international distribution of water. 35: Practical use of power generation, hydrogen production, and synthetic fuel production by gasification incorporating CCS, with economic efficiency, which is applicable to hydrocarbon resources such as coal, heavy oils and biomass. 36: Storage and management technology concerning the deep brine layer for the expansion of the potential of geologic sequestration of CO_2. 41：Economic purification technique for extra-heavy oils (oil sands and bitumen) by using supercritical water. 44: Effective system for monitoring, detecting of leakage, and repair related to underground CO_2 sequestration, including passive monitoring.

year	Topic (Leading number represents ID.)
	55: International trading system based on the systematic transfer analysis of the amount of imports and exports of required water (virtual water) for the production of agricultural products and product manufacturing on a global basis.
2020	56: Methodology for building regional consensus on resource development in emerging and developing countries.
2021	12: New technology for vegetation regeneration in deserts (arid zones) (genetically modified products and others).
	17: Practical extraction and separation technique for rare metal elements, using biotechnology.
2022	06: High efficiency energy supply technology using surface water and seawater as the heat source.
	09: Elucidation of the basic genetic network that controls the growth of plants, such as the shape, size and time of blooming.
	48: Implementation of utilization of solar energy at optimal places on a global basis, and energy interchange between the place of production and place of use.
2023	38: Underground coal gasification technology (gasifying coal while it is deep inside coal beds, where digging is difficult, and extracting usable gasses).
	43: Underground communication system for the safe and economic extraction of deep underground resources.
2024	13: Plant genome technology that dramatically improves atmospheric nitrogen fixing and soil phosphate utilization.
2025	01: Technology to economically extract seafloor mineral resources such as manganese nodules, heavy metal sludge, hydrothermal mineral deposits, and cobalt crusts.
	45: Technology for economically extracting rare metals such as uranium from seawater.
	53: Innovative technology that enables the diffusion of the use of non-fossil primary energy such as solar energy on a global basis.
	54: Building social consensus for the process of avoiding water disputes in relation to developments.
2026	07: Economic production technology for methane hydrates that are present deep under the seafloor.
	42: CO_2 ocean sequestration technology for which safety has been verified and which has been internationally approved (dissolution in the middle deep layer, and deep ocean sequestration).
2031	46: Technology for the production of reduction gas for iron manufacturing from unused carbon resources by using nuclear energy.
	51: Environmental conservation, improvement of environmental friendliness, and prevention of meteorological disasters, such as flood damage and droughts, by the use of solar energy on a global basis.
2033	50: Creation of resources by duplicating the Big Bang controlled within space.
2037	49: Technology to transport space and solar resources to earth from the production base.

<Social realization>

year	Topic (Leading number represents ID.)
2019	59: Training programs for engineers involved in the development and use of resources and who have knowledge and expertise sufficient to be active in the international arena.
2020	23: Establishment of a regional water reclamation system dealing with the uneven distribution of water by utilizing an economical and practical seawater desalination technology using reverse osmosis membrane, and purification and recycling technology for contaminated water.
	28: Financially viable selective separation and recovery of rare metals from Waste Electrical and Electronic Equipment (WEEE) and incineration ash.
2021	04: Technology utilizing medium and low temperature geothermal sources by binary power generation and heat pumps.
2022	27: Water treatment system capable of monitoring, removing, or controlling the occurrence of algae and pathogenic bacteria in urban rivers, moats, and parks, for the creation of safe waterfront space.
	34: Technology for separating useful components such as rare metals from metal scraps and non-ferrous metal waste.
2023	14: Wide-area monitoring system for agriculture, forestry and fisheries resources such as forests, seaweeds and sea grasses, by utilizing remote sensing technology and networks.
	25: Water cycle (purification and recycling) system in coastal areas for fish farming and maintenance of fishery resources.
	30: Technology that can be diffused on a financial basis in emerging countries for zero emissions of NOx and SOx from exhaust gasses.
	31: System capable of rendering coal ashes harmless and reasonable use of ashes in Japan.
	32: Technology to reduce the total amount of mercury in the waste gas produced by combustion boilers for coal, biomass, and waste to an amount that would not have an impact on the atmosphere, water, soil and other parts of the environment.
2024	03: Technology for the formation of a material cycle by utilizing natural and unused energies by a community unit.
	05: Monitoring technology for geothermal resources by using gravity measurement and geodetic technique.
	08: Technology for comprehensive utilization of highly migratory fish stocks such as tuna, that would contribute to the conservation of biological diversity.
	21: New detection and removal technology in the clean water supply system, based on the continuous monitoring of traces of hazardous chemical substances and the Noro virus.
	22: Technology for distributed ecological waste water treatment technology that ensures water quality control, the nutrient cycle and the maintenance of sanitation.
	26: Coastal environment restoration technology for seaweed beds and mudflats, based on the elucidation of the material cycle system linking continental areas, rivers, and coastal areas.
2025	33: Recovery system capable of supporting the Design for the Environment (DFE) production.
	57: Methodology for building international consensus on the cooperation in and transfer of technologies related to the environment, such as energy savings between developed countries, emerging countries and developing countries, so as to bring national interests, regional interests, and global interests to fruition.

year	Topic (Leading number represents ID.)
2026	18: Global-scale observations of the actual conditions of water use and water contamination (establishment of acquisition of global 1-km mesh data: including rivers, lakes and marshes, seawater, groundwater, extraction, drainage, siltation in dams, urban pollution, industrial pollution and natural chemical substances such as arsenic).
2026	19: Technology for the integration of hydrology (basin water cycle) and meteorology under the hydrology prediction model and global simulation.
	20: Proper management technique for groundwater through the development of observation and estimation technology for groundwater quality and flow, and groundwater recharge technology.
	29: Waste storage system for products containing rare metals that have been separated and metal-containing materials that can be recovered at the time of price hike for rare metals or the occurrence of supply risk, at a scale that can rival natural resources (mineral deposits) in financial terms.
	44: Effective system for monitoring, detecting of leakage, and repair related to underground CO_2 sequestration, including passive monitoring.
2027	37: Economic purification technique for low-grade rare metal materials not used in the past.
	39: Technology that gives economic incentives to geologic sequestration of CO_2, such as the development of energy resources from oil layers, gas pools, and coal beds by CO_2 injection, and recycling of sequestrated CO_2.
	40：Technology for reforming low-grade coal such as lignite, which is an abundant resource, into fine carbon materials for iron manufacturing.
	47: Economic concentration technology for low-concentration methane discharged from the ventilation of coal mines.
	58: International joint resource exploitation business in the polar regions, open seas, and space led by international organizations such as the United Nations.
2028	10: Technology for breeding and farming fisheries with favorable characteristics (environmental tolerance, disease tolerance, etc.), by applying the analysis technique for genome data, such as DNA markers.
	16: Technology for production of fuels and bio-chemicals on a commercial base by using plants and microorganisms as biomass cascading.
	17: Practical extraction and separation technique for rare metal elements, using biotechnology.
	24: Massive water transportation system for solving the problem of uneven international distribution of water.
	35: Practical use of power generation, hydrogen production, and synthetic fuel production by gasification incorporating CCS, with economic efficiency, which is applicable to hydrocarbon resources such as coal, heavy oils and biomass.
	36: Storage and management technology concerning the deep brine layer for the expansion of the potential of geologic sequestration of CO_2.
2029	02: Volcanic energy monitoring and utilization technology aiming for the future utilization of geothermal resources.
	06: High efficiency energy supply technology using surface water and seawater as the heat source.
	11: Production technologies for foods and medical supplies using the physiology of deep-sea microbes, which has not yet been utilized.

year	Topic (Leading number represents ID.)
	12: New technology for vegetation regeneration in deserts (arid zones) (genetically modified products and others).
	15: Commercial production technology for herbaceous biomass that enables high yields and crop rotation that could be established in mid-latitude temperate zones.
2029	41：Economic purification technique for extra-heavy oils (oil sands and bitumen) by using supercritical water.
	56: Methodology for building regional consensus on resource development in emerging and developing countries.
2030	43: Underground communication system for the safe and economic extraction of deep underground resources.
	55: International trading system based on the systematic transfer analysis of the amount of imports and exports of required water (virtual water) for the production of agricultural products and product manufacturing on a global basis.
2031	38: Underground coal gasification technology (gasifying coal while it is deep inside coal beds, where digging is difficult, and extracting usable gasses).
	48: Implementation of utilization of solar energy at optimal places on a global basis, and energy interchange between the place of production and place of use.
2032	13: Plant genome technology that dramatically improves atmospheric nitrogen fixing and soil phosphate utilization.
2033	01: Technology to economically extract seafloor mineral resources such as manganese nodules, heavy metal sludge, hydrothermal mineral deposits, and cobalt crusts.
	54: Building social consensus for the process of avoiding water disputes in relation to developments.
2034	07: Economic production technology for methane hydrates that are present deep under the seafloor.
	53: Innovative technology that enables the diffusion of the use of non-fossil primary energy such as solar energy on a global basis.
2035	42: CO_2 ocean sequestration technology for which safety has been verified and which has been internationally approved (dissolution in the middle deep layer, and deep ocean sequestration).
	45: Technology for economically extracting rare metals such as uranium from seawater.
2038	46: Technology for the production of reduction gas for iron manufacturing from unused carbon resources by using nuclear energy.
2040	51: Environmental conservation, improvement of environmental friendliness, and prevention of meteorological disasters, such as flood damage and droughts, by the use of solar energy on a global basis.
2041-	49: Technology to transport space and solar resources to earth from the production base.

Area	Topic number	Topic	Round	Responses	Degree of expertise (%)				Importance (%)				Forecasted time of technological realization (to be realized somewhere in the world) (%)						Sectors that will pave the way to technological (%)					Forecasted time of social realization (to become applicable/widely used in Japan) (%)						Sectors that will pave the way to social realization (%)					
					High	Moderate	Low	None	Important for Japan and the rest of the world	Especially important for Japan	Especially important for the world	Low importance/priority	Already realized	2011-2015	2016-2020	2021-2030	2031-2040	2041-	will not be realized	don't know	University	Public research organization	Private enterprise	Collaboration of multiple sectors	Others	2011-2015	2016-2020	2021-2030	2031-2040	2041-	will not be realized	don't know	University	Public research organization	Private enterprise	Government	Collaboration of multiple sectors	Others
Unused resources	1	Technology to economically extract seafloor mineral resources such as manganese nodules, heavy metal sludge, hydrothermal mineral deposits, and cobalt crusts.	1	115	14	24	62	-	40	52	0	8							2	10	22	50	31	48	3						1	11	11	28	48	24	39	7
			2	107	11	24	65	-	31	64	0	5							2	5	17	59	20	58	3						2	7	6	28	58	25	42	5
			E	12	100	0	0	-	25	67	0	8							8	0	45	91	36	27	0						9	0	30	70	80	30	20	0
	2	Volcanic energy monitoring and utilization technology aiming for the future utilization of geothermal resources.	1	108	8	37	55	-	25	61	4	10							2	9	31	61	29	26	0						1	10	15	41	40	28	34	1
			2	103	8	36	56	-	20	71	2	7							2	6	28	69	25	21	0						2	6	14	51	44	22	33	0
			E	8	100	0	0	-	25	62	13	0							0	13	38	63	13	25	0						0	13	43	57	29	57	29	0
	3	Technology for the formation of a material cycle by utilizing natural and unused energies by a community unit.	1	155	17	28	55	-	62	26	6	6							1	5	26	33	33	64	5						3	3	14	21	39	39	50	2
			2	142	13	29	58	-	71	22	4	3							0	4	14	31	29	76	1						1	4	8	14	36	41	61	0
			E	18	100	0	0	-	75	6	19	0							0	0	12	29	35	71	6						6	0	13	19	38	50	69	0
	4	Technology utilizing medium and low temperature geothermal sources by binary power generation and heat pumps.	1	119	12	35	53	-	39	50	4	7							1	3	26	37	57	31	2						3	3	13	19	65	21	27	2
			2	105	12	34	54	-	41	57	1	1							0	2	23	36	65	36	1						0	3	12	19	74	24	24	1
			E	13	100	0	0	-	69	31	0	0							0	0	31	31	77	31	0						0	0	17	8	92	33	25	0
	5	Monitoring technology for geothermal resources by using gravity measurement and geodetic technique.	1	76	9	30	61	-	34	45	3	18							3	8	42	53	27	22	3						3	7	22	49	35	17	25	3
			2	71	10	25	65	-	40	42	1	17							1	4	43	63	30	16	3						3	3	18	66	45	10	24	3
			E	7	100	0	0	-	71	29	0	0							0	0	71	71	29	0	0						0	0	43	86	71	0	0	0
	6	High efficiency energy supply technology using surface water and seawater as the heat source.	1	96	3	34	63	-	41	35	4	20							4	13	30	50	23	32	4						5	9	14	28	44	25	34	9
			2	89	3	27	70	-	44	37	2	17							5	5	32	67	21	29	3						5	5	10	37	47	23	36	6
			E	3	100	0	0	-	67	0	0	33							0	0	67	67	33	67	33						0	0	33	33	67	33	33	33
	7	Economic production technology for methane hydrates that are present deep under the seafloor.	1	137	15	32	53	-	39	52	1	8							5	6	24	57	23	43	3						6	8	14	34	47	27	43	5
			2	129	14	33	53	-	29	62	0	9							4	2	22	67	24	44	2						4	7	13	38	50	27	45	2
			E	18	100	0	0	-	25	75	0	0							0	0	28	72	17	39	0						0	0	6	19	63	25	38	0
Agriculture, forestry, and	8	Technology for comprehensive utilization of highly migratory fish stocks such as tuna, that would contribute to the conservation of biological diversity.	1	76	13	32	55	-	45	49	3	3							0	7	48	60	23	32	16						0	8	31	48	32	32	31	17
			2	70	11	26	63	-	44	50	3	3							0	4	46	65	18	32	9						0	4	30	61	33	26	38	7
			E	8	100	0	0	-	62	38	0	0							0	0	50	75	13	50	13						0	0	38	75	38	13	63	13

Area	Topic number	Topic	Round	Responses	Degree of expertise (%)				Importance (%)				Forecasted time of technological realization (to be realized somewhere in the world) (%)						Sectors that will pave the way to technological (%)					Forecasted time of social realization (to become applicable/widely used in Japan) (%)						Sectors that will pave the way to social realization (%)					
					High	Moderate	Low	None	Important for Japan and the rest of the world	Especially important for Japan	Especially important for the world	Low importance/priority	Already realized	2011-2015	2016-2020	2021-2030	2031-2040	2041-	don't know will not be realized	University	Public research organization	Private enterprise	Collaboration of multiple sectors	Others	2011-2015	2016-2020	2021-2030	2031-2040	2041-	don't know will not be realized	University	Public research organization	Private enterprise	Government	Collaboration of multiple sectors	Others
Agriculture, forestry, and fisheries resources (including forest conservation, and biohazards)	9	Elucidation of the basic genetic network that controls the growth of plants, such as the shape, size and time of blooming.	1	59	24	19	57	-	75	3	3	19							0	7	71	55	24	10	0											
			2	55	16	20	64	-	78	0	4	18							0	2	67	65	22	15	0											
			E	9	100	0	0	-	100	0	0	0							0	0	89	78	11	0	0											
	10	Technology for breeding and farming fisheries with favorable characteristics (environmental tolerance, disease tolerance, etc.), by applying the analysis technique for genome data, such as DNA markers.	1	71	13	27	60	-	51	26	6	17							1	6	60	62	21	21	1						3	9	31	55	37	15	31	4
			2	63	8	25	67	-	60	21	3	16							2	5	68	65	23	19	0						3	7	36	66	38	14	30	2
			E	5	100	0	0	-	40	40	0	20							0	0	80	100	0	0	0						0	0	25	75	50	25	50	25
	11	Production technologies for foods and medical supplies using the physiology of deep-sea microbes, which has not yet been utilized.	1	76	8	24	68	-	61	20	3	16							3	11	56	58	40	19	0						1	14	33	46	49	19	26	0
			2	73	7	26	67	-	70	14	3	13							1	7	50	59	41	21	0						1	9	29	53	53	9	23	0
			E	5	100	0	0	-	60	0	0	40							20	0	50	25	100	0	0						20	20	25	75	75	0	0	0
	12	New technology for vegetation regeneration in deserts (arid zones) (genetically modified products and others).	1	88	15	23	62	-	41	1	50	8							2	5	51	54	31	23	14						6	7	36	44	32	25	27	25
			2	82	13	21	66	-	43	0	52	5							1	5	46	58	26	25	11						4	8	35	52	32	20	24	20
			E	11	100	0	0	-	73	0	27	0							0	0	64	55	55	18	9						0	0	64	55	64	9	18	18
	13	Plant genome technology that dramatically improves atmospheric nitrogen fixing and soil phosphate utilization.	1	66	17	27	56	-	65	6	17	12							2	8	62	63	22	23	3						2	8	38	54	32	16	33	8
			2	62	15	26	59	-	74	3	10	13							0	3	66	67	17	19	2						0	5	39	64	30	11	30	4
			E	9	100	0	0	-	100	0	0	0							0	0	78	67	22	11	0						0	0	56	56	44	0	22	0
	14	Wide-area monitoring system for agriculture, forestry and fisheries resources such as forests, seaweeds and sea grasses, by utilizing remote sensing technology and networks.	1	98	12	32	56	-	68	16	9	7							0	5	48	68	13	31	7						0	6	33	59	20	27	34	14
			2	86	8	38	54	-	74	13	5	8							0	2	50	77	13	27	5						0	2	35	73	20	23	34	8
			E	7	100	0	0	-	86	14	0	0							0	0	86	86	14	29	0						0	0	29	100	14	14	43	0
	15	Commercial production technology for herbaceous biomass that enables high yields and crop rotation that could be established in mid-latitude temperate zones.	1	87	11	37	52	-	57	14	18	11							5	6	37	52	28	35	7						7	5	19	44	40	23	36	9
			2	79	10	38	52	-	69	10	8	13							4	5	37	56	31	33	7						5	5	14	46	46	17	39	7
			E	8	100	0	0	-	61	13	13	13							13	0	29	43	57	29	0						0	0	14	29	43	29	14	0
	16	Technology for production of fuels and bio-chemicals on a commercial base by using plants and microorganisms as biomass cascading.	1	105	16	37	47	-	74	14	8	4							0	5	37	47	49	38	4						1	9	16	28	53	19	45	8
			2	99	15	38	47	-	83	11	3	3							0	5	32	49	56	35	2						0	8	17	22	61	15	52	2
			E	15	100	0	0	-	87	13	0	0							0	0	40	33	67	40	0						0	13	27	20	60	20	33	0

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Agriculture, forestry, and	17	Practical extraction and separation technique for rare metal elements, using biotechnology.	1	90	4	31	65	-	48	38	3	11							6	7	59	58	38	21	1						5	10	33	48	46	13	26	4
			2	87	3	29	68	-	51	35	0	14							4	9	55	63	33	21	0						4	10	30	53	48	13	23	1
			E	3	100	0	0	-	0	33	0	67							0	33	67	100	33	0	0						33	0	33	67	33	0	0	0
Water resources	18	Global-scale observations of the actual conditions of water use and water contamination (establishment of acquisition of global 1-km mesh data: including rivers, lakes and marshes, seawater, groundwater, extraction, drainage, siltation in dams, urban pollution, industrial pollution and natural chemical substances such as arsenic).	1	99	12	29	59	-	82	2	9	7							5	6	46	68	14	27	22						5	6	32	57	19	33	27	21
			2	90	7	28	65	-	83	2	7	8							5	5	48	80	8	22	22						5	7	29	71	10	31	22	21
			E	6	100	0	0	-	100	0	0	0							0	0	33	100	0	17	0						0	0	0	83	0	17	0	0
	19	Technology for the integration of hydrology (basin water cycle) and meteorology under the hydrology prediction model and global simulation.	1	74	12	24	64	-	87	3	5	5							0	3	61	79	11	14	13						0	3	43	66	20	31	20	16
			2	73	8	22	70	-	87	0	6	7							0	1	56	81	3	10	16						1	0	40	75	16	29	18	12
			E	6	100	0	0	-	100	0	0	0							0	0	33	100	17	0	33						0	0	0	100	20	20	0	0
	20	Proper management technique for groundwater through the development of observation and estimation technology for groundwater quality and flow, and groundwater recharge technology.	1	76	12	33	55	-	69	11	17	3							0	4	49	69	20	28	5						1	3	32	53	25	32	30	8
			2	72	10	32	58	-	77	4	16	3							0	1	49	79	13	19	6						0	3	36	69	19	27	25	4
			E	7	100	0	0	-	86	0	14	0							0	0	43	71	14	14	0						0	0	17	67	17	0	33	0
	21	New detection and removal technology in the clean water supply system, based on the continuous monitoring of traces of hazardous chemical substances and the Noro virus.	1	78	12	23	65	-	62	18	8	12							0	6	43	66	29	25	1						1	5	23	47	45	31	27	3
			2	73	5	25	70	-	72	11	6	11							0	6	41	70	30	24	0						1	6	21	54	49	27	21	0
			E	4	100	0	0	-	50	0	25	25							0	0	75	50	50	0	0						0	0	25	50	75	50	0	0
	22	Technology for distributed ecological waste water treatment technology that ensures water quality control, the nutrient cycle and the maintenance of sanitation.	1	74	18	22	60	-	62	12	18	8							3	7	33	54	46	32	6						4	8	20	37	50	31	30	6
			2	65	15	23	62	-	70	5	14	11							3	5	32	71	49	19	5						3	7	13	49	61	30	18	5
			E	10	100	0	0	-	70	10	20	0							0	10	60	80	60	0	0						0	10	0	40	60	40	0	0
	23	Establishment of a regional water reclamation system dealing with the uneven distribution of water by utilizing an economical and practical seawater desalination technology using reverse osmosis membrane, and purification and recycling technology for contaminated water.	1	103	12	31	57	-	57	6	36	1							0	2	21	36	67	31	5						3	4	14	24	66	22	37	8
			2	93	9	35	56	-	66	3	29	2							0	1	21	37	75	26	2						3	2	14	24	76	23	28	5
			E	8	100	0	0	-	86	0	14	0							0	14	14	57	71	14	0						0	14	0	29	71	43	0	0
	24	Massive water transportation system for solving the problem of uneven international distribution of water.	1	74	5	32	63	-	37	3	37	23							15	7	18	31	41	32	24						21	10	8	23	41	23	33	27
			2	73	3	33	64	-	41	1	35	23							14	4	15	34	45	35	18						14	10	6	22	46	27	33	21
			E	2	100	0	0	-	100	0	0	0							0	50	0	50	50	0	0						0	50	0	50	50	0	0	0

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Water resources	25	Water cycle (purification and recycling) system in coastal areas for fish farming and maintenance of fishery resources.	1	85	16	25	59	-	46	45	2	7							4	10	36	64	40	35	4						3	10	23	44	47	29	32	3
			2	80	14	26	60	-	46	45	3	6							3	6	32	74	38	32	3						3	4	20	52	57	28	31	0
			E	11	100	0	0	-	55	45	0	0							0	0	64	91	64	55	9						0	0	27	55	82	64	45	0
	26	Coastal environment restoration technology for seaweed beds and mudflats, based on the elucidation of the material cycle system linking continental areas, rivers, and coastal areas.	1	88	17	26	57	-	52	45	1	2							0	3	47	66	16	36	2						0	4	32	46	25	51	29	0
			2	80	14	30	56	-	48	48	1	3							0	3	45	74	15	40	3						0	3	31	56	22	51	33	0
			E	11	100	0	0	-	64	36	0	0							0	0	91	91	36	55	0						0	0	45	64	36	73	45	0
	27	Water treatment system capable of monitoring, removing, or controlling the occurrence of algae and pathogenic bacteria in urban rivers, moats, and parks, for the creation of safe waterfront space.	1	76	13	24	63	-	43	37	4	16							4	5	37	61	33	36	1						3	7	27	45	37	38	34	1
			2	69	10	22	68	-	50	30	3	17							4	3	32	64	26	38	0						3	6	24	48	33	41	33	3
			E	7	100	0	0	-	43	43	0	14							0	14	57	71	43	43	0						0	14	43	71	43	43	43	0
Environment, recyclable resources, recycling (converting hazardous substances into resources), LCA	28	Financially viable selective separation and recovery of rare metals from Waste Electrical and Electronic Equipment (WEEE) and incineration ash.	1	111	12	31	57	-	45	52	1	2							2	5	27	35	61	34	0						1	4	11	22	69	22	34	1
			2	107	11	30	59	-	41	57	1	1							1	3	19	33	68	32	0						0	4	8	24	75	18	29	0
			E	12	100	0	0	-	58	42	0	0							8	0	50	67	75	17	0						0	0	9	45	91	36	18	0
	29	Waste storage system for products containing rare metals that have been separated and metal-containing materials that can be recovered at the time of price hike for rare metals or the occurrence of supply risk, at a scale that can rival natural resources (mineral deposits) in financial terms.	1	85	14	21	65	-	24	62	1	13							2	8	20	51	37	44	0						4	7	7	28	51	35	35	1
			2	86	12	24	64	-	21	67	1	11							2	6	13	49	35	48	0						5	7	5	28	51	31	34	0
			E	10	100	0	0	-	40	60	0	0							0	0	56	67	56	33	0						0	0	20	50	50	50	30	0
	30	Technology that can be diffused on a financial basis in emerging countries for zero emissions of NOx and SOx from exhaust gasses.	1	103	26	30	44	-	56	2	38	4							3	2	25	33	63	19	9						3	7	12	16	69	20	23	13
			2	97	28	31	41	-	60	1	37	2							2	1	24	36	70	18	7						2	4	13	18	77	23	24	9
			E	27	100	0	0	-	69	4	27	0							4	0	28	40	64	32	8						4	8	20	16	76	36	32	4
	31	System capable of rendering coal ashes harmless and reasonable use of ashes in Japan.	1	110	24	25	51	-	36	53	5	6							1	6	24	34	60	33	3						1	8	12	19	61	18	34	4
			2	107	25	21	54	-	34	55	6	5							1	5	18	28	68	30	0						1	6	9	17	70	15	31	1
			E	27	100	0	0	-	35	53	8	4							0	0	25	42	63	42	0						0	0	16	20	68	32	36	4
	32	Technology to reduce the total amount of mercury in the waste gas produced by combustion boilers for coal, biomass, and waste to an amount that would not have an impact on the atmosphere, water, soil and other parts of the environment.	1	93	24	35	41	-	72	12	8	8							0	4	22	42	57	29	5						0	5	11	24	55	27	30	7
			2	87	24	33	43	-	84	6	5	5							0	5	19	42	62	29	4						0	5	9	21	67	22	29	5
			E	21	100	0	0	-	80	5	5	10							0	5	30	50	70	30	5						0	5	17	22	78	44	33	6

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Environment, recyclable resources, recycling	33	Recovery system capable of supporting the Design for the Environment (DFE) production.	1	44	14	27	59	-	63	30	5	2							0	5	23	48	43	36	0						0	5	14	26	49	35	42	0
			2	44	14	23	63	-	72	18	5	5							0	5	19	53	47	37	0						0	5	14	26	60	36	36	0
			E	6	100	0	0	-	100	0	0	0							0	0	50	67	50	50	0						0	0	20	40	100	60	20	0
	34	Technology for separating useful components such as rare metals from metal scraps and non-ferrous metal waste.	1	105	12	25	63	-	44	55	0	1							0	5	31	39	52	30	0						0	5	13	24	63	22	33	0
			2	101	13	23	64	-	46	52	0	2							1	4	28	39	61	29	1						0	4	9	19	71	18	33	0
			E	13	100	0	0	-	54	46	0	0							0	15	77	69	62	15	0						0	15	38	23	85	23	15	0
Hydrocarbon resources, mineral resources, and CCS (conventional and unconventional fossil fuels, biomass resources, mineral resources and CCS)	35	Practical use of power generation, hydrogen production, and synthetic fuel production by gasification incorporating CCS, with economic efficiency, which is applicable to hydrocarbon resources such as coal, heavy oils and biomass.	1	133	22	34	44	-	75	15	4	6							5	6	24	46	47	47	4						6	6	15	30	50	25	47	6
			2	119	22	30	48	-	81	9	3	7							3	5	16	48	47	46	2						7	4	13	24	57	20	47	2
			E	26	100	0	0	-	88	0	0	12							15	0	24	40	60	40	4						23	0	21	25	58	21	42	4
	36	Storage and management technology concerning the deep brine layer for the expansion of the potential of geologic sequestration of CO_2.	1	120	23	31	46	-	66	20	3	11							8	6	26	58	31	45	6						9	7	17	34	38	35	45	7
			2	108	25	31	44	-	70	17	3	10							6	4	28	59	32	44	5						8	4	19	34	40	35	43	3
			E	27	100	0	0	-	78	11	0	11							7	0	26	52	33	41	4						11	0	19	33	33	37	37	4
	37	Economic purification technique for low-grade rare metal materials not used in the past.	1	87	11	28	61	-	46	49	1	4							1	8	37	47	47	29	1						1	10	13	30	63	22	29	2
			2	80	13	24	63	-	49	47	1	3							1	8	31	55	56	25	0						1	8	13	26	71	21	25	0
			E	10	100	0	0	-	40	50	10	0							11	0	60	70	60	10	0						11	11	40	50	70	30	20	0
	38	Underground coal gasification technology (gasifying coal while it is deep inside coal beds, where digging is difficult, and extracting usable gasses).	1	104	15	30	55	-	50	13	18	19							10	10	24	45	34	43	6						12	13	16	32	45	26	35	7
			2	99	14	32	54	-	61	5	16	18							6	7	24	51	35	44	2						6	9	14	36	53	24	36	3
			E	14	100	0	0	-	69	0	0	31							17	0	15	31	38	54	0						15	8	18	27	64	27	36	0
	39	Technology that gives economic incentives to geologic sequestration of CO_2, such as the development of energy resources from oil layers, gas pools, and coal beds by CO_2 injection, and recycling of sequestrated CO_2.	1	120	23	32	45	-	66	9	14	11							7	6	25	45	40	47	4						12	7	14	29	50	29	39	4
			2	109	24	31	45	-	75	3	9	13							7	7	23	43	40	49	2						9	7	12	28	57	29	39	1
			E	26	100	0	0	-	80	0	8	12							8	0	21	25	42	54	4						13	0	13	13	52	17	57	0
	40	Technology for reforming low-grade coal such as lignite, which is an abundant resource, into fine carbon materials for iron manufacturing.	1	100	25	33	42	-	51	32	8	9							3	5	30	30	66	34	1						4	4	16	21	76	18	23	1
			2	88	27	32	41	-	63	24	7	6							2	2	24	31	74	32	0						1	2	10	18	82	16	21	0
			E	24	100	0	0	-	71	29	0	0							0	0	33	42	67	38	0						0	0	25	29	71	29	21	0

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Hydrocarbon resources, mineral resources, and CCS (conventional and unconventional fossil fuels, biomass resources, mineral resources and CCS)	41	Economic purification technique for extra-heavy oils (oil sands and bitumen) by using supercritical water.	1	87	15	37	48	-	53	16	13	18							8	10	28	44	41	37	4						13	10	14	33	45	13	37	4
			2	83	14	37	49	-	63	8	11	18							7	5	23	51	41	36	0						9	5	17	38	49	9	34	0
			E	12	100	0	0	-	58	0	0	42							27	0	30	50	30	30	0						36	0	11	33	56	22	33	0
	42	CO_2 ocean sequestration technology for which safety has been verified and which has been internationally approved (dissolution in the middle deep layer, and deep ocean sequestration).	1	107	14	33	53	-	48	26	5	21							20	16	25	58	19	33	16						21	19	15	33	26	35	35	17
			2	98	13	34	53	-	59	20	2	19							19	12	24	64	16	31	14						21	14	16	43	27	38	31	19
			E	13	100	0	0	-	54	23	0	23							46	0	36	64	18	27	18						50	0	30	30	50	70	10	20
	43	Underground communication system for the safe and economic extraction of deep underground resources.	1	66	8	38	54	-	49	16	8	27							8	13	31	38	43	33	3						8	15	19	22	46	14	39	5
			2	59	8	34	58	-	66	5	5	24							7	9	28	41	47	29	5						7	9	14	27	61	13	30	4
			E	5	100	0	0	-	50	0	25	25							0	40	20	40	60	20	0						0	60	0	0	80	40	20	0
	44	Effective system for monitoring, detecting of leakage, and repair related to underground CO_2 sequestration, including passive monitoring.	1	88	18	31	51	-	79	8	5	8							5	6	31	56	29	41	6						5	6	16	39	38	29	46	6
			2	83	17	31	52	-	83	4	2	11							5	5	31	59	28	43	5						6	4	19	46	44	25	44	4
			E	14	100	0	0	-	93	7	0	0							0	0	36	57	29	36	0						0	0	21	50	50	21	21	0
	45	Technology for economically extracting rare metals such as uranium from seawater.	1	87	10	24	66	-	29	52	2	17							9	9	40	60	28	30	4						11	11	24	33	46	23	35	3
			2	79	11	20	69	-	29	54	3	14							6	8	35	66	27	26	1						6	9	17	36	55	20	31	0
			E	9	100	0	0	-	45	44	11	0							11	0	50	75	50	13	0						11	0	38	63	50	38	38	0
	46	Technology for the production of reduction gas for iron manufacturing from unused carbon resources by using nuclear energy.	1	73	14	22	64	-	33	32	6	29							14	9	20	47	33	34	3						15	12	16	35	37	22	27	5
			2	66	15	20	65	-	47	23	5	25							8	9	16	61	29	34	0						14	9	10	48	42	15	27	2
			E	10	100	0	0	-	40	10	0	50							20	10	38	63	13	50	0						56	0	13	25	25	13	38	0
	47	Economic concentration technology for low-concentration methane discharged from the ventilation of coal mines.	1	79	10	32	58	-	34	16	28	22							5	12	18	42	38	31	1						12	19	14	33	48	14	29	3
			2	71	10	35	55	-	44	7	28	21							4	10	18	51	40	31	1						9	16	12	35	55	12	26	3
			E	7	100	0	0	-	29	0	42	29							14	0	17	50	50	17	0						29	0	17	33	83	17	0	0
Solar use, space	48	Implementation of utilization of solar energy at optimal places on a global basis, and energy interchange between the place of production and place of use.	1	92	5	24	71	-	63	8	21	8							2	7	18	37	33	36	21						3	9	8	26	38	27	35	24
			2	81	7	23	70	-	75	5	10	10							4	5	15	40	32	44	19						4	6	8	27	45	27	40	20
			E	6	100	0	0	-	67	33	0	0							0	0	0	50	50	33	0						0	0	0	17	67	33	50	17

Area	Topic number	Topic	Round	Responses	Degree of expertise (%)				Importance (%)				Forecasted time of technological realization (to be realized somewhere in the world) (%)						Sectors that will pave the way to technological (%)					Forecasted time of social realization (to become applicable/widely used in Japan) (%)						Sectors that will pave the way to social realization (%)					
					High	Moderate	Low	None	Important for Japan and the rest of the world	Especially important for Japan	Especially important for the world	Low importance/priority	Already realized	2011-2015	2016-2020	2021-2030	2031-2040	2041-	don't know will not be realized	University	Public research organization	Private enterprise	Collaboration of multiple sectors	Others	2011-2015	2016-2020	2021-2030	2031-2040	2041-	don't know will not be realized	University	Public research organization	Private enterprise	Government	Collaboration of multiple sectors	Others
Solar use, space radiation (sunspot prediction, sunbelts)	49	Technology to transport space and solar resources to earth from the production base.	1	53	4	13	83	-	40	6	6	48						28	21	34	59	9	27	16					29	18	18	41	14	30	27	23
			2	51	2	14	84	-	40	4	4	52						28	20	34	61	5	23	14					31	19	14	45	7	31	26	24
			E	1	100	0	0	-	0	0	100	0						0	0	0	0	0	100	0					0	0	0	0	0	0	100	0
	50	Creation of resources by duplicating the Big Bang controlled within space.	1	34	3	6	91	-	24	6	6	64						59	18	48	39	9	22	17												
			2	33	0	9	91	-	22	0	0	78						56	16	61	36	7	14	14												
			E		0	0	0	-	0	0	0	0						0	0	0	0	0	0	0												
	51	Environmental conservation, improvement of environmental friendliness, and prevention of meteorological disasters, such as flood damage and droughts, by the use of solar energy on a global basis.	1	78	6	22	72	-	78	1	13	8						10	19	32	49	15	35	28					11	18	19	23	22	32	35	33
			2	73	5	21	74	-	87	0	8	5						7	11	37	64	14	31	23					7	11	17	41	22	33	36	32
			E	4	100	0	0	-	100	0	0	0						25	0	25	50	0	25	0					25	0	25	0	25	25	25	0
Resource based technology (database), fusion of humanity and sociology in relation to resources (search for a reasonable common ground),	52	Ascertaining the quality and resources of coking coal on a world-wide basis.	1	91	23	33	44	-	64	22	6	8						3	7	18	44	38	22	18												
			2	85	25	32	43	-	75	15	2	8						2	8	14	48	41	26	15												
			E	21	100	0	0	-	80	15	0	5						5	5	32	58	53	26	16												
	53	Innovative technology that enables the diffusion of the use of non-fossil primary energy such as solar energy on a global basis.	1	105	10	27	63	-	85	10	5	0						3	13	34	43	35	37	14					2	12	17	30	34	29	41	9
			2	93	10	27	63	-	91	7	2	0						2	8	33	52	42	34	10					2	9	15	35	45	27	42	10
			E	9	100	0	0	-	78	22	0	0						22	11	44	44	56	78	22					13	13	22	44	33	11	67	22
	54	Building social consensus for the process of avoiding water disputes in relation to developments.	1	65	9	23	68	-	45	2	50	3						6	20	23	37	11	29	48					8	18	13	21	13	58	24	44
			2	61	7	23	70	-	49	0	46	5						5	13	17	43	5	26	57					5	14	10	17	9	57	26	53
			E	4	100	0	0	-	50	0	50	0						0	0	0	25	0	50	25					25	0	0	25	0	25	25	25
	55	International trading system based on the systematic transfer analysis of the amount of imports and exports of required water (virtual water) for the production of agricultural products and product manufacturing on a global basis.	1	65	8	23	69	-	62	5	11	22						12	18	34	44	10	25	46					13	18	16	30	15	46	20	46
			2	60	7	18	75	-	65	3	10	22						10	12	34	46	11	20	55					9	16	14	28	18	47	19	53
			E	4	100	0	0	-	50	0	0	50						0	0	33	33	0	0	100					0	0	25	50	25	0	0	75
	56	Methodology for building regional consensus on resource development in emerging and developing countries.	1	76	13	25	62	-	61	7	31	1						7	18	19	31	10	28	56					10	20	13	21	13	41	19	54
			2	70	10	24	66	-	71	6	22	1						3	9	17	32	12	29	59					6	14	11	22	12	40	22	60
			E	7	100	0	0	-	71	0	29	0						0	0	29	43	43	29	29					0	14	29	43	29	57	14	29

Area	Topic number	Topic	Round	Responses	Degree of expertise (%)				Importance (%)				Forecasted time of technological realization (to be realized somewhere in the world) (%)						Sectors that will pave the way to technological (%)					Forecasted time of social realization (to become applicable/widely used in Japan) (%)						Sectors that will pave the way to social realization (%)					
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Resource based technology (database), fusion of humanity and sociology in relation	57	Methodology for building international consensus on the cooperation in and transfer of technologies related to the environment, such as energy savings between developed countries, emerging countries and developing countries, so as to bring national interests, regional interests, and global interests to fruition.	1	107	8	24	68	-	72	15	9	4							6	9	19	41	13	32	60						7	10	9	26	12	54	27	55
			2	94	7	23	70	-	78	13	8	1							7	2	15	45	12	28	63						9	5	6	23	10	53	24	59
			E	7	100	0	0	-	71	29	0	0							0	0	29	43	29	29	57						0	14	17	33	33	50	17	33
	58	International joint resource exploitation business in the polar regions, open seas, and space led by international organizations such as the United Nations.	1	82	5	26	69	-	72	8	11	9																			8	15	16	30	11	49	22	49
			2	78	3	26	71	-	80	6	8	6																			5	9	11	26	5	57	18	53
			E	2	100	0	0	-	50	0	50	0																			0	0	50	100	100	100	50	0
	59	Training programs for engineers involved in the development and use of resources and who have knowledge and expertise sufficient to be active in the international arena.	1	136	15	28	57	-	38	56	3	3																			2	10	49	37	21	53	26	11
			2	130	15	28	57	-	34	63	2	1																			2	10	54	38	22	58	30	9
			E	20	100	0	0	-	30	70	0	0																			0	6	78	56	44	61	17	0

Panel 8:

Technologies for protecting environment and forming sustainable society

Implementation of the questionnaires

	Sent	Returned (response rate)
<1st Round>	417	339 (81%)
<2nd Round>	339	281 (83%)

Sex	Male	255	Affiliation	Private enterprise	60
	Female	26		University	116
	N.A.	0		Research Institute	65
generation	20’s	0		Association	12
	30’s	29		Others	28
	40’s	79		N.A.	0
	50’s	90	Job category	R&D	199
	60’s	67		Others	82
	70’s and over	16		N.A.	0
	N.A.	0		Total	281

Survey items

A: Environmental risk evaluation / risk management / risk communication

B: Environmental and economic policy / environmental and economic evaluation / environmental and economic indices / environmental management methodology

C: Life style and environment (including environment ethics)

D: Environmental evaluation / environment forecast / environment simulation technology

E: Environment monitoring system

F: Urban and rural area environment (local environment protection)

G: Evaluation of and countermeasures to global warming

H: Maintenance, rehabilitation and related policies for a diversity of ecosystems, landscapes, species, habitats and genes

I: Technology for urban waste minimization / material circulation for environmental conservation / resource- and energy- saving products

J: Pollution prevention for atmosphere, water and soil / circulative use technology for water resources

Time-series tables of topics

<Technological realization>

year	Topic (Leading number represents ID.)
2012	41: Promotion of roof and vertical greening techniques with the function of artificial biotope to mitigate the heat island effect, aridification and habitat loss in urban areas.
2015	07: Information system for all industrial fields to transfer the data of MSDS (Material Safety Data Sheet) of raw materials and products themselves downstream along with the merchandise.
	09: Indication of the information related to the environment, such as carbon footprint and food mileage, on most of the merchandise.
2016	16: Distributed energy system including garbage processing technology that effectively uses household waste while promoting resident participation.
	47: Promotion of the technology to use the biomass waste that is incinerated thoughtlessly in developing countries.
	62: Gasification techniques for power generation or synthetic fuel production technology using unused biomass and waste that reduces dependence on fossil fuels.
2017	08: Life cycle assessment (LCA) and life cycle cost (LCC) estimation that are standardized as objective and quantitative methods to enable everyone to calculate and achieve the same solution.
	14: Technology promoting the shift from production-oriented agriculture to agriculture that will reduce CH4 and N2O, etc. emissions and that has a low environmental load, by reducing the amount of agrichemicals used while considering the timing of application.
	15: New therapy method using the characteristics of bio-resources of forests and woods through physiological analysis of their healing effects.
	44: Replacement of substitution materials for long-life greenhouse gases such as PFC, HFC and SF_6, which will cause global warming in the future.
	46: Promotion of the technology to collect and use the huge amount of methane gas generated from underdeveloped wastewater disposal systems in developing countries.
	65: Efficient reconstruction techniques, including the renewal of deteriorating water and sewage infrastructure and the introduction of a water recycling system, such as the intermediate water system.
2018	02: Speedy method for the evaluation of the risk of chemical materials to enable completion of the examination of a new material and the check on existing materials within several months.
	04: Disaster reduction technology preventing environmental damage in the neighboring area and making early rehabilitation possible in the case of an accident in a chemical plant and/or a tanker etc.
	21: Sophisticated simulation for atmospheric environment forecasting, providing an atmospheric chemical weather map that indicates information about particulate matter, oxidants, nitrogen compounds and so on and that will be used even by citizens, like weather forecasts are now.
	34: Information analysis techniques to efficiently determine water use and the materials cycle in urban areas, using information from the results of a inter-industry analysis and industry logistics information, etc.
	35: Environmental friendly land use planning that involves both urban and rural areas, and adopts a basin as the unit.

year	Topic (Leading number represents ID.)
2018	42: Analyses of the current status and the mechanism of the natural emission, absorption and fixation of greenhouse gas.
	48: Destruction prevention and rehabilitation of tropical forests in the primary regions of the world based on advanced technology for the observation and evaluation of tropical forests.
	52: Construction of a Japanese model for the application of the habitat evaluation procedure (HEP) in each area and project based on the accumulation of knowledge related to the habitat suitability index (HSI) regarding native species, including rare ones.
	53: Development of risk evaluation techniques for invasion involving alien species.
	54: Quantitative evaluation techniques for ecosystem services in each local area, using a basin as a unit.
	55: Comprehensive landscape evaluation taking the value of biodiversity into account during the environment assessment process.
	59: Technology to reasonably recover and use rare metals from urban mines, such as general and industrial waste, incinerated ash and fly ash, to supply more than 50% of the required amount of many kinds of rare metals.
	63: Water process and supply infrastructure that is low-cost, easily maintained, and accessible even in emerging countries and can be easily maintained to provide access to safe water for people all over the world.
	66: Soil pollution reduction and adaptive control techniques based on the combination of physicochemical treatment and natural cleaning to eliminate soil and groundwater pollution in Japan.
	67: Removal and detoxification of chemical materials to dramatically rehabilitate polluted soil and groundwater in developing countries through technology transfer from Japan.
2019	03: Technology and institution to take countermeasures by analyzing and communicating the environmental risks that occur in each region and office in real time.
	05: Technology to control and reduce the risk of chemical materials with long-term hazards influencing human beings, livestock, agricultural production and the natural ecosystem.
	19: Consensus building method to solve local environmental problems in urban and rural areas by minimizing the environmental load.
	24: Health and ecological risk evaluation methods based on environmental dynamics simulation techniques for air, water and soil pollution, and utilization of them in the assessment process.
	27: Evaluation techniques for the socioeconomic factors that cause deterioration in environmental indicator(s).
	28: An observation measurement system that observes the moment-by-moment changes in the condition of air pollutants (oxidants, NO_x, VOCs, etc.) using a synchronous satellite.
	32: Establishing simple frameworks of ecological effect indicators for the swift recognition of environmental load on familiar plants and animals.
	33: System for global monitoring and analysis of ocean and coastal pollution by POPs and other substances.
	37: Market economy methods including mitigation banking (biodiversity offset banking) that offsets the environmental load on urban areas by the rehabilitation and maintenance of natural resources in rural areas.
	38: An evaluation method for local environment preservation activities, including traditional festival and cultural behavior, which is impossible to evaluated with economical indicators.

year	Topic (Leading number represents ID.)
2019	40: Economically sustainable agriculture and forestry that produce high-value added products at low cost by efficiently using the biomass energy of local agroforestry resources and organic waste.
	43: Technology to estimate the amount of each nation's emission and absorption of CO_2 using accurate data derived from observation by artificial satellites.
	45: Prevention of the increase of N_2O gas within the atmosphere, using improved technology for the reduction of N_2O emissions from agriculture, industry and waste disposal.
	51: Compensatory mitigation (rehabilitation and regeneration of lost ecosystems and habitats) techniques for various eco sensitive areas, including ecotones.
	56: Banking system combining the effects of carbon offset and biodiversity offset.
	60: Promotion of a design, production, collection and reuse system that recycles 90% or more of (thermal, chemical and material) products based on legislatively-defined product liability related to the collection and disposal of waste.
	61: Waste disposal and recycling technology for each household that drastically reduces the household waste load and eliminates the need for collection.
	68: Development of greenhouse gas control technology through the elucidation of the metabolism process of carbon and nitrogen within farmland soil.
2020	06: Evaluation and forecasting technology for the risks of functional deterioration of the ecosystem due to climate change and the expansion of artificial activities
	12: Coordinated decision-making system involving all of the stakeholders, exploiting the evaluation of the risk trade-off as well as the knowledge and information infrastructure that consists of databases and knowledge bases relating to the environment.
	20: Systems to support the relevant governments to make a rational political decision by enabling them to assemble and analyze various scientific knowledge, opinion and evaluation, and then recognize and understand the overview of the problem in cases of the global environmental issues such as climate change.
	22: Forecasting technology that analyzes the climate change of this century with a spatial resolution of a municipality scale according to each socio-economic scenario.
	23: Forecasting technology for the future global environment on a time scale of several decades based on a global system model that simultaneously takes into account the material cycles within the atmosphere, oceans and land.
	29: A satellite measurement system for global greenhouse gas (CO_2, and CH_4, etc.) observation that meets the requirements for regional flux measurement (1ppm precision for a CO_2 column) and is hardly affected by the clouds.
	30: Forecasting techniques for the circulation of surface water and groundwater in every basin, based on the effective integration of satellite and ground observation measurement systems.
	31: An analysis and measurement system that separates and quantifies several hundred toxic substances with genetic toxicity such as carcinogenicity, endocrine disruption effect, and ecotoxicity for living things.
	39: A local recycling society that minimizes the nitrogen load on the basin by enabling nitrogen circulation to function effectively based on cooperation between urban and rural areas.
2021	25: Modeling and simulation techniques for large-scale environmental systems forecasting the transition of a disaster that is caused by a pollutant or a disease spread by wild animals.
	57: Building of a recycling society using materials, energy and water efficiently within the community unit.

year	Topic (Leading number represents ID.)
2021	58: Promotion of eco-factory and low-entropy technology that reduces the environmental load by 50% while considering the life cycle of products from production to disposition and the ecological influence of each industry.
2022	49: Improvement of quality of life for inhabitants of desert and semiarid areas based on the promotion of land use techniques securing adequate food production.

<Social realization>

year	Topic (Leading number represents ID.)
2018	17: Introduction of environment education that has an effect of change in citizens' lifestyles through a specific behavior such as practical action to reduce household emissions of CO_2.
	41: Promotion of roof and vertical greening techniques with the function of artificial biotope to mitigate the heat island effect, aridification and habitat loss in urban areas.
2019	09: Indication of the information related to the environment, such as carbon footprint and food mileage, on most of the merchandise.
	10: Institutionalization of the framework for environmental reporting and disclosure according to the corporate social responsibility (CSR) for the environment that is imposed on all companies
2020	01: Institutionalization of risk communication through standardization and promotion of the methodology for environmental risk management
	07: Information system for all industrial fields to transfer the data of MSDS (Material Safety Data Sheet) of raw materials and products themselves downstream along with the merchandise.
	11: Taxation and legislation system to promote a framework to exploit a market mechanism and environmental friendly financing structure for the development and maintenance of public goods and the natural and residential environments.
	16: Distributed energy system including garbage processing technology that effectively uses household waste while promoting resident participation.
2022	15: New therapy method using the characteristics of bio-resources of forests and woods through physiological analysis of their healing effects.
2023	02: Speedy method for the evaluation of the risk of chemical materials to enable completion of the examination of a new material and the check on existing materials within several months.
	08: Life cycle assessment (LCA) and life cycle cost (LCC) estimation that are standardized as objective and quantitative methods to enable everyone to calculate and achieve the same solution.
	13: Promotion of commuting agriculture (agricultural workers will tend to live in urban areas in order to save energy and living costs, and to prepare for the aging society).
	14: Technology promoting the shift from production-oriented agriculture to agriculture that will reduce CH4 and N2O, etc. emissions and that has a low environmental load, by reducing the amount of agrichemicals used while considering the timing of application.
	44: Replacement of substitution materials for long-life greenhouse gases such as PFC, HFC and SF_6, which will cause global warming in the future.
	65: Efficient reconstruction techniques, including the renewal of deteriorating water and sewage infrastructure and the introduction of a water recycling system, such as the intermediate water system.

year	Topic (Leading number represents ID.)
2024	18: Ownership style shift from possession to lease or sharing that will be caused by the changes in the idea of ownership of energy-consuming durable goods, such as cars.
	21: Sophisticated simulation for atmospheric environment forecasting, providing an atmospheric chemical weather map that indicates information about particulate matter, oxidants, nitrogen compounds and so on and that will be used even by citizens, like weather forecasts are now.
	34: Information analysis techniques to efficiently determine water use and the materials cycle in urban areas, using information from the results of a inter-industry analysis and industry logistics information, etc.
	47: Promotion of the technology to use the biomass waste that is incinerated thoughtlessly in developing countries.
	53: Development of risk evaluation techniques for invasion involving alien species.
	59: Technology to reasonably recover and use rare metals from urban mines, such as general and industrial waste, incinerated ash and fly ash, to supply more than 50% of the required amount of many kinds of rare metals.
	62: Gasification techniques for power generation or synthetic fuel production technology using unused biomass and waste that reduces dependence on fossil fuels.
	64: Technology and know-how for operating water supply and recycling systems overseas, including in emerging countries, which is strategically developed based on the all-Japan framework, while incorporating material, structure, operating process, finance and the other factors thereto to obtain a 30% market share in this area.
2025	04: Disaster reduction technology preventing environmental damage in the neighboring area and making early rehabilitation possible in the case of an accident in a chemical plant and/or a tanker etc.
	19: Consensus building method to solve local environmental problems in urban and rural areas by minimizing the environmental load.
	26: Specific planning for a 50% reduction of greenhouse gas emissions involving developing countries, based on an international agreement that is established through communication among policy makers and scientists against the backdrop of future improvements in social forecasting techniques.
	28: An observation measurement system that observes the moment-by-moment changes in the condition of air pollutants (oxidants, NO_x, VOCs, etc.) using a synchronous satellite.
	32: Establishing simple frameworks of ecological effect indicators for the swift recognition of environmental load on familiar plants and animals.
	38: An evaluation method for local environment preservation activities, including traditional festival and cultural behavior, which is impossible to evaluated with economical indicators.
	43: Technology to estimate the amount of each nation's emission and absorption of CO_2 using accurate data derived from observation by artificial satellites.
	46: Promotion of the technology to collect and use the huge amount of methane gas generated from underdeveloped wastewater disposal systems in developing countries.
	48: Destruction prevention and rehabilitation of tropical forests in the primary regions of the world based on advanced technology for the observation and evaluation of tropical forests.
	55: Comprehensive landscape evaluation taking the value of biodiversity into account during the environment assessment process.
2025	66: Soil pollution reduction and adaptive control techniques based on the combination of physicochemical treatment and natural cleaning to eliminate soil and groundwater pollution in Japan.

year	Topic (Leading number represents ID.)
2026	03: Technology and institution to take countermeasures by analyzing and communicating the environmental risks that occur in each region and office in real time.
	05: Technology to control and reduce the risk of chemical materials with long-term hazards influencing human beings, livestock, agricultural production and the natural ecosystem.
	24: Health and ecological risk evaluation methods based on environmental dynamics simulation techniques for air, water and soil pollution, and utilization of them in the assessment process.
	27: Evaluation techniques for the socioeconomic factors that cause deterioration in environmental indicator(s).
	33: System for global monitoring and analysis of ocean and coastal pollution by POPs and other substances.
	35: Environmental friendly land use planning that involves both urban and rural areas, and adopts a basin as the unit.
	37: Market economy methods including mitigation banking (biodiversity offset banking) that offsets the environmental load on urban areas by the rehabilitation and maintenance of natural resources in rural areas.
	54: Quantitative evaluation techniques for ecosystem services in each local area, using a basin as a unit.
	63: Water process and supply infrastructure that is low-cost, easily maintained, and accessible even in emerging countries and can be easily maintained to provide access to safe water for people all over the world.
	67: Removal and detoxification of chemical materials to dramatically rehabilitate polluted soil and groundwater in developing countries through technology transfer from Japan.
2027	06: Evaluation and forecasting technology for the risks of functional deterioration of the ecosystem due to climate change and the expansion of artificial activities
	20: Systems to support the relevant governments to make a rational political decision by enabling them to assemble and analyze various scientific knowledge, opinion and evaluation, and then recognize and understand the overview of the problem in cases of the global environmental issues such as climate change.
	22: Forecasting technology that analyzes the climate change of this century with a spatial resolution of a municipality scale according to each socio-economic scenario.
	29: A satellite measurement system for global greenhouse gas (CO_2, and CH_4, etc.) observation that meets the requirements for regional flux measurement (1ppm precision for a CO_2 column) and is hardly affected by the clouds.
	30: Forecasting techniques for the circulation of surface water and groundwater in every basin, based on the effective integration of satellite and ground observation measurement systems.
	31: An analysis and measurement system that separates and quantifies several hundred toxic substances with genetic toxicity such as carcinogenicity, endocrine disruption effect, and ecotoxicity for living things.
	36: A living environment that is comfortable for elderly people will be established in both urban and rural areas, and will enable younger people to choose the base for their future elderly life
2027	40: Economically sustainable agriculture and forestry that produce high-value added products at low cost by efficiently using the biomass energy of local agroforestry resources and organic waste.

year	Topic (Leading number represents ID.)
	45: Prevention of the increase of N_2O gas within the atmosphere, using improved technology for the reduction of N_2O emissions from agriculture, industry and waste disposal.
	50: Institutionalization of the consensus building process at the time of development planning that is based on the principle of No Net Loss (the policy to maintain the quality and amount of nature before and after a development project) so as to mitigate the loss of habitat of native species and the ecosystem.
	51: Compensatory mitigation (rehabilitation and regeneration of lost ecosystems and habitats) techniques for various eco sensitive areas, including ecotones.
	56: Banking system combining the effects of carbon offset and biodiversity offset.
	60: Promotion of a design, production, collection and reuse system that recycles 90% or more of (thermal, chemical and material) products based on legislatively-defined product liability related to the collection and disposal of waste.
2028	12: Coordinated decision-making system involving all of the stakeholders, exploiting the evaluation of the risk trade-off as well as the knowledge and information infrastructure that consists of databases and knowledge bases relating to the environment.
	23: Forecasting technology for the future global environment on a time scale of several decades based on a global system model that simultaneously takes into account the material cycles within the atmosphere, oceans and land.
	25: Modeling and simulation techniques for large-scale environmental systems forecasting the transition of a disaster that is caused by a pollutant or a disease spread by wild animals.
	39: A local recycling society that minimizes the nitrogen load on the basin by enabling nitrogen circulation to function effectively based on cooperation between urban and rural areas.
	61: Waste disposal and recycling technology for each household that drastically reduces the household waste load and eliminates the need for collection.
	68: Development of greenhouse gas control technology through the elucidation of the metabolism process of carbon and nitrogen within farmland soil.
2030	49: Improvement of quality of life for inhabitants of desert and semiarid areas based on the promotion of land use techniques securing adequate food production.
	57: Building of a recycling society using materials, energy and water efficiently within the community unit.
	58: Promotion of eco-factory and low-entropy technology that reduces the environmental load by 50% while considering the life cycle of products from production to disposition and the ecological influence of each industry.

Area	Topic number	Topic	Round	Responses	Degree of expertise (%)				Importance (%)				Forecasted time of technological realization (to be realized somewhere in the world) (%)							Sectors that will pave the way to technological realization (%)					Forecasted time of social realization (to become applicable/widely used in Japan) (%)							Sectors that will pave the way to social realization (%)					
					High	Moderate	Low	None	Important for Japan and the rest of the world	Especially important for Japan	Especially important for the world	Low importance/priority	Already realized	2011-2015	2016-2020	2021-2030	2031-2040	2041-	don't know will not be realized	University	Public research organization	Private enterprise	Collaboration of multiple sectors	Others	2011-2015	2016-2020	2021-2030	2031-2040	2041-	don't know will not be realized	University	Public research organization	Private enterprise	Government	Collaboration of multiple sectors	Others
Environmental risk evaluation / risk management / risk communication	1	Institutionalization of risk communication through standardization and promotion of the methodology for environmental risk management.	1	247	13	36	51	-	65	19	4	12							5	8									5	8	17	32	17	53	36	18
			2	214	13	33	54	-	75	12	3	10							3	5									3	5	12	31	14	61	39	15
			E	27	100	0	0	-	82	7	4	7							7	0									7	0	30	39	22	57	61	17
	2	Speedy method for the evaluation of the risk of chemical materials to enable completion of the examination of a new material and the check on existing materials within several months.	1	218	14	27	59	-	75	16	4	5						4	11	31	68	27	32	15						4	10	16	47	23	44	29	18
			2	182	14	26	60	-	84	11	3	2						2	4	31	81	25	29	12						2	6	12	62	18	54	27	14
			E	26	100	0	0	-	84	16	0	0						4	0	40	80	40	28	8						8	0	8	64	24	72	12	4
	3	Technology and institution to take countermeasures by analyzing and communicating the environmental risks that occur in each region and office in real time.	1	225	11	32	57	-	50	26	2	22						3	12	26	54	39	33	6						4	12	15	34	35	42	32	7
			2	186	8	31	61	-	60	21	2	17						2	7	22	63	40	31	4						3	5	12	43	39	49	31	7
			E	15	100	0	0	-	54	33	0	13						13	0	43	71	29	29	0						13	0	38	54	31	46	23	0
	4	Disaster reduction technology preventing environmental damage in the neighboring area and making early rehabilitation possible in the case of an accident in a chemical plant and/or a tanker etc.	1	197	7	30	63	-	76	11	8	5						2	8	18	48	47	39	9						2	7	12	34	45	33	32	13
			2	175	4	26	70	-	85	6	5	4						0	5	10	55	54	40	7						1	6	9	40	56	34	33	8
			E	7	100	0	0	-	72	14	14	0						0	0	14	43	14	57	0						0	0	0	14	43	0	57	14
	5	Technology to control and reduce the risk of chemical materials with long-term hazards influencing human beings, livestock, agricultural production and the natural ecosystem.	1	239	19	27	54	-	85	9	4	2						1	6	45	70	19	36	15						2	7	26	54	19	45	35	18
			2	202	15	28	57	-	90	6	3	1						0	6	42	78	17	34	11						1	5	24	63	16	47	34	15
			E	31	100	0	0	-	97	3	0	0						0	0	47	77	10	43	20						3	0	34	59	14	55	34	21
	6	Evaluation and forecasting technology for the risks of functional deterioration of the ecosystem due to climate change and the expansion of artificial activities.	1	253	15	38	47	-	88	2	8	2						4	8	56	63	7	33	23						3	9	35	54	10	40	32	27
			2	216	14	37	49	-	91	2	4	3						3	5	56	68	6	29	19						1	6	36	61	8	40	32	21
			E	31	100	0	0	-	100	0	0	0						7	0	65	71	3	19	26						7	0	33	57	7	37	37	20
	7	Information system for all industrial fields to transfer the data of MSDS (Material Safety Data Sheet) of raw materials and products themselves downstream along with the merchandise.	1	204	13	29	58	-	76	15	3	7						1	4	8	42	53	35	16						2	6	10	30	48	51	26	14
			2	179	10	27	63	-	78	12	3	7						1	1	6	47	60	36	13						1	2	5	29	53	59	21	11
			E	18	100	0	0	-	82	12	6	0						0	0	0	39	67	22	17						0	0	6	22	56	61	28	11
Environmental and	8	Life cycle assessment (LCA) and life cycle cost (LCC) estimation that are standardized as objective and quantitative methods to enable everyone to calculate and achieve the same solution.	1	241	14	33	53	-	67	18	4	11						6	5	37	57	28	33	14						5	7	20	43	36	35	30	16
			2	201	11	30	59	-	74	13	4	9						6	2	34	65	27	37	10						5	4	17	53	40	37	28	12
			E	23	100	0	0	-	80	10	5	5						9	0	22	48	35	48	26						9	0	23	50	45	50	18	23

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Environmental and economic policy / environmental and economic evaluation / Life style and environment (including environment ethics)	9	Indication of the information related to the environment, such as carbon footprint and food mileage, on most of the merchandise.	1	239	12	33	55	-	62	18	3	17							2 1	17	33	61	39	15						4 2	9	20	59	45	40	15
			2	206	10	28	62	-	68	14	3	15							1 1	7	31	70	41	13						3 1	6	15	71	50	37	9
			E	20	100	0	0	-	80	10	0	10							0 0	5	20	70	60	20						10 0	5	15	75	50	35	5
	10	Institutionalization of the framework for environmental reporting and disclosure according to the corporate social responsibility (CSR) for the environment that is imposed on all companies.	1	241	16	30	54	-	64	21	3	12																		6 4	3	13	56	57	24	13
			2	207	15	27	58	-	73	15	2	10																		5 2	1	11	63	62	22	9
			E	31	100	0	0	-	77	17	3	3																		6 0	0	13	63	57	20	7
	11	Taxation and legislation system to promote a framework to exploit a market mechanism and environmental friendly financing structure for the development and maintenance of public goods and the natural and residential environments.	1	203	10	29	61	-	57	35	3	5																		3 7	8	17	25	75	26	10
			2	169	8	28	64	-	58	34	2	6																		1 4	7	13	28	81	23	9
			E	14	100	0	0	-	79	14	0	7																		0 0	14	21	21	86	14	7
	12	Coordinated decision-making system involving all of the stakeholders, exploiting the evaluation of the risk trade-off as well as the knowledge and information infrastructure that consists of databases and knowledge bases relating to the environment.	1	204	11	32	57	-	59	22	3	16							11 9	40	45	23	51	15						11 11	22	31	28	39	51	15
			2	168	10	27	63	-	69	18	1	12							7 5	37	50	19	54	8						8 4	16	31	28	47	56	11
			E	16	100	0	0	-	93	7	0	0							13 0	36	57	29	50	21						13 0	21	43	29	64	43	29
	13	Promotion of commuting agriculture (agricultural workers will tend to live in urban areas in order to save energy and living costs, and to prepare for the aging society).	1	189	7	26	67	-	4	63	1	32																		20 10	7	6	36	58	35	2
			2	166	5	26	69	-	2	67	1	30																		19 6	6	8	43	63	39	1
			E	9	100	0	0	-	13	62	0	25																		0 0	13	0	13	13	75	0
	14	Technology promoting the shift from production-oriented agriculture to agriculture that will reduce CH4 and N2O, etc. emissions and that has a low environmental load, by reducing the amount of agrichemicals used while considering the timing of application.	1	189	13	33	54	-	60	30	6	4							2 6	34	61	35	42	11						2 7	20	44	36	46	45	8
			2	166	12	30	58	-	73	20	4	3							1 4	31	72	34	39	7						1 2	14	44	38	55	47	3
			E	20	100	0	0	-	85	15	0	0							0 0	50	61	22	50	0						0 0	21	42	37	47	42	0
	15	New therapy method using the characteristics of bio-resources of forests and woods through physiological analysis of their healing effects.	1	159	8	26	66	-	19	38	1	42							5 11	49	42	49	21	4						6 10	28	35	61	20	27	3
			2	147	6	20	74	-	17	39	1	43							4 8	53	41	56	14	2						5 8	27	35	70	13	19	1
			E	9	100	0	0	-	45	11	0	44							22 0	38	63	38	13	0						13 0	25	38	50	25	25	0
	16	Distributed energy system including garbage processing technology that effectively uses household waste while promoting resident participation.	1	246	16	32	52	-	40	51	2	7							3 4	29	41	59	48	3						4 5	18	29	47	53	42	3
			2	202	13	30	57	-	35	57	1	7							2 4	24	37	69	50	3						3 3	14	24	52	61	41	2
			E	27	100	0	0	-	54	42	0	4							7 0	26	26	67	37	11						8 0	15	33	48	48	48	4

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Life style and environment (including environment ethics)	17	Introduction of environment education that has an effect of change in citizens' lifestyles through a specific behavior such as practical action to reduce household emissions of CO_2.	1	261	19	29	52	-	68	24	4	4																		3	7	26	16	19	69	42	9
			2	218	14	32	54	-	78	17	2	3																		3	5	24	13	17	75	46	8
			E	31	100	0	0	-	83	17	0	0																		7	0	32	7	25	75	54	7
	18	Ownership style shift from possession to lease or sharing that will be caused by the changes in the idea of ownership of energy-consuming durable goods, such as cars.	1	203	16	26	58	-	42	32	3	23																		20	9	6	9	55	51	40	6
			2	172	11	21	68	-	46	31	1	22																		20	4	5	5	70	54	36	3
			E	19	100	0	0	-	42	32	0	26																		24	6	6	6	71	65	53	6
	19	Consensus building method to solve local environmental problems in urban and rural areas by minimizing the environmental load.	1	216	15	31	54	-	42	45	2	11							11	12	40	41	23	53	9					10	13	24	27	20	56	56	7
			2	185	11	28	61	-	40	49	2	9							6	8	38	39	17	66	8					8	8	22	23	17	66	62	5
			E	20	100	0	0	-	42	58	0	0							11	5	47	47	21	63	5					11	5	32	37	21	58	58	0
	20	Systems to support the relevant governments to make a rational political decision by enabling them to assemble and analyze various scientific knowledge, opinion and evaluation, and then recognize and understand the overview of the problem in cases of the global environmental issues such as climate change.	1	211	15	30	55	-	76	5	10	9							10	10	41	46	7	32	50					12	10	26	29	9	53	35	45
			2	176	12	27	61	-	84	4	6	6							8	5	33	48	6	30	60					9	5	24	30	6	59	35	52
			E	21	100	0	0	-	90	10	0	0							10	0	40	45	5	45	65					10	0	40	30	5	50	50	50
Environmental evaluation / environment forecast / environment simulation technology	21	Sophisticated simulation for atmospheric environment forecasting, providing an atmospheric chemical weather map that indicates information about particulate matter, oxidants, nitrogen compounds and so on and that will be used even by citizens, like weather forecasts are now.	1	237	17	27	56	-	53	21	7	19							4	4	47	72	12	28	9					7	4	27	60	20	38	29	11
			2	202	16	23	61	-	55	17	7	21							3	4	44	80	11	26	5					5	4	25	72	18	35	28	9
			E	32	100	0	0	-	75	19	0	6							0	0	66	91	9	16	0					0	0	50	91	22	38	22	3
	22	Forecasting technology that analyzes the climate change of this century with a spatial resolution of a municipality scale according to each socio-economic scenario.	1	192	10	30	60	-	49	22	5	24							10	5	60	71	8	24	14					10	6	44	58	10	35	29	14
			2	166	9	27	64	-	49	18	5	28							9	3	58	76	7	22	8					8	3	44	66	9	32	22	8
			E	15	100	0	0	-	74	13	0	13							7	0	67	87	7	0	7					7	0	60	80	0	27	7	13
	23	Forecasting technology for the future global environment on a time scale of several decades based on a global system model that simultaneously takes into account the material cycles within the atmosphere, oceans and land.	1	215	13	31	56	-	77	4	12	7							4	5	66	74	6	24	22					5	6	52	64	7	26	29	26
			2	190	11	25	64	-	81	4	8	7							3	1	68	78	4	22	17					4	3	58	73	5	22	28	26
			E	21	100	0	0	-	100	0	0	0							0	0	86	90	5	10	24					0	0	71	86	5	14	19	29
	24	Health and ecological risk evaluation methods based on environmental dynamics simulation techniques for air, water and soil pollution, and utilization of them in the assessment process.	1	241	22	29	49	-	68	20	5	7							2	5	62	73	17	31	12					3	6	46	61	20	40	36	14
			2	209	19	26	55	-	75	16	3	6							3	1	62	79	10	28	8					3	2	46	72	13	43	32	11
			E	40	100	0	0	-	92	5	0	3							3	0	54	82	15	23	13					3	3	41	72	21	46	31	15

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Environmental evaluation / environment forecast / environment simulation	25	Modeling and simulation techniques for large-scale environmental systems forecasting the transition of a disaster that is caused by a pollutant or a disease spread by wild animals.	1	182	5	26	69	-	71	7	11	11							8 8	61	69	9	29	16							9 9	41	61	9	33	30	24
			2	167	4	26	70	-	77	4	8	11							6 3	63	75	6	22	12							6 2	45	70	6	28	27	17
			E	7	100	0	0	-	100	0	0	0							0 0	67	67	0	17	33							0 0	57	71	0	14	14	29
	26	Specific planning for a 50% reduction of greenhouse gas emissions involving developing countries, based on an international agreement that is established through communication among policy makers and scientists against the backdrop of future improvements in social forecasting techniques.	1	218	13	28	59	-	83	1	14	2							8 8	15	22	8	58	30	53							8 8	15	22	8	58	30	53
			2	182	9	29	62	-	90	1	6	3							7 2	11	26	5	66	30	57							7 2	11	26	5	66	30	57
			E	17	100	0	0	-	94	0	6	0							0 0	7	33	7	80	20	60							0 0	7	33	7	80	20	60
	27	Evaluation techniques for the socioeconomic factors that cause deterioration in environmental indicator(s).	1	161	9	26	65	-	65	15	7	13							7 11	54	60	12	23	16							8 11	39	50	12	35	26	19
			2	144	5	26	69	-	72	9	4	15							6 7	64	68	6	17	10							6 7	36	65	12	36	22	9
			E	7	100	0	0	-	86	14	0	0							0 0	57	57	14	0	0							0 0	43	71	14	14	0	0
Environment monitoring system	28	An observation measurement system that observes the moment-by-moment changes in the condition of air pollutants (oxidants, NOx, VOCs, etc.) using a synchronous satellite.	1	174	11	26	63	-	66	9	11	14							4 11	51	72	16	27	22							6 12	38	59	14	39	28	25
			2	154	10	22	68	-	71	3	9	17							3 5	51	77	12	26	17							5 5	35	71	12	36	27	22
			E	15	100	0	0	-	100	0	0	0							0 0	53	80	0	7	13							0 0	27	80	7	33	0	7
	29	A satellite measurement system for global greenhouse gas (CO_2, and CH_4, etc.) observation that meets the requirements for regional flux measurement (1ppm precision for a CO_2 column) and is hardly affected by the clouds.	1	151	8	27	65	-	74	1	11	14							5 10	54	74	11	23	18							4 14	39	64	15	34	26	27
			2	138	7	23	70	-	76	1	10	13							4 3	55	80	8	24	15							4 6	37	76	9	28	25	21
			E	10	100	0	0	-	90	0	10	0							0 0	40	90	0	20	0							0 0	20	90	0	0	20	0
	30	Forecasting techniques for the circulation of surface water and groundwater in every basin, based on the effective integration of satellite and ground observation measurement systems.	1	167	10	30	60	-	63	13	16	8							2 10	58	74	10	25	17							4 12	46	65	15	32	28	22
			2	152	8	26	66	-	71	7	15	7							1 3	63	83	7	21	11							3 4	47	74	6	31	26	18
			E	12	100	0	0	-	83	17	0	0							0 0	58	67	0	8	8							0 0	58	67	0	17	25	8
	31	An analysis and measurement system that separates and quantifies several hundred toxic substances with genetic toxicity such as carcinogenicity, endocrine disruption effect, and ecotoxicity for living things.	1	160	13	33	54	-	70	16	3	11							10 9	62	62	39	27	7							10 10	42	54	38	26	32	12
			2	149	11	30	59	-	79	9	3	9							8 5	68	73	35	20	4							8 4	45	69	37	20	25	9
			E	16	100	0	0	-	88	6	0	6							0 0	69	88	38	6	0							0 0	56	81	38	31	19	6
	32	Establishing simple frameworks of ecological effect indicators for the swift recognition of environmental load on familiar plants and animals.	1	191	20	27	53	-	66	18	5	11							6 6	71	64	9	24	8							6 9	49	57	13	38	31	12
			2	171	16	26	58	-	72	12	4	12							5 4	73	69	7	18	4							5 4	54	68	10	33	26	9
			E	28	100	0	0	-	75	14	0	11							7 0	71	68	4	29	4							7 4	57	75	14	43	29	7

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					(%)				(%)				(%)						(%)											(%)						
Environment monitoring system	33	System for global monitoring and analysis of ocean and coastal pollution by POPs and other substances.	1	154	10	32	58	-	76	3	16	5						3	8	56	68	8	28	31						5	8	39	57	11	38	33	44
			2	142	8	29	63	-	77	2	15	6						2	2	52	80	6	22	27						4	4	33	72	9	36	27	38
			E	11	100	0	0	-	82	0	18	0						18	0	20	90	10	10	50						18	0	30	70	0	30	20	50
	34	Information analysis techniques to efficiently determine water use and the materials cycle in urban areas, using information from the results of a inter-industry analysis and industry logistics information, etc.	1	173	11	25	64	-	48	40	2	10						2	8	63	66	24	28	7						3	9	46	55	25	39	37	9
			2	151	8	22	70	-	52	36	2	10						2	3	65	76	18	24	4						3	2	44	69	21	36	30	3
			E	12	100	0	0	-	58	42	0	0						0	0	83	58	17	17	0						0	0	58	50	17	25	8	0
Urban and rural area environment (local environment protection)	35	Environmental friendly land use planning that involves both urban and rural areas, and adopts a basin as the unit.	1	171	16	31	53	-	31	58	5	6						1	11	55	55	8	41	7						2	14	29	40	13	58	39	6
			2	150	13	27	60	-	28	62	3	7						1	8	59	68	6	37	4						2	7	25	51	11	68	33	4
			E	19	100	0	0	-	37	63	0	0						0	0	67	67	6	39	6						0	0	32	53	11	68	21	0
	36	A living environment that is comfortable for elderly people will be established in both urban and rural areas, and will enable younger people to choose the base for their future elderly life	1	164	9	24	67	-	9	78	1	12																	21	11	9	18	15	74	29	2
			2	146	5	22	73	-	6	82	1	11																	18	10	7	14	16	82	30	2
			E	8	100	0	0	-	0	100	0	0																	25	0	25	25	25	75	25	0
	37	Market economy methods including mitigation banking (biodiversity offset banking) that offsets the environmental load on urban areas by the rehabilitation and maintenance of natural resources in rural areas.	1	152	11	25	64	-	36	46	1	17						10	8	41	49	28	47	4						13	13	18	29	31	47	46	7
			2	132	9	22	69	-	31	51	3	15						9	5	38	59	25	48	3						9	10	16	28	28	59	52	4
			E	12	100	0	0	-	67	25	8	0						0	0	75	67	33	33	8						0	0	45	36	45	64	27	9
	38	An evaluation method for local environment preservation activities, including traditional festival and cultural behavior, which is impossible to evaluated with economical indicators.	1	160	16	24	60	-	33	48	1	18						13	12	57	39	11	33	7						15	15	40	31	15	38	34	10
			2	144	9	22	69	-	33	52	1	14						12	7	65	40	9	35	6						15	7	52	27	9	41	44	8
			E	13	100	0	0	-	31	61	0	8						0	0	58	50	8	33	8						8	0	50	25	8	33	42	8
	39	A local recycling society that minimizes the nitrogen load on the basin by enabling nitrogen circulation to function effectively based on cooperation between urban and rural areas.	1	178	12	33	55	-	45	45	3	7						6	8	50	61	18	42	4						6	11	30	42	24	50	45	5
			2	158	10	25	65	-	48	46	3	3						4	3	51	68	14	41	3						4	5	25	43	18	60	45	3
			E	16	100	0	0	-	56	44	0	0						0	6	56	56	13	50	0						0	6	31	44	13	50	38	0
	40	Economically sustainable agriculture and forestry that produce high-value added products at low cost by efficiently using the biomass energy of local agroforestry resources and organic waste.	1	214	21	30	49	-	43	50	4	3						4	4	43	54	39	51	5						4	7	24	36	38	51	49	5
			2	181	18	26	56	-	43	54	2	1						3	2	42	68	37	51	3						4	3	23	38	38	62	50	3
			E	32	100	0	0	-	56	41	3	0						0	0	47	59	38	50	3						0	0	22	31	50	63	38	3

Area	Topic number	Topic	Round	Responses	Degree of expertise (%)				Importance (%)				Forecasted time of technological realization (to be realized somewhere in the world) (%)						Sectors that will pave the way to technological realization (%)					Forecasted time of social realization (to become applicable/widely used in Japan) (%)						Sectors that will pave the way to social realization (%)					
					High	Moderate	Low	None	Important for Japan and the rest of the world	Especially important for Japan	Especially important for the world	Low importance/priority	Already realized	2011-2015	2016-2020	2021-2030	2031-2040	2041-	don't know will not be realized	University	Public research organization	Private enterprise	Collaboration of multiple sectors	Others	2011-2015	2016-2020	2021-2030	2031-2040	2041-	don't know will not be realized	University	Public research organization	Private enterprise	Government	Collaboration of multiple sectors	Others
Urban and rural area	41	Promotion of roof and vertical greening techniques with the function of artificial biotope to mitigate the heat island effect, aridification and habitat loss in urban areas.	1	217	12	31	57	-	28	57	1	14							2	1	30	32	71	30	2						2	2	15	21	70	43	33	3
			2	185	10	30	60	-	21	67	1	11							1	1	25	32	74	26	2						1	1	11	19	75	45	29	1
			E	18	100	0	0	-	33	67	0	0							0	0	39	39	67	33	0						0	0	28	28	72	50	28	0
Evaluation of and countermeasures to global warming	42	Analyses of the current status and the mechanism of the natural emission, absorption and fixation of greenhouse gas.	1	218	21	36	43	-	88	4	6	2							2	8	70	67	11	23	23												
			2	193	19	35	46	-	92	2	4	2							2	4	73	75	6	19	16												
			E	36	100	0	0	-	97	3	0	0							0	0	80	83	6	23	11												
	43	Technology to estimate the amount of each nation's emission and absorption of CO2 using accurate data derived from observation by artificial satellites.	1	175	8	32	60	-	74	2	13	11							7	12	51	68	13	25	28						6	14	34	51	15	38	24	41
			2	155	8	31	61	-	82	1	8	9							5	6	53	81	8	17	21						7	7	31	69	7	41	20	34
			E	12	100	0	0	-	100	0	0	0							8	0	45	91	18	18	18						17	0	40	90	20	40	20	20
	44	Replacement of substitution materials for long-life greenhouse gases such as PFC, HFC and SF6, which will cause global warming in the future.	1	148	12	29	59	-	84	3	9	4							1	7	39	48	64	19	6						1	9	24	33	62	34	22	16
			2	134	12	25	63	-	90	2	6	2							1	3	38	52	71	11	5						1	4	20	31	75	32	15	8
			E	16	100	0	0	-	93	0	7	0							0	0	56	69	81	6	6						0	0	25	31	88	31	19	13
	45	Prevention of the increase of N2O gas within the atmosphere, using improved technology for the reduction of N2O emissions from agriculture, industry and waste disposal.	1	157	13	31	56	-	76	7	12	5							6	9	46	60	39	28	10						7	10	28	44	42	39	34	14
			2	145	10	31	59	-	85	3	7	5							5	4	53	71	38	16	7						4	4	23	51	55	42	28	10
			E	15	100	0	0	-	100	0	0	0							13	0	60	87	27	20	13						13	0	33	60	40	60	27	13
	46	Promotion of the technology to collect and use the huge amount of methane gas generated from underdeveloped wastewater disposal systems in developing countries.	1	174	13	32	55	-	46	2	46	6							4	5	41	49	50	34	25						5	7	23	30	46	35	39	37
			2	152	12	29	59	-	49	1	45	5							3	3	34	46	63	28	19						3	3	21	28	62	39	35	30
			E	18	100	0	0	-	89	0	11	0							6	0	39	56	67	33	44						6	0	33	44	61	61	56	33
	47	Promotion of the technology to use the biomass waste that is incinerated thoughtlessly in developing countries.	1	206	16	30	54	-	49	3	44	4							2	3	38	43	49	34	31						4	5	19	27	47	42	35	41
			2	181	13	25	62	-	55	2	40	3							2	2	35	45	58	32	30						1	3	16	25	60	45	36	37
			E	23	100	0	0	-	92	4	4	0							4	0	52	52	65	39	39						0	0	30	30	70	52	48	39
	48	Destruction prevention and rehabilitation of tropical forests in the primary regions of the world based on advanced technology for the observation and evaluation of tropical forests.	1	178	12	26	62	-	51	2	45	2							1	7	38	51	22	33	44						5	11	21	35	25	37	35	54
			2	154	10	21	69	-	59	0	39	2							1	3	34	59	16	30	42						3	7	15	39	26	44	34	56
			E	15	100	0	0	-	80	0	20	0							7	0	33	53	33	47	33						7	0	20	40	33	53	33	73

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Evaluation of and Maintenance, rehabilitation and related policies for a diversity of ecosystems, landscapes, species, habitats and genes	49	Improvement of quality of life for inhabitants of desert and semiarid areas based on the promotion of land use techniques securing adequate food production.	1	159	10	20	70	-	34	2	58	6							11	11	41	41	23	34	41						12	14	18	27	33	32	38	50
			2	139	9	19	72	-	32	1	62	5							7	7	43	51	20	29	45						9	9	14	26	33	41	41	54
			E	12	100	0	0	-	58	0	42	0							0	0	42	33	33	50	50						0	0	25	33	33	33	67	50
	50	Institutionalization of the consensus building process at the time of development planning that is based on the principle of No Net Loss (the policy to maintain the quality and amount of nature before and after a development project) so as to mitigate the loss of habitat of native species and the ecosystem.	1	131	13	34	53	-	62	16	9	13																			13	15	19	29	11	59	39	35
			2	116	9	29	62	-	73	9	7	11																			9	11	17	27	9	73	40	34
			E	10	100	0	0	-	90	10	0	0																			11	11	22	11	11	89	44	44
	51	Compensatory mitigation (rehabilitation and regeneration of lost ecosystems and habitats) techniques for various eco sensitive areas, including ecotones.	1	132	19	31	50	-	61	18	11	10							5	7	56	60	28	30	16						6	9	29	46	28	46	43	25
			2	122	16	26	58	-	73	11	8	8							6	5	57	69	23	30	15						5	7	25	53	27	55	41	16
			E	20	100	0	0	-	69	21	5	5							10	0	55	60	45	55	20						11	5	35	45	40	65	55	25
	52	Construction of a Japanese model for the application of the habitat evaluation procedure (HEP) in each area and project based on the accumulation of knowledge related to the habitat suitability index (HSI) regarding native species, including rare ones.	1	116	18	33	49	-	29	59	4	8							4	10	59	61	24	32	9												
			2	106	14	29	57	-	24	63	4	9							2	7	59	73	18	29	5												
			E	15	100	0	0	-	46	47	0	7							0	7	67	73	20	33	0												
	53	Development of risk evaluation techniques for invasion involving alien species.	1	139	12	27	61	-	53	36	4	7							6	7	68	68	10	24	15						6	7	34	54	15	52	34	23
			2	131	10	27	63	-	67	25	2	6							4	4	68	76	6	20	13						3	5	32	61	12	54	32	18
			E	13	100	0	0	-	62	38	0	0							15	0	92	85	0	46	38						8	0	54	54	23	85	54	38
	54	Quantitative evaluation techniques for ecosystem services in each local area, using a basin as a unit.	1	146	20	27	53	-	47	39	4	10							5	10	72	64	9	27	12						5	10	44	50	15	50	34	16
			2	127	17	27	56	-	53	33	4	10							4	6	79	70	8	23	7						4	6	50	64	10	52	27	11
			E	22	100	0	0	-	68	32	0	0							0	0	82	73	9	32	5						0	0	55	59	18	64	18	14
	55	Comprehensive landscape evaluation taking the value of biodiversity into account during the environment assessment process.	1	169	15	36	49	-	47	41	2	10							2	9	63	54	18	32	9						2	11	37	44	22	50	34	11
			2	147	15	29	56	-	56	31	3	10							1	5	68	62	13	29	6						3	6	35	51	17	59	30	5
			E	22	100	0	0	-	63	32	0	5							0	0	64	68	18	45	0						0	0	27	50	23	73	32	5
	56	Banking system combining the effects of carbon offset and biodiversity offset.	1	140	8	37	55	-	59	12	9	20							10	10	44	46	29	36	22						12	10	23	35	32	44	38	30
			2	124	6	30	64	-	70	5	7	18							4	8	46	54	26	41	23						7	9	20	34	33	51	39	26
			E	8	100	0	0	-	87	0	13	0							0	13	63	75	25	38	13						0	13	38	63	25	63	38	25

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					(%)				(%)				(%)							(%)											(%)						
Technology for urban waste minimization / material circulation for environmental conservation / resource- and energy- saving products	57	Building of a recycling society using materials, energy and water efficiently within the community unit.	1	232	19	30	51	-	69	23	3	5							4 7	44	52	39	57	9						5 9	22	34	41	57	55	10
			2	197	16	28	56	-	79	14	3	4							3 3	37	54	34	63	8						2 4	16	31	39	64	54	7
			E	32	100	0	0	-	81	13	3	3							3 3	53	53	41	50	9						3 3	19	25	47	75	56	13
	58	Promotion of eco-factory and low-entropy technology that reduces the environmental load by 50% while considering the life cycle of products from production to disposition and the ecological influence of each industry.	1	186	11	34	55	-	68	29	1	2							2 9	42	43	59	39	7						3 9	16	27	63	43	44	8
			2	160	9	34	57	-	78	19	2	1							1 4	41	42	70	35	5						2 4	12	24	77	46	42	6
			E	14	100	0	0	-	67	33	0	0							0 8	54	54	77	15	8						0 8	15	23	77	54	31	23
	59	Technology to reasonably recover and use rare metals from urban mines, such as general and industrial waste, incinerated ash and fly ash, to supply more than 50% of the required amount of many kinds of rare metals.	1	187	13	29	58	-	35	62	0	3							2 5	37	43	76	28	2						2 4	17	29	70	38	32	4
			2	158	11	29	60	-	31	66	0	3							3 2	34	45	81	24	1						3 1	11	29	82	37	26	1
			E	18	100	0	0	-	24	76	0	0							6 0	28	44	78	28	0						6 0	22	33	78	44	17	0
	60	Promotion of a design, production, collection and reuse system that recycles 90% or more of (thermal, chemical and material) products based on legislatively-defined product liability related to the collection and disposal of waste.	1	182	14	27	59	-	49	46	1	4							4 7	23	43	61	44	6						5 8	13	26	55	57	36	7
			2	155	14	26	60	-	53	44	0	3							4 2	15	40	76	40	3						5 3	8	22	70	62	30	3
			E	21	100	0	0	-	47	53	0	0							5 0	24	33	81	33	0						5 10	19	19	76	62	19	0
	61	Waste disposal and recycling technology for each household that drastically reduces the household waste load and eliminates the need for collection.	1	189	14	25	61	-	36	44	1	19							22 8	30	47	54	40	5						21 10	13	22	57	56	40	4
			2	164	11	25	64	-	33	48	1	18							21 1	29	46	65	39	3						22 4	9	17	68	58	32	1
			E	18	100	0	0	-	35	47	0	18							22 0	33	47	67	13	7						33 11	7	21	79	64	21	0
	62	Gasification techniques for power generation or synthetic fuel production technology using unused biomass and waste that reduces dependence on fossil fuels.	1	207	18	29	53	-	67	27	3	3							2 6	46	52	68	34	4						2 6	27	34	66	43	33	6
			2	173	17	28	55	-	75	22	1	2							2 1	42	54	76	30	2						2 1	22	28	75	43	31	2
			E	29	100	0	0	-	75	25	0	0							3 0	59	48	83	24	0						3 3	34	28	83	41	38	0
Pollution prevention for atmosphere, water and soil /	63	Water process and supply infrastructure that is low-cost, easily maintained, and accessible even in emerging countries and can be easily maintained to provide access to safe water for people all over the world.	1	188	20	27	53	-	46	3	51	0							2 4	38	40	55	30	28						4 8	18	24	49	40	30	41
			2	160	17	23	60	-	47	1	52	0							1 1	33	40	63	31	26						3 1	14	23	58	39	27	36
			E	27	100	0	0	-	60	4	36	0							0 0	52	48	59	26	33						4 0	27	23	50	62	23	35
	64	Technology and know-how for operating water supply and recycling systems overseas, including in emerging countries, which is strategically developed based on the all-Japan framework, while incorporating material, structure, operating process, finance and the other factors thereto to obtain a 30% market share in this area.	1	152	19	28	53	-	37	48	9	6																		14 15	13	22	59	51	44	15
			2	132	17	24	59	-	34	53	8	5																		8 12	6	17	71	61	39	8
			E	22	100	0	0	-	55	45	0	0																		10 5	11	11	79	58	47	21

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Pollution prevention for atmosphere, water and soil / circulative use technology for water resources	65	Efficient reconstruction techniques, including the renewal of deteriorating water and sewage infrastructure and the introduction of a water recycling system, such as the intermediate water system.	1	165	15	28	57	-	31	60	5	4							1	5	18	47	64	39	5						2	7	12	27	60	58	31	4
			2	146	12	27	61	-	26	68	3	3							1	2	11	45	79	33	1						2	3	6	24	73	64	26	1
			E	18	100	0	0	-	41	59	0	0							11	0	18	41	65	41	6						11	0	6	24	71	76	29	0
	66	Soil pollution reduction and adaptive control techniques based on the combination of physicochemical treatment and natural cleaning to eliminate soil and groundwater pollution in Japan.	1	188	18	31	51	-	38	56	2	4							3	8	41	53	56	37	6						4	12	23	35	57	48	37	8
			2	165	15	30	55	-	31	65	2	2							1	2	40	60	69	28	3						2	4	21	43	68	57	30	5
			E	25	100	0	0	-	52	48	0	0							4	4	52	52	76	20	8						4	4	32	28	68	68	28	8
	67	Removal and detoxification of chemical materials to dramatically rehabilitate polluted soil and groundwater in developing countries through technology transfer from Japan.	1	186	20	28	52	-	54	7	37	2							1	6	38	47	56	30	21						2	9	23	32	55	45	32	27
			2	164	18	28	54	-	66	3	29	2							0	2	36	50	70	24	12						2	4	19	29	70	52	29	19
			E	30	100	0	0	-	67	4	29	0							0	3	50	40	67	23	7						0	3	23	27	70	53	30	13
	68	Development of greenhouse gas control technology through the elucidation of the metabolism process of carbon and nitrogen within farmland soil.	1	150	15	29	56	-	71	9	11	9							3	12	64	67	24	20	10						4	12	31	49	30	49	30	20
			2	131	17	24	59	-	77	7	7	9							3	7	69	69	20	16	5						3	7	31	55	23	62	32	14
			E	22	100	0	0	-	90	0	5	5							5	5	77	73	27	14	18						5	5	38	52	33	67	29	10

Panel 9:

Fundamental technologies, including substances, materials, nanosystems, processing, measurement, etc.

Implementation of the questionnaires

	Sent	Returned (response rate)
<1st Round>	359	307 (86%)
<2nd Round>	307	268 (87%)

Sex	Male	253	Affiliation	Private enterprise	44
	Female	15		University	146
	N.A.	0		Research Institute	57
generation	20’s	2		Association	3
	30’s	19		Others	18
	40’s	76		N.A.	0
	50’s	102	Job category	R&D	241
	60’s	46		Others	27
	70’s and over	23		N.A.	0
	N.A.	0		Total	268

Survey items

A: Base materials for Nano-technology

B: Output (device, systemization and applied technology)

C: Measurement and analysis techniques

D: Modeling and Simulation

E: Social systems, others

Time-series tables of topics

<Technological realization>

year	Topic (Leading number represents ID.)
2016	50: A sheet-type light emitting device, made of organic polymers, for illumination and replacement of fluorescent lamps.
2017	03: New functional materials made of complex heterogeneous materials through nano-scale control of structure and interface.
	05: Cheap and simple technology for nano-scale mold forming.
	27: Non-volatile logic LSI.
	51: A materials for high efficiency separation of atoms or molecules using nanopores.
	57: An aberration-corrected ultra high resolution electron microscope generating images that can be used for identification of atoms (with a resolution of 0.05 nm).
	78: Sensor networks that monitor environmental and biological data in fields, barns, ponds and so on, on a sensitive and real-time basis for the early detection of abnormalities in livestock..
	82: Life cycle assessment (LCA) techniques for products, based on the establishment of an LCA database of materials.
	84: General-purpose processing technology which enables one-nanometer order measurements of length, displacement and surface roughness, and which is to be practically used in manufacturing processes.
2018	04: Industrial processing technology for 3-dimensional nano-scale integration.
	09: A lead-free ferroelectric with a piezoelectric modulus that is equivalent to that of PZT ($Pb(Zr,Ti)O_3$).
	11: A practical insulating material with a permittivity of 1.5 or less for super LSI.
	15: Ultra-precision angstrom-order semiconductor processing technology (processing, analysis, testing, and in-situ monitoring) based on the advancement of beam technology (ion, electron, laser and so on), instrument control technology and sensor technology.
	17: Optical devices that use a material with a negative refractive index.
	19: Technology for mass-producing fuel and bio-plastics from non-petroleum materials by using the function of plants or microorganisms
	38: A tissue-regenerative artificial vessel using a resolvable scaffold material, such as polylactic acid.
	39: Biomaterials with the same functionality level as human bones.
	40: Medicine production technology enabling the oral administration of medicines such as insulin and vaccines
	52: Interior and exterior materials with an environment control function that can control humidity and temperature at the same time.
	55: Technology that uses nondestructive inspection techniques to assess the deterioration of metal materials being used and thereby estimate their remaining lifespan.
	61: Generation, control and detection technology for polarized neutrons of a wide energy (wavelength) range for analysis of functions of high-temperature superconductivity or spintronics materials.
	67: Technology applying a simulation based on the first-principle calculation to material design, process design and material evaluation.

year	Topic (Leading number represents ID.)
2018	69: Techniques applying information collection and arrangement (database construction) based on calculation and experiments, to material design (materials informatics).
	75: Automation of analysis process and standardization of analysis technology for nanomaterials (sample preparation, measurement, analysis, software, etc.).
	76: Sensing devices and materials used in a continuous monitoring system for in-hospital infections with viruses and other sources
	83: Precise measurement and impact assessment technology related to trace amounts of water pollutants with carcinogenicity and an endocrine disruption effect.
2019	01: Materials for macro-deformation actuators, polymer materials and/or organic semiconductor materials to develop active soft materials.
	02: Industrial technology to control nanostructures of sizes of 10nm or less using self-assembly.
	13: Surface reforming and tribology to improve the lifespan of parts (at least twice as long as that at present).
	14: Practical, maintenance-free machine elements that have a bearing mechanism with a self-lubricating function to remove the need for lubricating oil.
	16: Manufacturing technology that uses nano-order self-assembly techniques.
	18: A chemical process for mass-production of basic molecules (particularly polyolefin-type polymers) from non-edible plant resources.
	23: Antithrombogenetic artificial valves and a vessel that eliminate the necessity for anticoagulant.
	25: Deep ultra-violet semiconductor lasers.
	26: Low-cost and large-area thin-film solar cells with a conversion efficiency of 20% or higher.
	28: A highly heat-resistant alloy for a high efficiency gas turbine (blade) that is durable against temperatures of 1200 degrees C or higher.
	36: Light emitting devices that consist only of elements with low environmental load.
	37: A conservation medium and technology for long-term conservation of organs for transplant (2 days for hearts and 1 month for kidneys).
	41: A heart valve for transplantation made of tissue-derived biomaterial, which secures safety by applying decellularization or other processes.
	42: Mass-production technology for artificial cornea materials.
	58: General-purpose measuring technology that can concurrently perform identification of chemical conditions, quantitative analysis and imaging of nanoclusters of metals or oxides, interface between metal and oxide, and soft materials, etc. at 0.1 nm spatial resolution.
	60: Neutron microbeam generation and detection technology for imaging water/proton transfer in a polymer membrane in a fuel cell, with a spatial resolution of 1 micrometer.
	65: Sophistication of synchrotron radiation X-ray absorption spectroscopy (measurement technology of the structure of nanoscale functional materials with no long-range periodicity, in a local domain, under various reaction conditions with sub-nanoscale spatial resolution within a microsecond, and a high speed analysis technology for the measurement).
	68: Techniques applying super high precision quantum chemistry calculation to the design of highly functional molecules.
	74: Evaluation and estimation techniques that make society recognize the physiological safety of nano materials

year	Topic (Leading number represents ID.)
2019	77: An ultra-compact chemical analysis system for on-the-spot food safety tests.
	79: A compact certification system for quick personal identification based on DNA.
2020	12: A practical semiconductive diamond for electronics.
	32: High efficiency fuel cells for vehicles using no rare metals.
	43: An artificial system for incubation of fertilized mammal ovum (artificial placenta)
	44: An artificial environment (niche) medium to precisely control stem cell differentiation.
	54: An instrument that automatically analyzes the arrangement of carbohydrate chains with 20 or more sugar units including branches and links.
	56: In-situ electron microscope observation techniques for catalysts, metals or molten salts under the extreme conditions of ultra high temperatures (800 degrees C or higher) and high pressure (3 kPa or higher).
	59: Probe technology to obtain information about chemical composition or chemical status by observing each single atom or molecule in a controlled environment.
	62: A small-size neutron source (accelerator) and experimental facility （10m x 10m） that can be installed within the site of a college, institute or plant.
	63: Super high resolution neutron scattering techniques for observation of slow dynamics of soft matter or heterostructure (such as a magnetic domain).
	64: Measurement and analysis technology using synchrotron radiation for functional materials at the nanoscale or mesoscale (Measurement and analysis technology for simultaneous imaging of chemical species and of chemical status with sub-nanometer spatial resolution and energy resolution of 0.05eV or less under various reaction conditions within a microsecond).
	72: Precise design technology for highly functional and high-value-added molecules based on the function-structure correlation analysis techniques for molecules.
	73: Technology precisely and non-empirically simulating chemical reactions and mass transfer on an interface and a surface, based on parameters such as temperature and chemical potential.
2021	24: Ceramic materials for structural use with a bending strength of 2000 MPa and a fracture toughness of 15MPa·m1/2 or more.
	45: Materials with high energy conversion efficiency, high energy capacity, and low environmental load to utilize renewable energy sources.
	46: Materials for carbon fixation so as to reduce CO_2
	48: Measurement and control technology for electron spin at atomic or molecular levels
	70: Material design techniques based on large scale calculation such as dynamics within a time span of a few microseconds or the first-principle calculation for 10^6 atoms, which are enabled by highly advanced hardware such as next generation super computers.
	71: Multiphysic, multiscale material simulation technology, from the electron scale, atom, meso- and macro-structure to industrial member scale.
2022	22: A thermoelectric power generation module with a conversion efficiency of 10% or higher.
	53: A device that counts the number of all the mRNA types and their copies within a cell.
2023	30: Practical and economical radiation resistant materials for fast-breeder reactors.
	33: Membrane separation techniques to produce hydrogen from coal without emitting CO_2 into the environment.

year	Topic (Leading number represents ID.)
2023	35: High density hydrogen storage materials with a hydrogen density of 10wt% or more and emission temperatures of 100 degrees C or lower.
2024	34: Technology to produce hydrogen from water and sunlight with an energy conversion efficiency of 5% or more.
	66: High quality theoretical calculation technology to comprehensively obtain thermodynamic properties and fundamental physical properties for all of the practically important materials up to quaternary systems, and to integrate them with the experimental techniques for the verification of the results of the calculation.
2025	06: A chemical synthesis methods for protein with a complete higher order structure.
2025	21: Materials reducing energy-loss in transmitting electricity between continents to a practical level
2026	07: An organic ferromagnetic material that has a Currie temperature higher than room temperature.
	08: A polymer material with conductivity and environmental durability that is equivalent to those of copper at room temperature.
	31: Implantable health care devices using bioenergy and functioning semipermanently.
2027	10: An organic superconductor with a transition temperature higher than the temperature of liquid nitrogen.
	47: A tera-hertz optical computer using optical integrated circuits made of photonic crystals.
2028	20: Artificial photosynthesis technology with an efficiency of the level same as plants (1% or more).
	29: Practical and economical plasma-facing materials and radiation resistant materials for fusion reactors.
2032	49: Technology that reduces the radioactivity of high-level radioactive waste to 1/10 through economic nuclear transmutation of radionuclides

<Social realization>

year	Topic (Leading number represents ID.)
2019	81: Establishing a safety standard for the use of nanoparticulates for consumer goods such as cosmetics and foods.
2023	03: New functional materials made of complex heterogeneous materials through nano-scale control of structure and interface.
	05: Cheap and simple technology for nano-scale mold forming.
	50: A sheet-type light emitting device, made of organic polymers, for illumination and replacement of fluorescent lamps.
	57: An aberration-corrected ultra high resolution electron microscope generating images that can be used for identification of atoms (with a resolution of 0.05 nm).
	78: Sensor networks that monitor environmental and biological data in fields, barns, ponds and so on, on a sensitive and real-time basis for the early detection of abnormalities in livestock..
	80: Establishing a safety standard for capsule material and dose amount in a drug delivery system (DDS).
	82: Life cycle assessment (LCA) techniques for products, based on the establishment of an LCA database of materials.

year	Topic (Leading number represents ID.)
2023	84: General-purpose processing technology which enables one-nanometer order measurements of length, displacement and surface roughness, and which is to be practically used in manufacturing processes.
2024	09: A lead-free ferroelectric with a piezoelectric modulus that is equivalent to that of PZT ($Pb(Zr,Ti)O_3$).
	83: Precise measurement and impact assessment technology related to trace amounts of water pollutants with carcinogenicity and an endocrine disruption effect.
2025	04: Industrial processing technology for 3-dimensional nano-scale integration.
	11: A practical insulating material with a permittivity of 1.5 or less for super LSI.
	19: Technology for mass-producing fuel and bio-plastics from non-petroleum materials by using the function of plants or microorganisms
	27: Non-volatile logic LSI.
	40: Medicine production technology enabling the oral administration of medicines such as insulin and vaccines
	51: A materials for high efficiency separation of atoms or molecules using nanopores.
	52: Interior and exterior materials with an environment control function that can control humidity and temperature at the same time.
	76: Sensing devices and materials used in a continuous monitoring system for in-hospital infections with viruses and other sources
2026	02: Industrial technology to control nanostructures of sizes of 10nm or less using self-assembly.
	13: Surface reforming and tribology to improve the lifespan of parts (at least twice as long as that at present).
	18: A chemical process for mass-production of basic molecules (particularly polyolefin-type polymers) from non-edible plant resources.
	25: Deep ultra-violet semiconductor lasers.
	37: A conservation medium and technology for long-term conservation of organs for transplant (2 days for hearts and 1 month for kidneys).
	38: A tissue-regenerative artificial vessel using a resolvable scaffold material, such as polylactic acid.
	39: Biomaterials with the same functionality level as human bones.
	42: Mass-production technology for artificial cornea materials.
	55: Technology that uses nondestructive inspection techniques to assess the deterioration of metal materials being used and thereby estimate their remaining lifespan.
	58: General-purpose measuring technology that can concurrently perform identification of chemical conditions, quantitative analysis and imaging of nanoclusters of metals or oxides, interface between metal and oxide, and soft materials, etc. at 0.1 nm spatial resolution.
	61: Generation, control and detection technology for polarized neutrons of a wide energy (wavelength) range for analysis of functions of high-temperature superconductivity or spintronics materials.
	67: Technology applying a simulation based on the first-principle calculation to material design, process design and material evaluation.
	69: Techniques applying information collection and arrangement (database construction) based on calculation and experiments, to material design (materials informatics).

year	Topic (Leading number represents ID.)
2026	74: Evaluation and estimation techniques that make society recognize the physiological safety of nano materials
	75: Automation of analysis process and standardization of analysis technology for nanomaterials (sample preparation, measurement, analysis, software, etc.).
	77: An ultra-compact chemical analysis system for on-the-spot food safety tests.
2027	01: Materials for macro-deformation actuators, polymer materials and/or organic semiconductor materials to develop active soft materials.
	15: Ultra-precision angstrom-order semiconductor processing technology (processing, analysis, testing, and in-situ monitoring) based on the advancement of beam technology (ion, electron, laser and so on), instrument control technology and sensor technology.
	16: Manufacturing technology that uses nano-order self-assembly techniques.
	23: Antithrombogenetic artificial valves and a vessel that eliminate the necessity for anticoagulant.
	26: Low-cost and large-area thin-film solar cells with a conversion efficiency of 20% or higher.
	41: A heart valve for transplantation made of tissue-derived biomaterial, which secures safety by applying decellularization or other processes.
	56: In-situ electron microscope observation techniques for catalysts, metals or molten salts under the extreme conditions of ultra high temperatures (800 degrees C or higher) and high pressure (3 kPa or higher).
	60: Neutron microbeam generation and detection technology for imaging water/proton transfer in a polymer membrane in a fuel cell, with a spatial resolution of 1 micrometer.
	68: Techniques applying super high precision quantum chemistry calculation to the design of highly functional molecules.
	79: A compact certification system for quick personal identification based on DNA.
2028	14: Practical, maintenance-free machine elements that have a bearing mechanism with a self-lubricating function to remove the need for lubricating oil.
	17: Optical devices that use a material with a negative refractive index.
	28: A highly heat-resistant alloy for a high efficiency gas turbine (blade) that is durable against temperatures of 1200 degrees C or higher.
	36: Light emitting devices that consist only of elements with low environmental load.
	59: Probe technology to obtain information about chemical composition or chemical status by observing each single atom or molecule in a controlled environment.
	63: Super high resolution neutron scattering techniques for observation of slow dynamics of soft matter or heterostructure (such as a magnetic domain).
	64: Measurement and analysis technology using synchrotron radiation for functional materials at the nanoscale or mesoscale (Measurement and analysis technology for simultaneous imaging of chemical species and of chemical status with sub-nanometer spatial resolution and energy resolution of 0.05eV or less under various reaction conditions within a microsecond).
	72: Precise design technology for highly functional and high-value-added molecules based on the function-structure correlation analysis techniques for molecules.
	73: Technology precisely and non-empirically simulating chemical reactions and mass transfer on an interface and a surface, based on parameters such as temperature and chemical potential.

year	Topic (Leading number represents ID.)
2029	12: A practical semiconductive diamond for electronics.
	44: An artificial environment (niche) medium to precisely control stem cell differentiation.
	62: A small-size neutron source (accelerator) and experimental facility （10m x 10m） that can be installed within the site of a college, institute or plant.
2030	32: High efficiency fuel cells for vehicles using no rare metals.
	45: Materials with high energy conversion efficiency, high energy capacity, and low environmental load to utilize renewable energy sources.
	46: Materials for carbon fixation so as to reduce CO_2
	53: A device that counts the number of all the mRNA types and their copies within a cell.
	70: Material design techniques based on large scale calculation such as dynamics within a time span of a few microseconds or the first-principle calculation for 10^6 atoms, which are enabled by highly advanced hardware such as next generation super computers.
	71: Multiphysic, multiscale material simulation technology, from the electron scale, atom, meso- and macro-structure to industrial member scale.
2031	22: A thermoelectric power generation module with a conversion efficiency of 10% or higher.
	33: Membrane separation techniques to produce hydrogen from coal without emitting CO_2 into the environment.
	34: Technology to produce hydrogen from water and sunlight with an energy conversion efficiency of 5% or more.
	43: An artificial system for incubation of fertilized mammal ovum (artificial placenta)
	54: An instrument that automatically analyzes the arrangement of carbohydrate chains with 20 or more sugar units including branches and links.
2032	24: Ceramic materials for structural use with a bending strength of 2000 MPa and a fracture toughness of 15MPa·m1/2 or more.
	30: Practical and economical radiation resistant materials for fast-breeder reactors.
	35: High density hydrogen storage materials with a hydrogen density of 10wt% or more and emission temperatures of 100 degrees C or lower.
	48: Measurement and control technology for electron spin at atomic or molecular levels
	66: High quality theoretical calculation technology to comprehensively obtain thermodynamic properties and fundamental physical properties for all of the practically important materials up to quaternary systems, and to integrate them with the experimental techniques for the verification of the results of the calculation.
2033	08: A polymer material with conductivity and environmental durability that is equivalent to those of copper at room temperature.
2034	07: An organic ferromagnetic material that has a Currie temperature higher than room temperature.
2035	21: Materials reducing energy-loss in transmitting electricity between continents to a practical level.
	31: Implantable health care devices using bioenergy and functioning semipermanently.
2036	10: An organic superconductor with a transition temperature higher than the temperature of liquid nitrogen.
	29: Practical and economical plasma-facing materials and radiation resistant materials for fusion reactors.

year	Topic (Leading number represents ID.)
2036	47: A tera-hertz optical computer using optical integrated circuits made of photonic crystals.
2037	20: Artificial photosynthesis technology with an efficiency of the level same as plants (1% or more).
2038	49: Technology that reduces the radioactivity of high-level radioactive waste to 1/10 through economic nuclear transmutation of radionuclides.

Area	Topic number	Topic	Round	Responses	Degree of expertise (%)				Importance (%)				Forecasted time of technological realization (to be realized somewhere in the world) (%)						Sectors that will pave the way to technological (%)					Forecasted time of social realization (The period when the topic will become applicable/widely (%)						Sectors that willpave the way to social realization (%)					
					High	Moderate	Low	None	Important for Japan and the rest of the world	Especially important for Japan	Especially important for the world	Low importance/priority	Already realized	2011-2015	2016-2020	2021-2030	2031-2040	2041-	don't know	will not be realized	University	Public research organization	Private enterprise	Collaboration of multiple sectors	Others	2011-2015	2016-2020	2021-2030	2031-2040	2041-	don't know	will not be realized	University	Public research organization	Private enterprise	Government	Collaboration of multiple sectors	Others
Base materials for Nano-technology	1	Materials for macro-deformation actuators, polymer materials and/or organic semiconductor materials to develop active soft materials.	1	165	11	24	65	-	63	25	2	10							1	9	67	45	29	25	2						2	12	24	19	73	4	23	2
			2	147	10	22	68	-	68	19	1	12							1	4	67	46	23	23	1						1	6	22	18	77	2	14	1
			E	14	100	0	0	-	93	7	0	0							0	0	64	50	29	29	0						0	0	64	29	57	14	21	0
	2	Industrial technology to control nanostructures of sizes of 10nm or less using self-assembly.	1	230	21	38	41	-	67	26	2	5							2	7	63	47	40	21	1						2	8	25	22	75	4	23	1
			2	199	22	35	43	-	72	22	1	5							1	4	65	48	35	15	1						2	4	25	19	79	2	20	1
			E	43	100	0	0	-	84	14	0	2							0	0	69	43	33	26	0						0	0	43	29	67	0	29	0
	3	New functional materials made of complex heterogeneous materials through nano-scale control of structure and interface.	1	265	37	35	28	-	73	24	1	2							0	3	67	46	40	23	1						0	4	25	26	74	4	23	1
			2	231	34	35	31	-	74	25	0	1							0	1	69	47	39	20	0						0	1	22	25	78	2	22	0
			E	80	100	0	0	-	86	14	0	0							0	0	67	44	41	22	0						0	0	21	27	78	1	19	0
	4	Industrial processing technology for 3-dimensional nano-scale integration.	1	211	16	35	49	-	64	33	2	1							0	3	48	44	60	25	1						0	3	18	21	80	4	25	0
			2	180	12	37	51	-	67	30	1	2							0	2	42	43	65	20	1						1	1	13	20	84	1	21	1
			E	21	100	0	0	-	90	10	0	0							0	0	57	43	81	33	0						0	0	35	25	80	0	35	0
	5	Cheap and simple technology for nano-scale mold forming.	1	198	15	36	49	-	55	34	3	8							1	4	46	35	57	24	0						1	4	19	16	75	2	24	0
			2	169	13	34	53	-	57	35	1	7							0	1	42	33	63	17	1						1	1	15	16	80	0	20	1
			E	22	100	0	0	-	66	24	0	10							0	0	38	33	52	33	0						5	0	18	23	73	0	45	0
	6	A chemical synthesis methods for protein with a complete higher order structure.	1	98	8	16	76	-	74	8	4	14							7	11	76	43	12	19	2													
			2	96	7	17	76	-	83	6	1	10							5	7	82	42	14	13	2													
			E	7	100	0	0	-	86	0	0	14							14	0	86	43	29	0	0													
	7	An organic ferromagnetic material that has a Currie temperature higher than room temperature.	1	119	8	33	59	-	62	15	4	19							6	15	85	41	15	10	2						10	17	41	33	46	3	20	1
			2	113	6	27	67	-	67	12	4	17							6	14	86	35	10	7	1						8	15	39	39	45	1	19	1
			E	7	100	0	0	-	86	0	14	0							0	0	86	43	0	14	0						0	0	43	29	43	0	29	0
	8	A polymer material with conductivity and environmental durability that is equivalent to those of copper at room temperature.	1	154	12	27	61	-	70	20	1	9							8	14	78	49	24	11	1						10	13	40	31	56	5	21	1
			2	143	7	27	66	-	74	16	1	9							9	11	79	47	18	9	1						11	12	45	32	56	1	18	1
			E	10	100	0	0	-	90	10	0	0							10	10	90	70	40	10	0						10	0	80	50	80	0	20	0

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Base materials for Nano-technology	9	A lead-free ferroelectric with a piezoelectric modulus that is equivalent to that of PZT ($Pb(Zr,Ti)O_3$).	1	143	17	32	51	-	63	25	4	8							2	7	67	47	46	16	1						2	9	28	29	73	6	22	3
			2	134	18	28	54	-	72	18	3	7							1	4	68	44	38	10	0						1	5	29	26	76	2	16	0
			E	24	100	0	0	-	79	13	0	8							0	0	83	46	33	0	0						0	0	33	29	79	0	0	0
	10	An organic superconductor with a transition temperature higher than the temperature of liquid nitrogen.	1	142	8	27	65	-	63	14	1	22							9	14	84	48	15	7	1						11	15	41	36	46	3	21	1
			2	129	8	23	69	-	72	9	2	17							9	11	89	44	9	6	1						12	14	45	38	50	2	17	1
			E	10	100	0	0	-	80	10	0	10							11	0	90	60	10	0	0						11	0	30	50	80	0	0	0
	11	A practical insulating material with a permittivity of 1.5 or less for super LSI.	1	145	14	32	54	-	68	28	1	3							1	8	53	48	57	20	0						0	9	19	31	78	5	22	0
			2	129	13	32	55	-	75	21	2	2							1	2	51	49	61	13	0						0	2	11	31	83	2	21	0
			E	17	100	0	0	-	65	35	0	0							6	0	50	38	63	13	0						0	0	6	19	81	0	19	0
	12	A practical semiconductive diamond for electronics.	1	163	12	31	57	-	64	25	4	7							1	9	51	56	42	19	1						2	9	20	40	62	4	24	1
			2	152	11	30	59	-	67	21	2	10							0	7	54	58	37	14	1						1	6	16	42	66	1	24	1
			E	16	100	0	0	-	50	38	6	6							0	0	29	57	36	21	0						0	0	0	33	73	0	20	0
	13	Surface reforming and tribology to improve the lifespan of parts (at least twice as long as that at present).	1	149	14	31	55	-	65	24	3	8							1	5	52	43	49	21	1						0	5	25	25	69	3	24	2
			2	128	13	34	53	-	74	21	1	4							0	0	57	37	49	15	0						0	1	20	22	77	1	22	0
			E	16	100	0	0	-	88	6	6	0							0	0	56	38	50	25	0						0	0	19	25	81	6	38	0
	14	Practical, maintenance-free machine elements that have a bearing mechanism with a self-lubricating function to remove the need for lubricating oil.	1	106	8	35	57	-	70	22	5	3							2	5	54	43	50	24	1						1	6	23	26	75	4	20	1
			2	98	7	31	62	-	77	18	3	2							0	3	52	38	53	14	0						0	3	14	23	80	1	18	0
			E	7	100	0	0	-	100	0	0	0							0	0	71	29	29	0	0						0	0	0	14	86	0	14	0
	15	Ultra-precision angstrom-order semiconductor processing technology (processing, analysis, testing, and in-situ monitoring) based on the advancement of beam technology (ion, electron, laser and so on), instrument control technology and sensor technology.	1	172	19	31	50	-	57	39	2	2							2	4	54	56	49	25	1						2	4	24	36	74	6	21	1
			2	155	17	28	55	-	64	35	0	1							1	1	57	56	41	14	1						1	1	18	36	79	2	18	0
			E	26	100	0	0	-	65	35	0	0							0	0	54	69	42	15	4						0	0	8	35	81	0	12	0
	16	Manufacturing technology that uses nano-order self-assembly techniques.	1	219	25	33	42	-	67	25	1	7							4	6	74	49	35	22	1						4	7	33	35	65	5	23	0
			2	194	20	30	50	-	71	21	1	7							2	5	77	44	32	13	1						2	7	31	28	72	2	20	1
			E	39	100	0	0	-	87	8	0	5							0	3	79	49	26	15	0						0	3	36	44	67	3	21	3

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Base materials for Nano-technology	17	Optical devices that use a material with a negative refractive index.	1	114	13	28	59	-	66	20	2	12							1	8	82	44	19	14	1						1	11	33	36	58	5	24	1
			2	105	10	25	65	-	74	15	0	11							1	7	84	44	17	11	0						1	8	29	33	63	1	24	0
			E	11	100	0	0	-	82	18	0	0							0	0	82	45	0	0	0						0	0	18	45	64	0	9	0
	18	A chemical process for mass-production of basic molecules (particularly polyolefin-type polymers) from non-edible plant resources.	1	84	14	29	57	-	65	17	7	11							4	7	54	43	43	27	1						4	6	21	27	63	14	21	1
			2	81	15	27	58	-	78	9	5	8							3	4	53	44	35	23	1						3	3	22	26	71	9	21	1
			E	12	100	0	0	-	83	17	0	0							0	0	75	42	42	25	0						0	0	33	33	58	17	8	0
	19	Technology for mass-producing fuel and bio-plastics from non-petroleum materials by using the function of plants or microorganisms.	1	126	12	24	64	-	75	17	5	3							2	6	48	52	56	29	2						2	7	20	26	68	15	28	2
			2	116	12	22	66	-	85	11	2	2							0	3	43	52	54	19	2						0	2	19	21	71	8	24	1
			E	14	100	0	0	-	93	7	0	0							0	0	64	43	64	21	0						0	0	43	21	57	21	14	0
	20	Artificial photosynthesis technology with an efficiency of the level same as plants (1% or more).	1	106	2	29	69	-	77	13	4	6							4	8	89	50	16	14	2						7	13	36	43	40	14	29	4
			2	100	2	26	72	-	91	4	1	4							2	4	87	49	14	13	1						4	7	40	45	46	8	29	1
			E	2	100	0	0	-	50	0	0	50							50	0	100	100	0	0	0						50	0	100	50	50	0	0	0
	21	Materials reducing energy-loss in transmitting electricity between continents to a practical level.	1	118	9	25	66	-	79	8	9	4							3	10	45	51	42	26	4						6	11	18	26	63	20	28	7
			2	111	7	18	75	-	84	5	6	5							3	3	41	60	43	18	2						3	5	10	25	72	14	23	3
			E	8	100	0	0	-	100	0	0	0							0	0	38	50	75	13	0						0	0	25	38	88	13	13	0
Output (device, systemization and applied technology)	22	A thermoelectric power generation module with a conversion efficiency of 10% or higher.	1	134	15	28	57	-	75	19	3	3							2	8	64	51	37	23	2						2	9	30	38	65	11	22	4
			2	127	14	28	58	-	85	11	2	2							0	5	71	55	27	18	1						0	5	25	36	68	4	21	1
			E	18	100	0	0	-	88	12	0	0							0	0	89	50	28	11	0						0	0	28	39	83	6	22	0
	23	Antithrombogenetic artificial valves and a vessel that eliminate the necessity for anticoagulant.	1	84	21	30	49	-	82	10	6	2							1	7	72	44	46	23	2						2	5	33	28	69	8	25	3
			2	79	14	28	58	-	87	7	3	3							0	5	74	42	39	19	1						1	4	28	27	75	3	20	1
			E	11	100	0	0	-	90	10	0	0							0	0	73	64	27	0	0						0	0	36	18	64	0	18	0
	24	Ceramic materials for structural use with a bending strength of 2000 MPa and a fracture toughness of 15MPa･m1/2 or more.	1	119	22	29	49	-	56	30	5	9							3	14	66	55	32	16	0						3	15	32	38	63	3	26	2
			2	109	18	28	54	-	64	25	2	9							1	7	69	56	27	13	0						0	8	23	37	70	2	22	0
			E	20	100	0	0	-	75	20	0	5							5	0	55	60	45	5	0						0	5	20	45	80	0	20	0

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Output (device, systemization and applied technology)	25	Deep ultra-violet semiconductor lasers.	1	110	20	34	46	-	65	28	1	6											2	6	64	56	42	15	1												0	6	27	34	74	7	21	0
			2	96	17	35	48	-	69	26	2	3											0	3	67	48	37	14	0												0	2	20	31	75	1	18	0
			E	16	100	0	0	-	75	25	0	0											0	0	69	56	38	6	0												0	0	25	50	81	0	13	0
	26	Low-cost and large-area thin-film solar cells with a conversion efficiency of 20% or higher.	1	194	18	26	56	-	73	23	3	1											2	4	53	52	59	27	1												2	4	20	29	77	14	26	1
			2	170	14	28	58	-	79	19	1	1											2	2	51	50	57	22	0												2	1	18	26	80	9	23	1
			E	24	100	0	0	-	83	13	4	0											0	4	75	63	54	17	0												0	5	14	32	95	23	18	0
	27	Non-volatile logic LSI.	1	88	19	27	54	-	63	21	6	10											0	10	46	51	56	25	2												0	10	18	26	79	6	23	1
			2	84	19	32	49	-	71	21	2	6											0	4	45	52	57	22	0												0	4	14	23	88	1	20	0
			E	16	100	0	0	-	94	6	0	0											0	0	50	63	63	38	0												0	0	13	31	88	0	25	0
	28	A highly heat-resistant alloy for a high efficiency gas turbine (blade) that is durable against temperatures of 1200 dgrees C or higher.	1	110	23	26	51	-	66	25	3	6											2	7	41	59	50	16	0												3	9	19	42	70	9	20	0
			2	99	21	26	53	-	79	14	1	6											1	5	36	65	47	13	0												1	7	10	38	77	6	20	0
			E	21	100	0	0	-	85	15	0	0											0	0	40	85	30	0	0												0	0	16	53	79	5	21	0
	29	Practical and economical plasma-facing materials and radiation resistant materials for fusion reactors.	1	86	14	24	62	-	59	17	7	17											8	10	44	58	25	29	8												11	12	25	44	36	19	30	10
			2	79	11	25	64	-	67	14	4	15											12	8	38	63	16	24	5												14	12	15	53	36	16	26	8
			E	9	100	0	0	-	78	22	0	0											0	0	11	67	11	0	11												11	0	0	50	25	0	25	13
	30	Practical and economical radiation resistant materials for fast-breeder reactors.	1	80	11	29	60	-	48	35	6	11											3	9	37	66	30	30	3												4	10	20	57	43	25	34	3
			2	76	9	33	58	-	51	36	3	10											3	7	33	79	23	20	0												3	8	12	66	42	12	32	1
			E	7	100	0	0	-	71	29	0	0											0	0	14	86	0	0	0												0	0	0	86	14	0	14	0
	31	Implantable health care devices using bioenergy and functioning semipermanently.	1	116	13	18	69	-	72	14	2	12											5	9	64	49	28	25	4												7	13	27	25	61	15	31	4
			2	102	7	21	72	-	77	9	1	13											5	7	69	43	19	22	2												4	9	29	26	67	4	29	3
			E	7	100	0	0	-	71	0	0	29											0	0	71	43	0	14	0												0	0	43	29	71	0	29	14
	32	High efficiency fuel cells for vehicles using no rare metals.	1	172	16	31	53	-	64	32	1	3											5	9	52	48	55	26	4												4	9	20	28	76	14	28	2
			2	149	13	33	54	-	70	26	1	3											3	6	51	45	58	21	2												3	6	14	26	79	11	26	2
			E	19	100	0	0	-	74	26	0	0											0	0	56	33	33	33	0												0	0	6	17	61	17	22	0

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Output (device, systemization and applied technology)	33	Membrane separation techniques to produce hydrogen from coal without emitting CO_2 into the environment.	1	112	10	34	56	-	68	18	6	8							7 8	50	59	38	26	4						8 10	22	33	51	15	29	4
			2	108	8	29	63	-	76	17	0	7							5 5	52	65	29	23	3						6 6	17	36	59	9	29	2
			E	9	100	0	0	-	89	11	0	0							0 0	56	89	22	0	0						11 0	22	44	67	0	11	0
	34	Technology to produce hydrogen from water and sunlight with an energy conversion efficiency of 5% or more.	1	146	10	27	63	-	74	18	3	5							6 9	66	54	34	25	1						8 10	28	41	51	15	29	1
			2	131	9	29	62	-	84	11	1	4							2 3	69	54	27	18	2						2 4	21	42	62	9	26	2
			E	12	100	0	0	-	84	8	0	8							8 0	73	64	27	9	0						0 0	0	55	64	9	9	0
	35	High density hydrogen storage materials with a hydrogen density of 10wt% or more and emission temperatures of 100 degrees C or lower.	1	108	10	30	60	-	66	22	4	8							6 12	66	57	28	22	2						7 13	28	35	57	14	28	3
			2	102	12	25	63	-	80	11	2	7							3 9	71	53	21	17	2						3 9	18	39	71	4	26	2
			E	12	100	0	0	-	92	8	0	0							0 17	73	55	18	18	0						0 17	18	36	73	0	27	0
	36	Light emitting devices that consist only of elements with low environmental load.	1	135	21	31	48	-	68	24	2	6							2 8	67	45	37	21	1						2 8	26	23	67	10	26	2
			2	114	18	30	52	-	78	19	0	3							1 3	71	45	27	15	1						1 4	24	22	75	5	22	2
			E	21	100	0	0	-	90	10	0	0							0 0	76	48	19	5	0						0 0	30	35	75	5	15	0
	37	A conservation medium and technology for long-term conservation of organs for transplant (2 days for hearts and 1 month for kidneys).	1	48	10	25	65	-	78	11	7	4							0 9	72	52	17	24	2						2 9	47	40	49	7	28	2
			2	46	7	24	69	-	83	9	4	4							0 4	78	48	11	15	2						2 4	44	42	60	4	20	2
			E	3	100	0	0	-	67	33	0	0							0 0	100	67	0	0	0						0 0	0	67	67	67	0	0
	38	A tissue-regenerative artificial vessel using a resolvable scaffold material, such as polylactic acid.	1	85	24	29	47	-	83	13	2	2							0 9	72	52	37	26	1						0 9	34	28	56	9	31	3
			2	80	16	35	49	-	90	9	0	1							0 5	72	51	35	18	0						0 5	36	29	63	3	28	0
			E	13	100	0	0	-	77	15	0	8							0 15	77	31	31	8	0						0 23	54	15	54	8	8	0
	39	Biomaterials with the same functionality level as human bones.	1	135	19	30	51	-	79	13	3	5							2 8	71	52	34	27	2						2 7	39	34	63	9	29	2
			2	122	15	30	55	-	87	7	2	4							2 4	75	51	41	15	1						2 5	34	37	74	6	22	1
			E	18	100	0	0	-	89	11	0	0							0 0	89	50	28	17	0						0 0	44	39	72	0	17	0
	40	Medicine production technology enabling the oral administration of medicines such as insulin and vaccines.	1	64	20	27	53	-	76	5	6	13							3 11	68	41	42	17	2						5 8	33	28	71	5	24	2
			2	59	10	25	65	-	86	2	2	10							0 9	69	33	41	17	0						0 6	26	19	74	0	20	0
			E	6	100	0	0	-	100	0	0	0							0 0	50	50	50	0	0						0 0	17	17	83	0	17	0

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Output (device, systemization and applied technology)	41	A heart valve for transplantation made of tissue-derived biomaterial, which secures safety by applying decellularization or other processes.	1	48	19	21	60	-	76	9	2	13							4	4	70	43	17	24	2						4	6	43	32	36	9	30	2
			2	48	15	19	66	-	88	6	0	6							0	4	74	43	15	17	0						0	7	53	33	44	2	24	0
			E	7	100	0	0	-	86	0	0	14							0	0	86	57	29	0	0						0	14	57	57	86	0	0	0
	42	Mass-production technology for artificial cornea materials.	1	56	14	23	63	-	76	11	4	9							2	5	58	53	42	25	2						2	7	23	28	57	6	30	4
			2	53	8	21	71	-	84	8	2	6							0	4	65	51	31	20	0						0	6	27	24	65	2	27	0
			E	4	100	0	0	-	75	25	0	0							0	0	100	50	50	0	0						0	0	50	25	75	0	0	0
	43	An artificial system for incubation of fertilized mammal ovum (artificial placenta).	1	28	14	18	68	-	68	7	7	18							8	4	73	65	15	15	4						11	0	27	46	46	8	19	4
			2	28	14	4	82	-	67	11	4	18							7	7	70	59	15	0	4						8	8	35	65	50	4	4	4
			E	4	100	0	0	-	100	0	0	0							0	0	100	50	0	0	0						0	0	25	75	25	25	25	0
	44	An artificial environment (niche) medium to precisely control stem cell differentiation.	1	51	22	20	58	-	78	12	2	8							2	12	84	55	12	14	2						2	10	38	36	34	12	34	2
			2	49	16	18	66	-	79	13	2	6							2	6	90	46	19	4	2						2	6	47	45	47	0	19	2
			E	8	100	0	0	-	100	0	0	0							0	0	100	38	0	0	0						0	0	63	38	50	0	0	0
	45	Materials with high energy conversion efficiency, high energy capacity, and low environmental load to utilize renewable energy sources.	1	153	18	28	54	-	76	20	3	1							1	5	61	56	35	32	1						1	5	27	41	52	23	34	1
			2	137	15	26	59	-	82	14	3	1							1	5	60	51	34	25	1						1	5	20	40	63	15	33	1
			E	21	100	0	0	-	90	5	5	0							0	10	62	57	48	19	0						0	10	24	48	71	24	29	0
	46	Materials for carbon fixation so as to reduce CO_2.	1	138	14	22	64	-	78	11	4	7							4	5	63	59	25	23	4						4	5	27	45	42	20	30	5
			2	128	12	21	67	-	80	10	2	8							4	2	63	53	22	19	3						4	4	20	53	45	14	35	3
			E	15	100	0	0	-	93	7	0	0							0	0	67	33	27	20	7						0	0	7	47	53	20	27	7
	47	A tera-hertz optical computer using optical integrated circuits made of photonic crystals.	1	108	10	28	62	-	55	24	3	18							6	10	77	52	29	17	2						10	13	37	33	61	10	27	2
			2	94	9	30	61	-	69	16	2	13							3	5	79	46	20	13	1						7	6	36	33	64	3	26	1
			E	8	100	0	0	-	75	0	0	25							13	0	57	57	14	29	0						13	0	14	57	57	14	43	0
	48	Measurement and control technology for electron spin at atomic or molecular levels.	1	142	21	26	53	-	61	24	6	9							2	5	86	53	19	12	1						3	7	52	47	42	7	21	3
			2	129	19	25	56	-	72	18	1	9							2	2	83	44	11	11	2						2	6	53	48	41	2	19	2
			E	25	100	0	0	-	88	4	0	8							4	0	78	52	9	13	4						4	4	38	58	42	0	21	4

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Output (device, systemization and applied technology)	49	Technology that reduces the radioactivity of high-level radioactive waste to 1/10 through economic nuclear transmutation of radionuclides.	1	57	12	26	62	-	59	25	5	11							16	7	34	77	13	21	6						23	13	23	69	19	31	23	6
			2	55	13	25	62	-	69	21	4	6							17	4	31	83	4	10	2						22	4	19	81	17	19	15	2
			E	7	100	0	0	-	86	0	0	14							17	0	0	100	0	0	0						17	0	0	100	17	0	0	0
	50	A sheet-type light emitting device, made of organic polymers, for illumination and replacement of fluorescent lamps.	1	142	11	28	61	-	68	26	1	5							0	2	53	43	59	22	1						1	3	16	20	83	8	24	1
			2	124	11	27	62	-	77	19	1	3							1	0	51	43	58	16	0						1	0	10	15	85	3	17	0
			E	14	100	0	0	-	93	7	0	0							0	0	71	57	50	7	0						0	0	21	36	79	7	21	0
	51	A materials for high efficiency separation of atoms or molecules using nanopores.	1	142	13	34	53	-	67	24	3	6							0	5	71	50	42	18	1						1	6	29	29	68	4	27	1
			2	129	13	29	58	-	75	18	1	6							1	3	74	48	38	14	0						1	3	22	26	74	1	21	0
			E	17	100	0	0	-	88	12	0	0							0	0	65	35	35	12	0						0	0	29	18	59	0	18	0
	52	Interior and exterior materials with an environment control function that can control humidity and temperature at the same time.	1	101	11	29	60	-	41	35	3	21							3	9	47	36	59	21	2						2	9	22	20	72	4	23	2
			2	90	7	31	62	-	49	30	2	19							3	3	50	33	66	8	0						1	5	20	16	80	2	21	0
			E	6	100	0	0	-	66	17	0	17							17	0	50	33	50	17	0						0	17	17	17	50	0	33	0
Measurement and analysis techniques	53	A device that counts the number of all the mRNA types and their copies within a cell.	1	40	10	25	65	-	67	15	8	10							3	8	70	51	24	24	0						3	5	36	33	36	3	41	0
			2	40	5	15	80	-	82	5	5	8							0	3	74	49	13	10	0						0	5	43	38	46	3	27	0
			E	2	100	0	0	-	100	0	0	0							0	0	100	50	0	0	0						0	0	50	50	0	0	50	0
	54	An instrument that automatically analyzes the arrangement of carbohydrate chains with 20 or more sugar units including branches and links.	1	40	3	38	59	-	66	24	5	5							0	5	77	51	23	20	0						0	3	38	36	49	0	36	0
			2	41	2	20	78	-	79	13	5	3							0	0	83	45	15	10	0						0	0	46	41	54	0	23	0
			E	1	100	0	0	-	100	0	0	0							0	0	100	0	0	0	0						0	0	0	100	0	0	0	0
	55	Technology that uses nondestructive inspection techniques to assess the deterioration of metal materials being used and thereby estimate their remaining lifespan.	1	134	12	39	49	-	75	20	2	3							1	10	57	58	38	22	1						1	10	32	38	64	14	24	1
			2	125	9	34	57	-	82	15	1	2							0	9	61	61	34	15	1						0	9	26	39	73	7	22	0
			E	11	100	0	0	-	100	0	0	0							0	9	73	73	27	9	0						0	9	45	73	82	0	27	0
	56	In-situ electron microscope observation techniques for catalysts, metals or molten salts under the extreme conditions of ultra high temperatures (800 dgrees C or higher) and high pressure (3 kPa or higher).	1	124	15	31	54	-	55	23	2	20							7	6	65	54	34	16	1						7	10	38	40	53	4	23	1
			2	110	13	29	58	-	62	19	1	18							6	4	72	59	23	9	1						7	5	35	51	61	0	23	1
			E	14	100	0	0	-	77	8	0	15							7	0	79	57	14	0	0						7	0	23	54	62	0	15	0

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Measurement and analysis techniques	57	An aberration-corrected ultra high resolution electron microscope generating images that can be used for identification of atoms (with a resolution of 0.05 nm).	1	143	17	28	55	-	65	26	1	8							1	9	62	50	46	17	0							1	9	32	40	71	5	21	1
			2	127	15	28	57	-	68	24	1	7							0	6	63	52	42	15	0							1	6	27	39	75	1	20	0
			E	19	100	0	0	-	74	26	0	0							0	0	63	53	42	26	0							0	0	28	44	78	0	22	0
	58	General-purpose measuring technology that can concurrently perform identification of chemical conditions, quantitative analysis and imaging of nanoclusters of metals or oxides, interface between metal and oxide, and soft materials, etc. at 0.1 nm spatial resolution.	1	149	18	40	42	-	68	24	1	7							5	9	64	53	36	15	0							3	10	33	44	63	4	18	1
			2	133	13	41	46	-	72	23	0	5							2	5	68	51	32	12	0							2	5	31	46	69	0	17	0
			E	17	100	0	0	-	88	12	0	0							0	0	76	53	24	12	0							0	0	24	41	71	0	24	0
	59	Probe technology to obtain information about chemical composition or chemical status by observing each single atom or molecule in a controlled environment.	1	169	20	33	47	-	76	16	1	7							5	10	72	54	29	16	0							4	10	39	44	49	6	22	0
			2	149	15	32	53	-	79	16	1	4							3	6	78	48	23	12	0							3	6	42	44	51	1	21	0
			E	23	100	0	0	-	91	9	0	0							0	4	78	48	22	9	0							0	4	35	48	70	0	22	0
	60	Neutron microbeam generation and detection technology for imaging water/proton transfer in a polymer membrane in a fuel cell, with a spatial resolution of 1 micrometer.	1	74	11	30	59	-	44	33	4	19							3	10	53	63	26	17	3							4	7	36	58	42	6	21	6
			2	71	10	25	65	-	53	26	4	17							3	3	48	61	18	15	3							5	3	29	65	32	0	25	3
			E	7	100	0	0	-	72	14	0	14							0	0	57	100	0	0	0							14	0	33	100	33	0	17	0
	61	Generation, control and detection technology for polarized neutrons of a wide energy (wavelength) range for analysis of functions of high-temperature superconductivity or spintronics materials.	1	67	18	30	52	-	62	27	1	10							0	11	52	72	25	18	0							4	13	36	63	36	8	30	3
			2	64	16	27	57	-	70	18	2	10							0	6	52	82	15	10	0							3	8	27	80	30	0	25	0
			E	10	100	0	0	-	70	10	0	20							0	0	50	90	0	0	0							20	10	25	88	13	0	25	0
	62	A small-size neutron source (accelerator) and experimental facility（10m x 10m）that can be installed within the site of a college, institute or plant.	1	91	13	26	61	-	38	26	4	32							11	15	49	70	23	17	1							9	16	32	63	39	13	29	2
			2	84	12	20	68	-	44	20	5	31							6	13	40	80	12	15	0							8	11	22	74	28	2	27	0
			E	10	100	0	0	-	60	20	0	20							0	10	30	70	0	30	0							0	10	20	60	10	10	50	0
	63	Super high resolution neutron scattering techniques for observation of slow dynamics of soft matter or heterostructure (such as a magnetic domain).	1	81	16	23	61	-	46	30	4	20							2	12	51	72	18	19	0							3	18	39	67	32	11	27	3
			2	72	13	22	65	-	55	25	6	14							1	8	47	80	13	10	0							3	11	32	78	25	3	24	0
			E	9	100	0	0	-	67	11	0	22							0	0	44	89	11	11	0							11	0	25	88	13	0	25	0
	64	Measurement and analysis technology using synchrotron radiation for functional materials at the nanoscale or mesoscale (Measurement and analysis technology for simultaneous imaging of chemical species and of chemical status with sub-nanometer spatial resolution and energy resolution of 0.05eV or less under various reaction conditions within a microsecond).	1	122	16	30	54	-	65	21	2	12							2	11	60	74	13	19	2							2	14	40	67	30	12	28	3
			2	106	12	28	60	-	68	20	3	9							0	7	57	75	10	18	0							1	10	38	75	23	7	29	0
			E	13	100	0	0	-	62	23	0	15							0	8	69	92	8	15	0							8	8	67	75	25	0	25	0

Area	Topic number	Topic	Round	Responses	Degree of expertise (%)				Importance (%)				Forecasted time of technological realization (to be realized somewhere in the world) (%)						Sectors that will pave the way to technological (%)					Forecasted time of social realization (The period when the topic will become applicable/widely (%)						Sectors that willpave the way to social realization (%)					
					High	Moderate	Low	None	Important for Japan and the rest of the world	Especially important for Japan	Especially important for the world	Low importance/priority	Already realized	2011-2015	2016-2020	2021-2030	2031-2040	2041-	don't know will not be realized	University	Public research organization	Private enterprise	Collaboration of multiple sectors	Others	2011-2015	2016-2020	2021-2030	2031-2040	2041-	don't know will not be realized	University	Public research organization	Private enterprise	Government	Collaboration of multiple sectors	Others
Measurement and analysis	65	Sophistication of synchrotron radiation X-ray absorption spectroscopy (measurement technology of the structure of nanoscale functional materials with no long-range periodicity, in a local domain, under various reaction conditions with sub-nanoscale spatial resolution within a microsecond, and a high speed analysis technology for the measurement).	1	110	17	27	56	-	67	23	3	7							0	14	59	75	16	15	1											
			2	102	14	26	60	-	74	17	2	7							1	9	59	76	12	16	1											
			E	14	100	0	0	-	93	0	0	7							0	0	71	93	0	14	0											
Modeling and Simulation	66	High quality theoretical calculation technology to comprehensively obtain thermodynamic properties and fundamental physical properties for all of the practically important materials up to quaternary systems, and to integrate them with the experimental techniques for the verification of the results of the calculation.	1	103	17	28	55	-	64	27	2	7							4	10	74	56	18	23	2						3	11	56	49	29	9	31	2
			2	93	13	26	61	-	71	21	1	7							3	2	76	55	10	16	1						3	4	62	54	26	2	26	0
			E	12	100	0	0	-	83	17	0	0							0	0	83	58	0	8	0						0	0	67	67	33	0	8	0
	67	Technology applying a simulation based on the first-principle calculation to material design, process design and material evaluation.	1	166	19	22	59	-	74	18	1	7							2	8	80	56	22	17	1						2	8	55	50	41	4	24	1
			2	152	17	22	61	-	76	19	0	5							1	3	83	51	17	12	1						1	5	55	51	38	2	21	0
			E	26	100	0	0	-	80	20	0	0							0	0	85	65	15	15	0						0	4	77	69	35	0	8	0
	68	Techniques applying super high precision quantum chemistry calculation to the design of highly functional molecules.	1	104	17	22	61	-	67	19	2	12							1	8	79	48	24	18	1						2	5	53	51	39	5	18	2
			2	97	11	27	62	-	76	14	1	9							1	2	85	44	13	15	0						2	2	57	47	35	2	14	0
			E	11	100	0	0	-	82	18	0	0							0	0	64	27	0	18	0						0	0	64	36	9	0	9	0
	69	Techniques applying information collection and arrangement (database construction) based on calculation and experiments, to material design (materials informatics).	1	133	17	24	59	-	63	25	1	11							0	9	69	58	25	20	1						1	8	44	50	45	9	27	2
			2	125	12	28	60	-	70	21	0	9							0	4	71	61	16	14	0						1	4	41	53	47	2	24	0
			E	15	100	0	0	-	80	13	0	7							0	0	73	53	7	0	0						0	0	53	53	40	0	7	0
	70	Material design techniques based on large scale calculation such as dynamics within a time span of a few microseconds or the first-principle calculation for 10^6 atoms, which are enabled by highly advanced hardware such as next generation super computers.	1	121	16	25	59	-	58	28	2	12							0	10	69	58	22	21	1						1	9	49	50	35	13	26	2
			2	116	10	29	61	-	62	24	3	11							0	6	71	60	15	18	0						1	7	46	55	32	6	26	1
			E	12	100	0	0	-	83	17	0	0							0	0	83	42	0	8	0						0	0	50	42	25	0	17	0
	71	Multiphysic, multiscale material simulation technology, from the electron scale, atom, meso- and macro-structure to industrial member scale.	1	129	13	28	59	-	62	29	2	7							0	9	78	53	17	18	1						1	8	54	46	36	6	24	2
			2	120	9	28	63	-	73	19	3	5							0	2	84	47	9	12	0						0	3	53	47	38	2	22	0
			E	11	100	0	0	-	82	9	9	0							0	0	73	27	9	18	0						0	0	36	27	36	0	18	0
	72	Precise design technology for highly functional and high-value-added molecules based on the function-structure correlation analysis techniques for molecules.	1	103	12	32	56	-	62	28	2	8							1	13	80	45	19	17	1						2	9	44	40	40	7	24	3
			2	94	10	33	57	-	72	23	1	4							0	0	80	41	12	12	0						0	1	51	44	51	0	22	0
			E	9	100	0	0	-	89	11	0	0							0	0	89	44	0	11	0						0	0	56	67	44	0	11	0

Area	Topic number	Topic	Round	Responses	Degree of expertise (%)				Importance (%)				Forecasted time of technological realization (to be realized somewhere in the world)								Sectors that will pave the way to technological (%)					Forecasted time of social realization (The period when the topic will become applicable/widely								Sectors that willpave the way to social realization (%)						
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Modeling and Simulation	73	Technology precisely and non-empirically simulating chemical reactions and mass transfer on an interface and a surface, based on parameters such as temperature and chemical potential.	1	133	17	27	56	-	73	13	2	12							2	10	84	54	11	15	1						2	10	64	49	30	6	20	1
			2	119	16	26	58	-	76	12	0	12							2	5	88	46	9	12	0						2	5	69	46	25	1	20	0
			E	19	100	0	0	-	95	0	0	5							0	5	89	37	11	11	0						0	5	58	42	21	0	11	0
Social systems, others	74	Evaluation and estimation techniques that make society recognize the physiological safety of nano materials.	1	129	5	32	63	-	81	13	2	4							2	7	54	68	20	27	9						2	6	34	60	30	27	30	10
			2	120	4	25	71	-	85	10	1	4							1	5	44	69	14	23	5						1	4	30	69	29	20	30	6
			E	5	100	0	0	-	80	20	0	0							0	0	80	80	40	0	20						0	0	40	100	40	20	40	20
	75	Automation of analysis process and standardization of analysis technology for nanomaterials (sample preparation, measurement, analysis, software, etc.).	1	139	12	30	58	-	61	25	2	12							1	6	48	62	36	21	6						1	6	29	52	49	15	28	4
			2	121	7	29	64	-	71	18	2	9							0	3	41	66	29	17	4						0	3	18	59	50	9	26	2
			E	8	100	0	0	-	74	13	13	0							0	13	63	63	13	0	25						0	13	13	75	38	13	25	13
	76	Sensing devices and materials used in a continuous monitoring system for in-hospital infections with viruses and other sources.	1	67	6	30	64	-	80	5	6	9							2	2	66	55	32	27	5						2	2	35	45	42	16	29	6
			2	66	2	23	75	-	82	6	6	6							0	0	64	58	22	16	3						0	0	33	49	54	6	22	3
			E	1	100	0	0	-	0	100	0	0							0	0	100	0	0	0	0						0	0	100	0	0	0	0	0
	77	An ultra-compact chemical analysis system for on-the-spot food safety tests.	1	87	7	21	72	-	66	19	6	9							5	4	51	52	38	22	5						4	4	21	34	54	15	30	4
			2	79	3	18	79	-	74	13	4	9							3	4	49	60	36	12	3						1	4	16	36	72	5	24	3
			E	2	100	0	0	-	50	0	0	50							0	0	50	0	50	0	0						0	0	0	0	50	0	50	0
	78	Sensor networks that monitor environmental and biological data in fields, barns, ponds and so on, on a sensitive and real-time basis for the early detection of abnormalities in livestock..	1	54	4	26	70	-	59	15	13	13							2	2	38	51	32	32	0						2	2	19	32	55	19	30	2
			2	54	0	17	83	-	70	9	4	17							0	4	35	67	29	16	0						0	4	14	42	66	10	28	0
			E		0	0	0	-	0	0	0	0							0	0	0	0	0	0	0						0	0	0	0	0	0	0	0
	79	A compact certification system for quick personal identification based on DNA.	1	70	6	16	78	-	73	6	7	14							1	7	39	52	47	22	5						2	6	17	33	51	27	27	10
			2	70	3	9	88	-	80	1	4	15							0	6	34	55	46	13	3						0	7	12	37	60	18	22	5
			E	2	100	0	0	-	100	0	0	0							0	0	50	0	0	50	0						0	0	0	0	50	0	50	0
	80	Establishing a safety standard for capsule material and dose amount in a drug delivery system (DDS).	1	90	11	28	61	-	81	11	2	6																			1	5	29	45	37	47	28	7
			2	80	8	20	72	-	86	9	1	4																			0	3	25	53	36	36	23	3
			E	6	100	0	0	-	83	17	0	0																			0	0	67	50	17	0	17	0

Area	Topic number	Topic	Round	Responses	Degree of expertise (%)				Importance (%)				Forecasted time of technological realization (to be realized somewhere in the world) (%)							Sectors that will pave the way to technological (%)					Forecasted time of social realization (The period when the topic will become applicable/widely (%)						Sectors that willpave the way to social realization (%)					
					High	Moderate	Low	None	Important for Japan and the rest of the world	Especially important for Japan	Especially important for the world	Low importance/priority	Already realized	2011-2015	2016-2020	2021-2030	2031-2040	2041-	don't know will not be realized	University	Public research organization	Private enterprise	Collaboration of multiple sectors	Others	2011-2015	2016-2020	2021-2030	2031-2040	2041-	don't know will not be realized	University	Public research organization	Private enterprise	Government	Collaboration of multiple sectors	Others
Social systems, others	81	Establishing a safety standard for the use of nanoparticulates for consumer goods such as cosmetics and foods.	1	128	6	27	67	-	74	15	2	9							0 9										0 9	19	60	31	39	27	12
			2	125	8	22	70	-	79	11	2	8							0 4										0 4	16	67	27	34	25	9
			E	10	100	0	0	-	90	10	0	0							0 0										0 0	10	40	10	30	30	0
	82	Life cycle assessment (LCA) techniques for products, based on the establishment of an LCA database of materials.	1	111	8	34	58	-	62	27	4	7						0 7		29	62	33	31	12					2 7		16	52	43	31	35	13
			2	113	8	27	65	-	72	21	1	6						0 5		25	66	31	32	8					1 4		10	62	44	20	35	11
			E	9	100	0	0	-	100	0	0	0						0 0		38	88	13	25	13					0 0		22	56	33	22	33	0
	83	Precise measurement and impact assessment technology related to trace amounts of water pollutants with carcinogenicity and an endocrine disruption effect.	1	78	6	13	81	-	70	16	7	7						0 7		50	70	32	23	1					3 7		26	57	46	25	29	4
			2	76	7	8	85	-	83	5	4	8						1 1		50	75	28	16	4					1 1		20	70	38	17	28	3
			E	5	100	0	0	-	80	20	0	0						0 0		75	75	50	25	0					0 0		75	75	50	25	25	0
	84	General-purpose processing technology which enables one-nanometer order measurements of length, displacement and surface roughness, and which is to be practically used in manufacturing processes.	1	157	10	31	59	-	57	35	1	7						3 5		42	56	56	25	1					1 6		24	38	75	8	27	3
			2	147	7	30	63	-	61	29	1	9						1 3		40	59	58	18	1					0 3		19	39	79	3	25	1
			E	10	100	0	0	-	70	20	0	10						0 0		30	40	70	10	0					0 0		0	20	90	10	10	0

Panel 10:

Manufacturing technologies which totally support development of industry, society, and science and technology

Implementation of the questionnaires

	Sent	Returned (response rate)
<1st Round>	328	276 (84%)
<2nd Round>	274	241 (88%)

Sex	Male	241	Affiliation	Private enterprise	84
	Female	0		University	109
	N.A.	0		Research Institute	27
generation	20’s	1		Association	6
	30’s	16		Others	15
	40’s	60		N.A.	0
	50’s	94	Job category	R&D	178
	60’s	60		Others	61
	70’s and over	10		N.A.	2
	N.A.	0		Total	241

Survey items

A: Large volume production for small variety of products

B: Adaptive production for various items with variable quantity

C: On-demand production

D: Other production schemes

E: Globalization, value-adding and market creation

F: Energy, resources and environment

G: Unpopularlity of science and engineering, human resource problem, the declining birth rate and aging population

H: Safety and security

Time-series tables of topics

<Technological realization>

year	Topic (Leading number represents ID.)
2013	57: Supply chain management techniques that can evaluate the place where parts and materials should be procured from and where the product (service) should be produced (provided) to optimize QCD (quality, cost, delivery) for the customer region of the product (service).
2014	03: A failure tracking system that embeds an IC chip in each part of the manufactured product to identify its history information (including the manufacturer, materials, parts, changes in function and characteristics, users, etc).
2014	54: Information system that provides comprehensive support for global design businesses among distant locations and promotes the necessary coordination.
2014	71: An automatic content monitoring system (including adult verification system) aiming to enable minors to use the Internet safely.
2015	45: Techniques for secondary use of customers' production information that is collected by receiving orders for personal production while considering the protection of personal information.
2016	08: Positioning technology that work both indoors and outdoors, and is linked to a map for intelligent production management without requiring new infrastructure.
2016	21: Systematization technology enabling consumers to design a product according to personal preference and the rapid manufacture and supply of such product based on the information of the consumer's design.
2016	25: Product and device technology for extra-long-term use (including recycling) based on comprehensive and long-term continuous recording and storage of information related to the history of products, including the initial design, the reliability evaluation and the maintenance records.
2016	28: Rapid Product Manufacturing (RPM) technology for the prototype process so as to form a test mold based on a three-dimensional image within 10 minutes.
2016	39: Shape analysis and counting technology for nano particles with a diameter of 10nm or less within liquid or gas.
2016	40: Measurement technology concerning cumulative exposure to nano particles, to estimate the amounts of inhalation and skin absorption when people spend time in an environment including nano particles.
2016	43: Information database technology capable of maintaining the up-to-date status of manufacturing knowledge, experimental data, product examples, public facts and corporate know-how that can be used for prior assessment of each process during design and production.
2017	05: Heat-radiating and energy-saving actuator technology for the super-downsizing of mechatronics devices.
2017	06: Battery and energy-saving technology enabling autonomous 24-hour operation of robots.
2017	19: Comprehensive design methodology for total optimization, from the overall picture of the life cycle, from design and production to disposal and recycling, the overview of the global supply chain, and a product series that can flexibly correspond to the variety of customers' needs.
2017	20: Reconstructable production system for various products and the fluctuating amount of production, which will be introduced into at least 50% of plants.

year	Topic (Leading number represents ID.)
2017	29: Evaluation techniques for the product properties (strength, reliability, disposal) and the manufacturing methods (in terms of environmental harmonization, productivity and maintenance) in which design information is used to reproduce the production process from materials to products (virtual manufacturing/digital mock-up).
2017	31: A design-supporting system, based on knowledge management, to explicitly record, refer and reuse the developed design knowledge, which is used to develop brand-new designs.
2017	32: A general-purpose personal compact processing system including a 3D printer and microfactory for personal fabrication (for in-house manufacturing, using and/or group sharing products that satisfy the preferred specification).
2017	35: Production technology for an interface providing good experiences to the customer.
2017	41: Non-contact transmission technology to transfer the energy required to move an autonomous mobile micro robot that is placed at a distance away in the order of meters.
2017	44: Final quality assurance techniques that consist of monitoring and feedback coordination of all processes from the material to manufacturing during on-site production.
2017	48: Evaluation techniques identifying the suitable point to add value within various value chains (ex. market/customer research → development & design → procurement → production → sales → service) in each industry, to maximize industrial development and job creation.
2017	52: Manufacturing methodology based on intellectual properties related to unique core technology to create products that are fundamentally different from the characteristics of the Japanese market, while considering the existence of global mega markets, including the markets in developed countries, and the creation of ultra-low price products that are required in developing countries.
2017	53: Organization and design process methodology enabling design and production in an unprecedented form and level to cope with domestic and foreign (onsite) production bases by using various global human resources effectively to solve complicated global production problems.
2017	58: Net shape forming (casting, sintering, and plasticity) technology with a processing accuracy of 1 micrometer or finer.
2017	59: Safe and low-cost storage system for general waste, such as home appliances including rare metals for which reuse and efficient disposal methods have not yet been developed, in a condition enabling future use.
2017	62: Solar cell system that is developed considering recycling and reuse with a low environmental load upon disposal.
2017	65: Comprehensive and objective evaluation indices that replace CO_2 as an indicator for the environmental load of energy and resource consumption, production processes (plants) and products, and measurement techniques for such indices.
2017	66: An intelligent production system that supports the work of elderly persons and women in manufacturing processes while taking into consideration their characteristics.
2018	11: A multifunctional large-scale integrated device that surpasses discrete devices by using power electronics based on GaN and SiC that overcome limits due to the physical properties of silicon.
2018	23: Simulation techniques for rough but reasonable prediction of the behavior and function of the target system even in a phase in which the contents of the design intention, such as the aim and concept, have not been specified in detail (for example, techniques related to FOA).

year	Topic (Leading number represents ID.)
2018	24: Methodology and supporting techniques for speedy and reasonable mechatronics product design that highly integrate mechanics, electronics and information from a new point of view (for example, various design techniques to develop diverse products through customization based on the design of the common architecture and standard modules that facilitate the speed and simplicity of the design process for complicated systems due to integration).
2018	26: Continuous production system using micro chemistry, when there is no stock, to rapidly and flexibly cope with a request for on-demand production of various items in the device industry.
2018	27: Micro chemistry process for on-site production of drugs, cosmetics and medium-activity material whose activity deteriorates quickly (including measures to relax laws).
2018	46: A production management system with a self correction mechanism enabling flexible adaptation for changes in the situation by self-refinement of the system according to the condition of the target during the supply chain management, production planning, and scheduling.
2018	51: Modeling techniques and design methodology for efficient design process in the aspects of design, ergonomics, and sensibility, to satisfy intensifying customer needs.
2018	55: Remote monitoring technology for products based on perception by the five senses (ex. data globe) enabling the building of a virtual market (such as an IT auction) for the products manufactured by a personal fabricator.
2018	61: Efficient application technology for the unused thermal energy that is generated intermittently.
2018	63: A recycling production system unifying the processes of the "input of resource → design and production → use → disposition" and the "collection → separation → resource recycling."
2018	72: Forming and processing a database that covers more than 95% of structural materials (steel, alloys of Cu, Al, Mg, and Ti) and includes information about strength, fatigue life, plastic deformation stress, texture and anisotropy, and material structural change.
2018	75: Quality assurance on the basis of non-contact measurement for the inside structure of a product using electromagnetic waves and/or a neutron beam, and improvement of in-situ measurement for condition change during the casting and molding process.
2019	01: Small-deformation and low-strain joint technology using liquid or solid diffusion joints and other techniques instead of the conventional weld joint in heavy structures.
2019	13: Made-to-order joint technology of different materials enabling low cost manufacturing and quick delivery of a dual-layer composite of metal-metal or metal-plastic according to the purpose.
2019	14: Refinement technology with low environmental load that is realized by developing a new production system using direct reduction, etc.
2019	22: Methodology to embody a product architecture and production system for creating new value and services in addition to realizing a new function from the physical aspect.
2019	33: Technology and institutions required for safe and secure work environment where humans, robots and machines share the work space.
2019	34: A mathematical modeling framework and corresponding optimization methodology that support the embodiment process according to the scheme and scenario related to various design methodology (it is important to mainly aim the design optimization at the system level and to establish a practical framework that can optimize the design of a system including a large-scale and complicated combination of elements).
2019	47: Multiscale and multiphysics simulation technology integrating from molecular behavior to macroscopic reaction and flow.

year	Topic (Leading number represents ID.)
2019	60: Technology to efficiently convert low-grade thermal energy, which is hard to use from the viewpoint of exergy, to high exergy.
2019	64: Technology that breaks down the materials used in manufacturing facilities in a plant into single raw materials upon disposal, to enable reuse of the resources, and that is applied to 90% or more of such manufacturing facilities.
2019	67: An intelligent system and robot enabling remote control, semi-autonomization, or automation of safe, efficient and low cost outdoor work on behalf of human beings, aiming to minimize harm to humans due to natural and human-caused disasters, or during inspections in danger zones and repair work for infrastructure that are deteriorated or damaged by a natural disaster.
2019	76: Virtual plant-operation support system that visualizes the inside condition of a reactor and the future deteriorated condition of the plant.
2020	15: An ultra high strength and high corrosion-resistant material created using ultrafine control technology for large-scale bridges with spans of 4,000 meters or longer and large-scale structures installed in special environments in deep sea developments.
2020	36: Joining technology using the double helix structure of DNA.
2020	37: Fabrication technology for fine objects, controlling the several elements of the external environment together, including a magnetic field, electric field and gravity (manipulating nano particles to produce a device).
2020	38: Membrane processing and formation technology that can maintain biocompatibility for 10 years or more within an implanted device.
2020	56: Recognition technology to analyze the services that the person requires and to provide appropriate advice and guidance to the service provider.
2020	73: Molding die technology (including coating and material) to realize long life (can be used for 10^7 times at 1000 degrees centigrade) and low friction (coefficient of friction of 0.05).
2021	02: Product and material manufacturing technology for safe, clean and energy-efficient mass production using knowledge of the mechanism of nature and organisms.
2021	12: Local heating joint technology enabling large area junctions by using the interface absorption of light energy.
2021	30: Next-generation system engineering for the "System of Systems" (the advanced system coupling various systems including hierarchy and mutual dependency in wider areas, which surpasses the target level of conventional system engineering).
2021	42: Design, development, evaluation and maintenance techniques for reliable large-scale software that are not excessively dependent on personal skills.
2022	10: Ultra-large storage memory of 1PB (peta byte) or more capacity, including atomic memory, molecular memory, and self-organizing memory, that is beyond the concept of the conventional semiconductor device (i.e. flash memory).
2022	16: Development techniques for atomic wires and atomic clusters that consist of different atoms (single-atom control technology, two-dimensional atomic wire, and a multi-dimensional atomic cluster) for realizing a quantum conductor and a functional catalyst by using atomic-scale manufacturing techniques to control functional atoms.
2022	74: Oil-less, wash-less scrap-less and noiseless (4 less) manufacturing.
2024	18: Post nanotechnology based on cross-disciplinary collaboration of various aspects of science, including physics, chemistry, biology, engineering, inorganic and organic material science, polymer science, and other domains related to material and living bodies.
2025	07: Flexible machine technology realizing motion functions and environmental adaptability similar to those of organisms.

year	Topic (Leading number represents ID.)
2027	04: Technology that supports design and development by displaying human thoughts on a computer by detecting brain waves.
2027	17: Front atom control technology to determine material functions (to establish and realize fabrication technology for a nanomachine whose function is determined by using quantum simulation science based on research for the maximization of the quantum effect and a new quantum function).
2030	09: Nano- and micro-sized plasma technology for high temperature and high density, whose controllability is better than large-scale thermal fusion reactors such as the ITER.

<Social realization>

year	Topic (Leading number represents ID.)
2018	57: Supply chain management techniques that can evaluate the place where parts and materials should be procured from and where the product (service) should be produced (provided) to optimize QCD (quality, cost, delivery) for the customer region of the product (service).
2019	03: A failure tracking system that embeds an IC chip in each part of the manufactured product to identify its history information (including the manufacturer, materials, parts, changes in function and characteristics, users, etc).
2019	54: Information system that provides comprehensive support for global design businesses among distant locations and promotes the necessary coordination.
2019	71: An automatic content monitoring system (including adult verification system) aiming to enable minors to use the Internet safely.
2020	45: Techniques for secondary use of customers' production information that is collected by receiving orders for personal production while considering the protection of personal information.
2020	50: Fundamental methodology for the paradigm shift from simple manufacturing to a new industrial structure that attaches much importance to value creation (such as service engineering).
2021	49: MOT methodology to fill the gap between basic science & technology research and the practical techniques in the manufacturing industry.
2022	28: Rapid Product Manufacturing (RPM) technology for the prototype process so as to form a test mold based on a three-dimensional image within 10 minutes.
2022	39: Shape analysis and counting technology for nano particles with a diameter of 10nm or less within liquid or gas.
2022	68: Education system to train engineers who can rationally improve design in a more upper-stream phase than the conventional design process intends, and to continuously develop their ability.
2023	05: Heat-radiating and energy-saving actuator technology for the super-downsizing of mechatronics devices.
2023	08: Positioning technology that work both indoors and outdoors, and is linked to a map for intelligent production management without requiring new infrastructure.
2023	20: Reconstructable production system for various products and the fluctuating amount of production, which will be introduced into at least 50% of plants.
2023	21: Systematization technology enabling consumers to design a product according to personal preference and the rapid manufacture and supply of such product based on the information of the consumer's design.

year	Topic (Leading number represents ID.)
2023	25: Product and device technology for extra-long-term use (including recycling) based on comprehensive and long-term continuous recording and storage of information related to the history of products, including the initial design, the reliability evaluation and the maintenance records.
2023	43: Information database technology capable of maintaining the up-to-date status of manufacturing knowledge, experimental data, product examples, public facts and corporate know-how that can be used for prior assessment of each process during design and production.
2023	44: Final quality assurance techniques that consist of monitoring and feedback coordination of all processes from the material to manufacturing during on-site production.
2023	48: Evaluation techniques identifying the suitable point to add value within various value chains (ex. market/customer research → development & design → procurement → production → sales → service) in each industry, to maximize industrial development and job creation.
2023	52: Manufacturing methodology based on intellectual properties related to unique core technology to create products that are fundamentally different from the characteristics of the Japanese market, while considering the existence of global mega markets, including the markets in developed countries, and the creation of ultra-low price products that are required in developing countries.
2023	53: Organization and design process methodology enabling design and production in an unprecedented form and level to cope with domestic and foreign (onsite) production bases by using various global human resources effectively to solve complicated global production problems.
2023	59: Safe and low-cost storage system for general waste, such as home appliances including rare metals for which reuse and efficient disposal methods have not yet been developed, in a condition enabling future use.
2023	65: Comprehensive and objective evaluation indices that replace CO_2 as an indicator for the environmental load of energy and resource consumption, production processes (plants) and products, and measurement techniques for such indices.
2024	06: Battery and energy-saving technology enabling autonomous 24-hour operation of robots.
2024	31: A design-supporting system, based on knowledge management, to explicitly record, refer and reuse the developed design knowledge, which is used to develop brand-new designs.
2024	35: Production technology for an interface providing good experiences to the customer.
2024	40: Measurement technology concerning cumulative exposure to nano particles, to estimate the amounts of inhalation and skin absorption when people spend time in an environment including nano particles.
2024	58: Net shape forming (casting, sintering, and plasticity) technology with a processing accuracy of 1 micrometer or finer.
2024	62: Solar cell system that is developed considering recycling and reuse with a low environmental load upon disposal.
2024	66: An intelligent production system that supports the work of elderly persons and women in manufacturing processes while taking into consideration their characteristics.
2025	19: Comprehensive design methodology for total optimization, from the overall picture of the life cycle, from design and production to disposal and recycling, the overview of the global supply chain, and a product series that can flexibly correspond to the variety of customers' needs.

year	Topic (Leading number represents ID.)
2025	24: Methodology and supporting techniques for speedy and reasonable mechatronics product design that highly integrate mechanics, electronics and information from a new point of view (for example, various design techniques to develop diverse products through customization based on the design of the common architecture and standard modules that facilitate the speed and simplicity of the design process for complicated systems due to integration).
2025	27: Micro chemistry process for on-site production of drugs, cosmetics and medium-activity material whose activity deteriorates quickly (including measures to relax laws).
2025	29: Evaluation techniques for the product properties (strength, reliability, disposal) and the manufacturing methods (in terms of environmental harmonization, productivity and maintenance) in which design information is used to reproduce the production process from materials to products (virtual manufacturing/digital mock-up).
2025	32: A general-purpose personal compact processing system including a 3D printer and microfactory for personal fabrication (for in-house manufacturing, using and/or group sharing products that satisfy the preferred specification).
2025	41: Non-contact transmission technology to transfer the energy required to move an autonomous mobile micro robot that is placed at a distance away in the order of meters.
2025	46: A production management system with a self correction mechanism enabling flexible adaptation for changes in the situation by self-refinement of the system according to the condition of the target during the supply chain management, production planning, and scheduling.
2025	51: Modeling techniques and design methodology for efficient design process in the aspects of design, ergonomics, and sensibility, to satisfy intensifying customer needs.
2025	61: Efficient application technology for the unused thermal energy that is generated intermittently.
2025	63: A recycling production system unifying the processes of the "input of resource → design and production → use → disposition" and the "collection → separation → resource recycling."
2025	72: Forming and processing a database that covers more than 95% of structural materials (steel, alloys of Cu, Al, Mg, and Ti) and includes information about strength, fatigue life, plastic deformation stress, texture and anisotropy, and material structural change.
2025	75: Quality assurance on the basis of non-contact measurement for the inside structure of a product using electromagnetic waves and/or a neutron beam, and improvement of in-situ measurement for condition change during the casting and molding process.
2026	11: A multifunctional large-scale integrated device that surpasses discrete devices by using power electronics based on GaN and SiC that overcome limits due to the physical properties of silicon.
2026	13: Made-to-order joint technology of different materials enabling low cost manufacturing and quick delivery of a dual-layer composite of metal-metal or metal-plastic according to the purpose.
2026	22: Methodology to embody a product architecture and production system for creating new value and services in addition to realizing a new function from the physical aspect.
2026	23: Simulation techniques for rough but reasonable prediction of the behavior and function of the target system even in a phase in which the contents of the design intention, such as the aim and concept, have not been specified in detail (for example, techniques related to FOA).
2026	26: Continuous production system using micro chemistry, when there is no stock, to rapidly and flexibly cope with a request for on-demand production of various items in the device industry.

year	Topic (Leading number represents ID.)
2026	55: Remote monitoring technology for products based on perception by the five senses (ex. data globe) enabling the building of a virtual market (such as an IT auction) for the products manufactured by a personal fabricator.
2026	60: Technology to efficiently convert low-grade thermal energy, which is hard to use from the viewpoint of exergy, to high exergy.
2026	69: Establishing faculties and courses that aim to train human resources who can create contents (movie, music, literature, comics, etc) in more than 50% of universities in Japan.
2027	01: Small-deformation and low-strain joint technology using liquid or solid diffusion joints and other techniques instead of the conventional weld joint in heavy structures.
2027	33: Technology and institutions required for safe and secure work environment where humans, robots and machines share the work space.
2027	64: Technology that breaks down the materials used in manufacturing facilities in a plant into single raw materials upon disposal, to enable reuse of the resources, and that is applied to 90% or more of such manufacturing facilities.
2027	76: Virtual plant-operation support system that visualizes the inside condition of a reactor and the future deteriorated condition of the plant.
2028	14: Refinement technology with low environmental load that is realized by developing a new production system using direct reduction, etc.
2028	67: An intelligent system and robot enabling remote control, semi-autonomization, or automation of safe, efficient and low cost outdoor work on behalf of human beings, aiming to minimize harm to humans due to natural and human-caused disasters, or during inspections in danger zones and repair work for infrastructure that are deteriorated or damaged by a natural disaster.
2028	70: Establishing faculties and courses that study methods to support the creation of contents (movie, music, literature, comics, etc) in more than 75% of universities in Japan.
2029	12: Local heating joint technology enabling large area junctions by using the interface absorption of light energy.
2029	15: An ultra high strength and high corrosion-resistant material created using ultrafine control technology for large-scale bridges with spans of 4,000 meters or longer and large-scale structures installed in special environments in deep sea developments.
2029	34: A mathematical modeling framework and corresponding optimization methodology that support the embodiment process according to the scheme and scenario related to various design methodology (it is important to mainly aim the design optimization at the system level and to establish a practical framework that can optimize the design of a system including a large-scale and complicated combination of elements).
2029	38: Membrane processing and formation technology that can maintain biocompatibility for 10 years or more within an implanted device.
2029	47: Multiscale and multiphysics simulation technology integrating from molecular behavior to macroscopic reaction and flow.
2029	56: Recognition technology to analyze the services that the person requires and to provide appropriate advice and guidance to the service provider.
2030	02: Product and material manufacturing technology for safe, clean and energy-efficient mass production using knowledge of the mechanism of nature and organisms.
2030	10: Ultra-large storage memory of 1PB (peta byte) or more capacity, including atomic memory, molecular memory, and self-organizing memory, that is beyond the concept of the conventional semiconductor device (i.e. flash memory).

year	Topic (Leading number represents ID.)
2030	73: Molding die technology (including coating and material) to realize long life (can be used for 10^7 times at 1000 degrees centigrade) and low friction (coefficient of friction of 0.05).
2031	36: Joining technology using the double helix structure of DNA.
2031	42: Design, development, evaluation and maintenance techniques for reliable large-scale software that are not excessively dependent on personal skills.
2031	74: Oil-less, wash-less scrap-less and noiseless (4 less) manufacturing.
2032	30: Next-generation system engineering for the "System of Systems" (the advanced system coupling various systems including hierarchy and mutual dependency in wider areas, which surpasses the target level of conventional system engineering).
2032	37: Fabrication technology for fine objects, controlling the several elements of the external environment together, including a magnetic field, electric field and gravity (manipulating nano particles to produce a device).
2033	16: Development techniques for atomic wires and atomic clusters that consist of different atoms (single-atom control technology, two-dimensional atomic wire, and a multi-dimensional atomic cluster) for realizing a quantum conductor and a functional catalyst by using atomic-scale manufacturing techniques to control functional atoms.
2034	07: Flexible machine technology realizing motion functions and environmental adaptability similar to those of organisms.
2034	18: Post nanotechnology based on cross-disciplinary collaboration of various aspects of science, including physics, chemistry, biology, engineering, inorganic and organic material science, polymer science, and other domains related to material and living bodies.
2035	04: Technology that supports design and development by displaying human thoughts on a computer by detecting brain waves.
2036	09: Nano- and micro-sized plasma technology for high temperature and high density, whose controllability is better than large-scale thermal fusion reactors such as the ITER.
2037	17: Front atom control technology to determine material functions (to establish and realize fabrication technology for a nanomachine whose function is determined by using quantum simulation science based on research for the maximization of the quantum effect and a new quantum function).

Area	Topic number	Topic	Round	Responses	Degree of expertise (%)				Importance (%)				Forecasted time of technological realization (to be realized somewhere in the world) (%)						Sectors that will pave the way to technological realization (%)					Forecasted time of social realization (to become applicable/widely used in Japan) (%)						Sectors that will pave the way to social realization (%)					
					High	Moderate	Low	None	Important for Japan and the rest of the world	Especially important for Japan	Especially important for the world	Low importance/priority	Already realized	2011-2015	2016-2020	2021-2030	2031-2040	2041-	will not be realized	don't know	University	Public research organization	Private enterprise	Collaboration of multiple sectors	Others	2011-2015	2016-2020	2021-2030	2031-2040	2041-	don't know	will not be realized	University	Public research organization	Private enterprise	Government	Collaboration of multiple sectors	Others
Large volume production for small variety of products	1	Small-deformation and low-strain joint technology using liquid or solid diffusion joints and other techniques instead of the conventional weld joint in heavy structures.	1	111	14	32	54	-	50	23	2	25							4	19	46	37	52	25	0						5	20	18	14	74	4	15	0
			2	99	10	31	59	-	57	20	2	21							4	12	49	36	64	17	0						5	16	18	12	78	3	14	0
			E	10	100	0	0	-	70	30	0	0							0	10	50	50	90	30	0						0	10	40	20	80	0	30	0
	2	Product and material manufacturing technology for safe, clean and energy-efficient mass production using knowledge of the mechanism of nature and organisms.	1	189	7	35	58	-	74	17	3	6							2	10	48	34	37	37	5						2	9	15	18	67	16	24	3
			2	171	6	34	60	-	79	16	1	4							1	6	54	35	40	35	3						1	8	12	15	74	11	20	2
			E	11	100	0	0	-	82	18	0	0							0	0	73	36	64	45	9						0	0	22	33	89	22	11	11
	3	A failure tracking system that embeds an IC chip in each part of the manufactured product to identify its history information (including the manufacturer, materials, parts, changes in function and characteristics, users, etc).	1	212	14	35	51	-	63	23	1	13							1	4	11	14	77	23	9						1	5	2	10	73	15	23	10
			2	193	11	34	55	-	65	23	2	10							2	2	10	10	79	23	5						1	3	3	7	83	11	20	6
			E	22	100	0	0	-	72	23	0	5							0	0	0	15	80	35	10						0	0	0	0	85	15	35	10
	4	Technology that supports design and development by displaying human thoughts on a computer by detecting brain waves.	1	158	8	25	67	-	42	15	3	40							20	8	75	42	13	15	2						24	13	43	31	35	3	23	1
			2	146	6	24	70	-	46	12	1	41							17	4	78	45	13	13	2						19	6	54	31	37	1	20	0
			E	9	100	0	0	-	67	0	0	33							0	0	71	71	14	29	0						13	0	57	43	43	0	14	0
	5	Heat-radiating and energy-saving actuator technology for the super-downsizing of mechatronics devices.	1	196	16	38	46	-	49	47	1	3							1	4	51	37	62	18	2						2	4	20	19	80	3	17	0
			2	177	14	38	48	-	50	46	1	3							0	1	51	31	69	15	1						0	1	19	15	84	2	13	0
			E	25	100	0	0	-	68	32	0	0							0	0	46	29	63	17	0						0	0	13	8	79	4	17	0
	6	Battery and energy-saving technology enabling autonomous 24-hour operation of robots.	1	180	10	25	65	-	51	40	1	8							0	4	30	25	73	26	1						1	5	13	17	82	8	18	1
			2	161	7	25	68	-	54	38	1	7							0	1	29	24	81	18	0						1	1	10	13	87	3	12	1
			E	12	100	0	0	-	84	8	0	8							0	0	27	27	100	0	0						0	0	0	0	100	0	0	0
	7	Flexible machine technology realizing motion functions and environmental adaptability similar to those of organisms.	1	159	13	26	61	-	46	31	1	22							9	6	77	34	22	20	2						10	8	35	28	47	3	26	1
			2	145	12	23	65	-	46	34	0	20							7	3	84	35	20	15	1						8	5	44	26	49	0	27	1
			E	17	100	0	0	-	62	19	0	19							6	0	88	50	19	6	0						0	6	41	29	59	0	24	0
Adaptive production for various items with variable quantity	8	Positioning technology that work both indoors and outdoors, and is linked to a map for intelligent production management without requiring new infrastructure.	1	119	11	33	56	-	51	27	6	16							1	3	32	36	55	24	7						1	3	11	18	73	10	25	9
			2	111	10	30	60	-	61	22	3	14							1	5	28	35	65	17	4						1	4	13	18	79	7	20	2
			E	11	100	0	0	-	64	18	0	18							0	0	20	10	60	30	0						0	0	18	0	82	0	9	0

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					High	Moderate	Low	None	Important for Japan and the rest of the world	Especially important for Japan	Especially important for the world	Low importance/priority	Already realized	2011-2015	2016-2020	2021-2030	2031-2040	2041-	will not be realized	don't know	University	Public research organization	Private enterprise	Collaboration of multiple sectors	Others	2011-2015	2016-2020	2021-2030	2031-2040	2041-	don't know	will not be realized	University	Public research organization	Private enterprise	Government	Collaboration of multiple sectors	Others
Adaptive production for various items with variable quantity	9	Nano- and micro-sized plasma technology for high temperature and high density, whose controllability is better than large-scale thermal fusion reactors such as the ITER.	1	69	6	23	71	-	58	22	4	16							10	9	44	67	11	23	15							12	16	33	56	25	19	30	17
			2	61	5	25	70	-	73	17	2	8							8	5	53	69	8	19	8							11	15	34	62	24	21	22	9
			E	3	100	0	0	-	67	0	33	0							67	0	50	50	0	0	50							67	0	50	50	0	0	0	50
	10	Ultra-large storage memory of 1PB (peta byte) or more capacity, including atomic memory, molecular memory, and self-organizing memory, that is beyond the concept of the conventional semiconductor device (i.e. flash memory).	1	98	5	27	68	-	72	21	1	6							1	7	57	38	53	25	5							3	7	20	21	77	7	20	2
			2	91	3	29	68	-	77	22	0	1							0	3	58	31	67	21	5							1	4	18	19	82	8	18	2
			E	3	100	0	0	-	100	0	0	0							0	0	67	67	33	33	0							0	0	33	33	67	33	67	0
	11	A multifunctional large-scale integrated device that surpasses discrete devices by using power electronics based on GaN and SiC that overcome limits due to the physical properties of silicon.	1	99	7	24	69	-	61	30	2	7							0	6	41	44	59	29	5							1	8	16	22	82	7	22	1
			2	86	6	24	70	-	65	31	2	2							0	7	38	42	69	21	2							0	9	15	16	91	6	16	0
			E	5	100	0	0	-	80	20	0	0							0	0	40	40	60	40	0							0	0	20	20	80	20	60	0
	12	Local heating joint technology enabling large area junctions by using the interface absorption of light energy.	1	82	15	23	62	-	44	32	1	23							5	12	53	40	34	25	3							5	16	22	20	70	4	27	1
			2	70	14	19	67	-	41	34	0	25							3	4	61	43	33	22	1							3	13	25	17	72	3	23	0
			E	10	100	0	0	-	30	50	0	20							10	0	60	20	20	20	0							10	0	50	10	70	0	0	0
	13	Made-to-order joint technology of different materials enabling low cost manufacturing and quick delivery of a dual-layer composite of metal-metal or metal-plastic according to the purpose.	1	138	13	28	59	-	45	41	2	12							3	4	51	46	54	19	3							3	5	25	23	70	5	19	2
			2	119	13	25	62	-	47	40	2	11							3	4	54	44	62	12	2							3	4	26	22	77	5	18	1
			E	15	100	0	0	-	53	40	0	7							0	0	71	36	71	14	0							7	0	33	20	80	7	20	0
	14	Refinement technology with low environmental load that is realized by developing a new production system using direct reduction, etc.	1	100	9	37	54	-	49	44	1	6							1	6	35	32	70	24	4							0	8	14	15	82	19	23	3
			2	88	10	32	58	-	54	42	0	4							1	3	34	34	81	15	4							1	6	15	16	86	12	16	4
			E	9	100	0	0	-	78	11	0	11							0	0	63	25	75	25	0							0	0	56	22	67	44	22	11
	15	An ultra high strength and high corrosion-resistant material created using ultrafine control technology for large-scale bridges with spans of 4,000 meters or longer and large-scale structures installed in special environments in deep sea developments.	1	107	10	35	55	-	56	34	2	8							2	6	46	55	59	25	2							3	7	21	28	76	14	24	2
			2	90	10	33	57	-	61	31	2	6							2	3	47	59	59	17	1							2	5	16	28	84	7	15	1
			E	9	100	0	0	-	67	33	0	0							0	0	78	67	78	11	0							0	0	22	33	100	33	11	0
	16	Development techniques for atomic wires and atomic clusters that consist of different atoms (single-atom control technology, two-dimensional atomic wire, and a multi-dimensional atomic cluster) for realizing a quantum conductor and a functional catalyst by using atomic-scale manufacturing techniques to control functional atoms.	1	93	4	29	67	-	46	38	3	13							3	7	73	57	18	15	6							7	10	35	39	54	5	21	4
			2	86	3	27	70	-	50	36	1	13							0	5	82	56	17	8	5							5	7	39	40	61	4	17	1
			E	3	100	0	0	-	67	33	0	0							0	0	67	33	33	33	33							0	0	33	0	67	33	33	0

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Adaptive production for various items with variable quantity	17	Front atom control technology to determine material functions (to establish and realize fabrication technology for a nanomachine whose function is determined by using quantum simulation science based on research for the maximization of the quantum effect and a new quantum function).	1	68	4	24	72	-	46	33	0	21							0	15	82	52	11	15	6							2	15	59	50	36	5	22	3
			2	64	5	25	70	-	49	28	0	23							0	13	85	51	10	11	3							0	15	69	56	34	0	12	0
			E	3	100	0	0	-	100	0	0	0							0	33	100	33	0	0	0							0	33	100	50	0	0	0	0
	18	Post nanotechnology based on cross-disciplinary collaboration of various aspects of science, including physics, chemistry, biology, engineering, inorganic and organic material science, polymer science, and other domains related to material and living bodies.	1	118	9	25	66	-	56	30	3	11							3	21	81	53	17	23	6							3	22	52	38	38	10	32	4
			2	108	6	26	68	-	65	22	1	12							1	13	85	58	17	15	4							1	14	63	43	37	7	25	4
			E	7	100	0	0	-	71	29	0	0							14	14	100	50	33	0	0							14	14	67	33	33	17	33	33
	19	Comprehensive design methodology for total optimization, from the overall picture of the life cycle, from design and production to disposal and recycling, the overview of the global supply chain, and a product series that can flexibly correspond to the variety of customers' needs.	1	191	25	34	41	-	63	30	1	6							2	5	46	29	49	37	8							2	5	24	19	62	14	36	8
			2	170	24	31	45	-	67	26	0	7							2	2	45	24	58	31	8							2	1	24	18	70	6	32	6
			E	40	100	0	0	-	72	25	0	3							5	0	58	20	55	33	15							5	0	23	15	67	8	31	10
	20	Reconstructable production system for various products and the fluctuating amount of production, which will be introduced into at least 50% of plants.	1	179	20	41	39	-	27	64	1	8							5	5	25	19	75	23	2							6	5	13	12	85	5	20	3
			2	164	18	35	47	-	24	66	1	9							4	4	22	12	83	22	1							4	4	8	7	94	3	16	3
			E	30	100	0	0	-	27	63	0	10							3	0	30	3	83	13	3							3	3	7	3	97	0	10	3
On-demand production	21	Systematization technology enabling consumers to design a product according to personal preference and the rapid manufacture and supply of such product based on the information of the consumer's design.	1	185	19	32	49	-	34	43	0	23							8	5	27	16	69	22	1							9	9	11	11	84	2	19	2
			2	170	17	29	54	-	32	47	0	21							5	4	25	12	82	15	1							7	5	8	9	92	1	12	2
			E	29	100	0	0	-	38	38	0	24							0	3	29	4	86	11	4							3	3	7	11	86	0	4	4
	22	Methodology to embody a product architecture and production system for creating new value and services in addition to realizing a new function from the physical aspect.	1	125	20	29	51	-	35	44	3	18							5	15	54	15	44	30	3							5	14	33	12	60	3	29	3
			2	118	17	27	56	-	30	48	1	21							4	11	56	14	54	22	2							4	11	28	9	76	0	20	3
			E	20	100	0	0	-	35	50	0	15							10	5	60	5	40	25	0							10	5	40	0	70	0	5	0
	23	Simulation techniques for rough but reasonable prediction of the behavior and function of the target system even in a phase in which the contents of the design intention, such as the aim and concept, have not been specified in detail (for example, techniques related to FOA).	1	141	22	31	47	-	52	37	1	10							5	7	60	30	44	22	1							4	9	29	21	64	4	23	1
			2	128	19	29	52	-	54	33	0	13							4	6	60	22	51	19	2							3	7	25	15	74	0	15	2
			E	24	100	0	0	-	62	25	0	13							4	0	70	13	48	26	0							4	0	33	0	75	0	8	0
	24	Methodology and supporting techniques for speedy and reasonable mechatronics product design that highly integrate mechanics, electronics and information from a new point of view (for example, various design techniques to develop diverse products through customization based on the design of the common architecture and standard modules that facilitate the speed and simplicity of the design process for complicated systems due to integration).	1	152	22	34	44	-	40	50	2	8							3	8	43	26	55	33	5							3	9	21	17	73	3	21	5
			2	139	20	34	46	-	36	52	0	12							3	4	42	21	67	28	2							2	5	19	10	83	1	19	3
			E	28	100	0	0	-	43	53	0	4							0	0	43	14	64	29	0							0	0	18	7	82	0	11	0

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On-demand production	25	Product and device technology for extra-long-term use (including recycling) based on comprehensive and long-term continuous recording and storage of information related to the history of products, including the initial design, the reliability evaluation and the maintenance records.	1	170	20	31	49	-	65	24	2	9							2	3	32	30	63	30	5						2	4	14	19	68	14	34	7
			2	151	19	29	52	-	75	21	0	4							1	1	28	29	71	28	3						1	1	11	15	79	8	31	5
			E	29	100	0	0	-	90	7	0	3							0	0	24	24	79	28	3						0	0	7	14	86	18	25	11
	26	Continuous production system using micro chemistry, when there is no stock, to rapidly and flexibly cope with a request for on-demand production of various items in the device industry.	1	118	19	28	53	-	42	42	0	16							3	7	52	35	50	24	2						4	8	21	19	73	4	26	3
			2	106	19	23	58	-	43	44	0	13							4	4	50	35	65	15	2						4	6	24	15	84	2	20	2
			E	20	100	0	0	-	70	30	0	0							0	0	80	55	75	15	0						0	0	42	26	84	11	26	5
	27	Micro chemistry process for on-site production of drugs, cosmetics and medium-activity material whose activity deteriorates quickly (including measures to relax laws).	1	80	21	30	49	-	52	33	1	14							1	9	49	45	58	27	5						1	9	23	25	70	9	32	4
			2	75	20	28	52	-	58	31	0	11							1	8	52	42	64	21	3						1	10	28	21	81	1	25	1
			E	15	100	0	0	-	67	33	0	0							0	0	73	60	87	7	0						0	0	50	36	93	0	14	0
	28	Rapid Product Manufacturing (RPM) technology for the prototype process so as to form a test mold based on a three-dimensional image within 10 minutes.	1	188	18	42	40	-	30	59	1	10							2	6	31	32	80	16	1						2	8	11	16	88	2	16	1
			2	161	18	37	45	-	23	69	1	7							1	1	27	28	85	12	1						0	1	10	14	94	0	11	1
			E	29	100	0	0	-	31	59	0	10							3	0	29	7	86	11	0						0	0	18	4	93	0	14	0
	29	Evaluation techniques for the product properties (strength, reliability, disposal) and the manufacturing methods (in terms of environmental harmonization, productivity and maintenance) in which design information is used to reproduce the production process from materials to products (virtual manufacturing/digital mock-up).	1	178	22	34	44	-	47	45	1	7							2	5	45	32	62	25	1						3	5	22	17	76	4	25	2
			2	158	21	33	46	-	45	48	1	6							1	2	45	31	68	19	1						1	3	18	13	88	1	19	1
			E	33	100	0	0	-	52	45	0	3							3	0	34	25	75	13	0						3	3	16	9	84	0	9	0
Other production schemes	30	Next-generation system engineering for the "System of Systems" (the advanced system coupling various systems including hierarchy and mutual dependency in wider areas, which surpasses the target level of conventional system engineering).	1	87	16	32	52	-	57	21	7	15							2	16	72	27	19	19	2						2	20	50	23	32	9	26	7
			2	80	15	26	59	-	60	22	0	18							4	9	80	25	17	11	1						4	14	63	26	34	3	22	4
			E	12	100	0	0	-	78	22	0	0							0	0	82	27	9	27	0						0	0	82	18	27	0	36	9
	31	A design-supporting system, based on knowledge management, to explicitly record, refer and reuse the developed design knowledge, which is used to develop brand-new designs.	1	155	19	27	54	-	43	49	2	6							3	5	51	32	53	22	1						4	5	30	22	67	1	23	1
			2	142	17	26	57	-	36	55	1	8							1	3	54	25	62	17	1						1	5	26	16	81	1	16	1
			E	24	100	0	0	-	57	38	0	5							0	0	48	13	57	17	0						0	4	21	13	75	4	13	0
	32	A general-purpose personal compact processing system including a 3D printer and microfactory for personal fabrication (for in-house manufacturing, using and/or group sharing products that satisfy the preferred specification).	1	146	14	31	55	-	31	34	2	33							3	8	35	40	59	17	1						6	8	18	23	72	2	15	1
			2	131	12	27	61	-	26	38	2	34							4	5	33	36	71	12	2						5	5	15	21	80	2	12	1
			E	16	100	0	0	-	46	47	0	7							0	0	40	47	67	0	0						0	0	13	20	87	0	0	0

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Other production schemes	33	Technology and institutions required for safe and secure work environment where humans, robots and machines share the work space.	1	161	19	34	47	-	55	39	2	4							0	3	39	43	49	42	13							1	3	20	31	58	28	33	13
			2	149	18	30	52	-	60	35	1	4							0	3	35	46	54	36	9							0	3	16	27	68	23	32	9
			E	27	100	0	0	-	55	41	0	4							0	0	48	44	59	19	15							0	0	22	19	74	15	11	11
	34	A mathematical modeling framework and corresponding optimization methodology that support the embodiment process according to the scheme and scenario related to various design methodology (it is important to mainly aim the design optimization at the system level and to establish a practical framework that can optimize the design of a system including a large-scale and complicated combination of elements).	1	113	27	27	46	-	59	24	2	15							2	8	75	31	26	23	6							6	7	46	30	46	5	27	5
			2	107	23	24	53	-	64	21	2	13							1	5	80	24	27	17	4							4	5	54	26	62	2	16	5
			E	25	100	0	0	-	64	20	0	16							4	4	79	21	25	21	4							4	8	58	25	54	0	13	0
Globalization, value-adding and market creation	35	Production technology for an interface providing good experiences to the customer.	1	111	6	28	66	-	46	38	4	12							2	10	46	30	61	20	4							4	12	22	18	77	3	16	3
			2	102	5	24	71	-	52	34	1	13							1	10	50	22	61	14	2							2	10	21	14	82	2	13	3
			E	5	100	0	0	-	80	20	0	0							0	0	80	40	40	40	0							0	0	40	0	60	0	20	0
	36	Joining technology using the double helix structure of DNA.	1	41	5	17	78	-	44	22	0	34							7	27	87	38	13	10	3							12	27	59	30	43	3	16	0
			2	37	5	14	81	-	48	14	0	38							11	22	89	29	20	9	3							11	22	60	31	51	0	9	3
			E	2	100	0	0	-	50	0	0	50							50	50	100	0	0	0	0							50	50	100	0	0	0	0	0
	37	Fabrication technology for fine objects, controlling the several elements of the external environment together, including a magnetic field, electric field and gravity (manipulating nano particles to produce a device).	1	111	9	27	64	-	49	38	2	11							0	9	78	46	28	29	3							1	9	43	31	50	7	35	1
			2	101	9	24	67	-	51	37	1	11							0	5	80	51	24	25	2							1	6	47	32	62	4	30	0
			E	9	100	0	0	-	56	33	0	11							0	0	89	67	56	22	0							0	0	67	56	67	11	11	0
	38	Membrane processing and formation technology that can maintain biocompatibility for 10 years or more within an implanted device.	1	87	8	24	68	-	82	15	3	0							1	8	76	51	36	21	2							1	9	48	27	56	9	29	0
			2	77	9	21	70	-	84	12	4	0							1	4	78	47	38	16	3							1	5	48	28	65	7	23	0
			E	7	100	0	0	-	86	14	0	0							14	0	86	71	71	14	14							14	0	57	57	57	43	29	0
	39	Shape analysis and counting technology for nano particles with a diameter of 10nm or less within liquid or gas.	1	91	14	25	61	-	65	24	3	8							1	4	66	56	34	19	4							2	6	40	44	56	5	23	3
			2	77	18	22	60	-	77	18	0	5							1	3	67	59	29	13	3							3	4	41	49	59	3	20	3
			E	14	100	0	0	-	79	14	0	7							7	0	79	71	29	0	0							7	0	64	57	71	0	7	0
	40	Measurement technology concerning cumulative exposure to nano particles, to estimate the amounts of inhalation and skin absorption when people spend time in an environment including nano particles.	1	66	9	29	62	-	80	6	3	11							2	5	61	70	24	24	8							3	8	34	57	38	18	25	3
			2	58	12	24	64	-	84	7	0	9							2	2	60	68	25	16	5							4	4	33	63	37	11	18	4
			E	7	100	0	0	-	72	14	0	14							0	0	57	71	14	14	0							0	0	57	57	29	0	14	0

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Globalization, value-adding and market creation	41	Non-contact transmission technology to transfer the energy required to move an autonomous mobile micro robot that is placed at a distance away in the order of meters.	1	115	4	33	63	-	45	34	2	19							2	2	63	41	37	22	2						3	4	35	30	62	5	29	1
			2	109	3	31	66	-	49	33	1	17							1	3	67	38	42	18	2						3	3	34	28	76	2	22	1
			E	3	100	0	0	-	67	0	0	33							0	0	100	0	33	0	0						0	0	0	33	100	0	0	0
	42	Design, development, evaluation and maintenance techniques for reliable large-scale software that are not excessively dependent on personal skills.	1	123	8	27	65	-	72	19	0	9							8	9	54	38	44	24	6						8	9	30	30	58	3	26	5
			2	109	8	25	67	-	76	13	0	11							6	8	62	36	46	16	3						7	7	24	28	74	0	16	2
			E	9	100	0	0	-	89	11	0	0							11	0	78	56	56	0	0						11	11	38	13	75	0	0	0
	43	Information database technology capable of maintaining the up-to-date status of manufacturing knowledge, experimental data, product examples, public facts and corporate know-how that can be used for prior assessment of each process during design and production.	1	168	11	36	53	-	48	43	1	8							3	4	25	34	71	28	7						2	6	14	25	77	7	27	8
			2	151	11	31	58	-	50	42	0	8							1	3	21	34	80	21	3						1	3	8	23	87	3	22	5
			E	16	100	0	0	-	19	56	0	25							6	0	13	25	75	19	0						6	6	0	20	80	0	20	0
	44	Final quality assurance techniques that consist of monitoring and feedback coordination of all processes from the material to manufacturing during on-site production.	1	156	17	33	50	-	47	42	1	10							4	5	26	27	76	23	5						5	5	14	19	79	5	24	4
			2	136	15	28	57	-	50	41	1	8							2	3	22	26	84	18	3						2	3	11	15	92	2	20	2
			E	21	100	0	0	-	67	33	0	0							0	0	14	10	81	19	5						0	0	10	10	100	0	19	0
	45	Techniques for secondary use of customers' production information that is collected by receiving orders for personal production while considering the protection of personal information.	1	81	5	26	69	-	35	30	1	34							4	6	14	26	70	19	3						5	9	7	21	76	7	13	5
			2	73	4	23	73	-	34	32	0	34							3	4	11	23	79	11	3						6	4	6	15	85	3	8	4
			E	3	100	0	0	-	67	0	0	33							33	0	0	67	67	0	0						33	0	0	0	100	0	0	0
	46	A production management system with a self correction mechanism enabling flexible adaptation for changes in the situation by self-refinement of the system according to the condition of the target during the supply chain management, production planning, and scheduling.	1	123	16	32	52	-	42	36	1	21							7	8	34	24	65	21	1						7	8	17	12	77	1	17	2
			2	113	13	29	58	-	43	37	1	19							7	4	34	16	72	13	0						7	4	16	10	87	0	14	1
			E	15	100	0	0	-	54	33	0	13							7	0	50	7	64	7	0						7	0	27	7	80	0	13	0
	47	Multiscale and multiphysics simulation technology integrating from molecular behavior to macroscopic reaction and flow.	1	136	16	35	49	-	72	18	1	9							1	6	77	50	27	25	4						1	8	52	44	47	7	27	2
			2	123	15	32	53	-	72	19	0	9							2	3	83	49	25	16	3						2	4	55	45	48	4	19	2
			E	18	100	0	0	-	94	6	0	0							0	0	82	59	47	12	0						0	0	61	50	61	6	11	0
	48	Evaluation techniques identifying the suitable point to add value within various value chains (ex. market/customer research → development & design → procurement → production → sales → service) in each industry, to maximize industrial development and job creation.	1	108	10	31	59	-	37	40	2	21							6	11	41	40	51	23	4						7	10	21	23	69	17	17	3
			2	100	10	29	61	-	29	49	1	21							6	8	41	38	64	15	2						5	7	22	23	78	13	17	2
			E	10	100	0	0	-	20	60	0	20							10	10	50	50	63	13	0						0	0	13	25	88	13	13	0

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Globalization, value-adding and market creation	49	MOT methodology to fill the gap between basic science & technology research and the practical techniques in the manufacturing industry.	1	144	8	32	60	-	39	44	1	16							3	13									3	13	45	24	38	13	38	1
			2	130	8	29	63	-	34	50	1	15							2	9									2	9	52	19	40	6	40	1
			E	11	100	0	0	-	36	46	0	18							9	0									9	0	55	9	36	0	55	0
	50	Fundamental methodology for the paradigm shift from simple manufacturing to a new industrial structure that attaches much importance to value creation (such as service engineering).	1	145	12	28	60	-	34	52	1	13							6	7									6	7	49	27	45	16	32	3
			2	130	12	26	62	-	27	60	0	13							3	4									3	4	51	23	53	10	33	3
			E	15	100	0	0	-	13	67	0	20							7	0									7	0	67	20	47	7	27	0
	51	Modeling techniques and design methodology for efficient design process in the aspects of design, ergonomics, and sensibility, to satisfy intensifying customer needs.	1	131	15	27	58	-	38	47	0	15					2	5	55	30	53	22	1						2	8	30	17	67	4	23	2
			2	123	11	27	62	-	28	58	0	14					3	3	58	23	61	14	1						3	4	27	12	79	3	18	2
			E	14	100	0	0	-	21	72	0	7					0	0	69	23	46	15	0						0	0	38	15	62	0	23	0
	52	Manufacturing methodology based on intellectual properties related to unique core technology to create products that are fundamentally different from the characteristics of the Japanese market, while considering the existence of global mega markets, including the markets in developed countries, and the creation of ultra-low price products that are required in developing countries.	1	119	7	29	64	-	20	65	3	12					5	10	25	24	57	28	5						5	10	20	21	61	11	24	4
			2	106	8	25	67	-	16	71	2	11					2	6	26	18	68	23	3						3	6	18	12	76	3	22	4
			E	8	100	0	0	-	0	83	0	17					0	0	43	14	57	14	0						14	0	29	0	57	0	29	0
	53	Organization and design process methodology enabling design and production in an unprecedented form and level to cope with domestic and foreign (onsite) production bases by using various global human resources effectively to solve complicated global production problems.	1	125	8	34	58	-	38	53	2	7					3	6	20	16	62	27	8						4	7	16	15	68	11	23	6
			2	114	7	31	62	-	31	62	2	5					2	4	20	7	75	27	4						3	5	12	8	83	4	20	4
			E	8	100	0	0	-	29	57	0	14					0	0	50	0	75	25	0						14	0	33	0	67	0	17	0
	54	Information system that provides comprehensive support for global design businesses among distant locations and promotes the necessary coordination.	1	144	13	28	59	-	58	34	1	7					1	3	21	14	75	18	6						1	4	15	11	79	3	16	7
			2	127	13	26	61	-	69	23	1	7					0	2	18	12	81	13	4						1	2	10	7	89	2	12	5
			E	16	100	0	0	-	86	14	0	0					0	0	20	13	87	7	7						0	0	14	7	93	0	0	7
	55	Remote monitoring technology for products based on perception by the five senses (ex. data globe) enabling the building of a virtual market (such as an IT auction) for the products manufactured by a personal fabricator.	1	81	15	30	55	-	37	22	4	37					1	4	60	29	55	19	3						4	3	22	20	70	3	24	1
			2	80	14	21	65	-	38	21	4	37					1	1	57	20	52	19	3						5	0	15	13	81	3	24	3
			E	11	100	0	0	-	67	11	0	22					0	0	70	20	30	20	0						0	0	20	0	70	0	30	0
	56	Recognition technology to analyze the services that the person requires and to provide appropriate advice and guidance to the service provider.	1	94	13	20	67	-	45	32	1	22					8	4	57	38	41	16	1						9	3	30	26	55	0	23	2
			2	91	12	16	72	-	45	31	0	24					7	3	61	27	42	13	1						8	6	25	20	73	0	15	1
			E	11	100	0	0	-	40	30	0	30					0	0	60	30	40	0	0						0	10	33	22	44	0	0	0

Area	Topic number	Topic	Round	Responses	Degree of expertise (%)				Importance (%)				Forecasted time of technological realization (to be realized somewhere in the world) (%)						Sectors that will pave the way to technological realization (%)					Forecasted time of social realization (to become applicable/widely used in Japan) (%)						Sectors that will pave the way to social realization (%)					
					High	Moderate	Low	None	Important for Japan and the rest of the world	Especially important for Japan	Especially important for the world	Low importance/priority	Already realized	2011-2015	2016-2020	2021-2030	2031-2040	2041-	will not be realized	don't know	University	Public research organization	Private enterprise	Collaboration of multiple sectors	Others	2011-2015	2016-2020	2021-2030	2031-2040	2041-	don't know	will not be realized	University	Public research organization	Private enterprise	Government	Collaboration of multiple sectors	Others
Globalization, value-adding and market creation	57	Supply chain management techniques that can evaluate the place where parts and materials should be procured from and where the product (service) should be produced (provided) to optimize QCD (quality, cost, delivery) for the customer region of the product (service).	1	139	12	28	60	-	53	41	1	5							1	3	24	16	82	18	2						2	4	11	9	90	3	19	3
			2	125	12	30	58	-	58	38	0	4							0	1	24	10	89	13	2						1	2	8	6	93	1	17	3
			E	15	100	0	0	-	100	0	0	0							0	0	47	7	93	0	0						0	0	7	0	100	0	7	0
	58	Net shape forming (casting, sintering, and plasticity) technology with a processing accuracy of 1 micrometer or finer.	1	136	24	41	35	-	28	63	1	8							2	7	57	42	66	22	2						2	7	30	23	80	6	20	0
			2	118	24	36	40	-	22	73	0	5							1	6	57	39	71	20	2						1	4	28	24	89	4	17	0
			E	28	100	0	0	-	39	57	0	4							4	4	68	29	82	11	0						4	4	37	26	96	4	7	0
Energy, resources and environment	59	Safe and low-cost storage system for general waste, such as home appliances including rare metals for which reuse and efficient disposal methods have not yet been developed, in a condition enabling future use.	1	135	6	28	66	-	51	47	1	1							1	5	35	44	50	44	2						1	4	18	27	52	39	41	3
			2	121	7	27	66	-	53	47	0	0							1	2	31	44	53	39	3						1	1	14	23	66	37	40	3
			E	9	100	0	0	-	67	33	0	0							0	0	56	56	44	33	0						0	0	33	11	67	44	22	11
	60	Technology to efficiently convert low-grade thermal energy, which is hard to use from the viewpoint of exergy, to high exergy.	1	108	12	30	58	-	65	22	2	11							4	12	50	39	40	30	1						4	12	31	28	50	17	38	1
			2	104	12	30	58	-	68	20	1	11							5	8	61	40	41	16	0						5	7	30	23	60	13	30	0
			E	12	100	0	0	-	84	8	8	0							0	0	58	50	58	17	0						8	0	25	25	58	25	50	0
	61	Efficient application technology for the unused thermal energy that is generated intermittently.	1	139	9	23	68	-	63	29	1	7							1	9	46	46	46	29	2						1	10	23	27	57	20	33	2
			2	126	11	25	64	-	71	23	0	6							2	6	50	55	53	18	3						1	5	18	25	68	13	32	1
			E	14	100	0	0	-	79	21	0	0							7	0	69	69	62	15	0						0	0	29	29	71	21	36	0
	62	Solar cell system that is developed considering recycling and reuse with a low environmental load upon disposal.	1	119	8	25	67	-	64	29	2	5							2	3	35	35	67	26	3						2	3	15	21	76	18	27	3
			2	112	10	23	67	-	67	26	2	5							2	1	33	35	70	19	4						2	1	15	17	83	15	29	4
			E	11	100	0	0	-	46	27	18	9							9	0	55	36	55	0	0						9	0	36	27	73	9	9	0
	63	A recycling production system unifying the processes of the "input of resource → design and production → use → disposition" and the "collection → separation → resource recycling."	1	172	12	34	54	-	72	26	1	1							2	5	29	42	62	41	6						2	6	16	29	66	28	37	7
			2	161	11	34	55	-	79	19	1	1							1	1	25	39	65	38	2						1	2	13	22	76	27	36	3
			E	17	100	0	0	-	88	6	0	6							6	0	44	44	63	38	0						6	0	29	35	71	41	41	0
	64	Technology that breaks down the materials used in manufacturing facilities in a plant into single raw materials upon disposal, to enable reuse of the resources, and that is applied to 90% or more of such manufacturing facilities.	1	135	9	27	64	-	58	27	1	14							6	8	26	38	63	32	4						7	9	15	23	68	23	29	5
			2	126	9	23	68	-	66	22	1	11							4	5	23	39	67	28	3						5	4	13	20	77	16	30	3
			E	11	100	0	0	-	73	9	0	18							9	0	45	36	73	18	0						9	0	45	18	73	18	27	0

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Energy, resources and environment	65	Comprehensive and objective evaluation indices that replace CO_2 as an indicator for the environmental load of energy and resource consumption, production processes (plants) and products, and measurement techniques for such indices.	1	139	13	27	60	-	88	6	2	4							1	9	47	55	20	28	23							1	10	28	41	29	36	29	28
			2	129	14	20	66	-	91	4	2	3							0	6	50	66	21	25	19							1	6	24	54	31	32	28	25
			E	18	100	0	0	-	94	6	0	0							0	0	67	78	22	17	11							0	0	39	67	44	50	28	22
Unpopularity of science and engineering, human resource problem, the declining birth rate and aging population	66	An intelligent production system that supports the work of elderly persons and women in manufacturing processes while taking into consideration their characteristics.	1	152	9	38	53	-	26	67	0	7							1	7	35	37	56	32	1							2	10	17	21	73	22	28	2
			2	138	9	35	56	-	24	72	0	4							2	1	30	37	66	27	2							2	2	9	18	80	17	23	1
			E	12	100	0	0	-	33	59	0	8							8	0	42	33	58	8	0							8	0	17	17	75	0	17	8
	67	An intelligent system and robot enabling remote control, semi-autonomization, or automation of safe, efficient and low cost outdoor work on behalf of human beings, aiming to minimize harm to humans due to natural and human-caused disasters, or during inspections in danger zones and repair work for infrastructure that are deteriorated or damaged by a natural disaster.	1	154	11	38	51	-	55	39	1	5							0	5	47	49	42	39	3							3	7	25	34	53	21	40	5
			2	146	10	35	55	-	60	36	1	3							0	2	46	57	50	28	2							0	3	20	32	70	14	35	2
			E	14	100	0	0	-	71	29	0	0							0	0	50	50	36	14	0							0	0	21	21	71	7	14	0
	68	Education system to train engineers who can rationally improve design in a more upper-stream phase than the conventional design process intends, and to continuously develop their ability.	1	165	16	32	52	-	24	67	0	9																			4	15	59	18	36	27	23	3
			2	144	16	28	56	-	18	74	0	8																			2	12	61	13	40	22	20	1
			E	23	100	0	0	-	14	81	0	5																			5	5	67	19	33	24	19	0
	69	Establishing faculties and courses that aim to train human resources who can create contents (movie, music, literature, comics, etc) in more than 50% of universities in Japan.	1	98	3	14	83	-	1	41	0	58																			35	19	68	5	18	36	11	3
			2	91	4	13	83	-	1	43	0	56																			36	21	68	8	12	41	11	1
			E	4	100	0	0	-	0	50	0	50																			0	33	67	33	0	67	0	0
	70	Establishing faculties and courses that study methods to support the creation of contents (movie, music, literature, comics, etc) in more than 75% of universities in Japan.	1	98	3	15	82	-	1	35	0	64																			43	22	67	5	14	32	9	3
			2	92	4	14	82	-	1	34	0	65																			45	22	68	5	8	40	9	1
			E	4	100	0	0	-	0	50	0	50																			33	33	67	33	0	33	0	0
Safety and security	71	An automatic content monitoring system (including adult verification system) aiming to enable minors to use the Internet safely.	1	110	5	13	82	-	64	20	1	15							2	6	26	42	51	24	10							2	10	13	31	50	44	23	11
			2	99	5	11	84	-	74	13	0	13							1	5	22	45	60	14	8							1	8	12	29	56	41	18	8
			E	5	100	0	0	-	75	25	0	0							0	0	40	60	40	20	0							0	20	40	60	60	60	0	0
	72	Forming and processing a database that covers more than 95% of structural materials (steel, alloys of Cu, Al, Mg, and Ti) and includes information about strength, fatigue life, plastic deformation stress, texture and anisotropy, and material structural change.	1	142	20	32	48	-	52	37	0	11							3	8	42	65	29	36	9							3	9	34	61	40	15	33	10
			2	125	21	30	49	-	62	29	0	9							1	4	40	76	28	36	8							2	6	29	71	44	10	34	8
			E	26	100	0	0	-	69	31	0	0							0	0	52	76	36	40	16							0	0	52	72	56	12	40	8

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Safety and security	73	Molding die technology (including coating and material) to realize long life (can be used for 107 times at 1000 degrees centigrade) and low friction (coefficient of friction of 0.05).	1	106	17	35	48	-	42	50	0	8							5	13	63	59	49	25	3						5	11	39	43	66	6	32	1
			2	96	14	38	48	-	42	50	0	8							3	9	71	65	51	23	1						4	8	36	47	76	3	24	1
			E	13	100	0	0	-	62	38	0	0							0	0	77	85	54	0	0						0	0	46	54	92	8	8	0
	74	Oil-less, wash-less scrap-less and noiseless (4 less) manufacturing.	1	110	11	30	59	-	49	35	1	15							16	14	52	46	50	25	2						13	15	33	33	61	6	28	1
			2	97	10	27	63	-	54	32	1	13							13	14	60	47	58	19	2						13	11	31	29	78	2	19	1
			E	10	100	0	0	-	60	30	10	0							0	0	70	40	90	0	0						0	0	60	40	100	0	0	0
	75	Quality assurance on the basis of non-contact measurement for the inside structure of a product using electromagnetic waves and/or a neutron beam, and improvement of in-situ measurement for condition change during the casting and molding process.	1	116	9	41	50	-	46	45	0	9							1	5	57	54	54	20	1						1	5	33	40	71	6	23	0
			2	105	9	43	48	-	47	43	0	10							1	4	59	55	59	16	1						1	4	32	42	79	7	18	0
			E	9	100	0	0	-	45	44	0	11							0	0	88	63	63	25	0						0	13	50	50	88	13	13	0
	76	Virtual plant-operation support system that visualizes the inside condition of a reactor and the future deteriorated condition of the plant.	1	109	23	27	50	-	55	35	0	10							1	6	49	36	57	27	2						1	6	27	29	71	10	22	3
			2	101	23	26	51	-	65	25	0	10							1	5	59	40	61	17	2						1	5	27	31	81	7	18	2
			E	23	100	0	0	-	83	13	0	4							4	0	78	52	70	17	0						4	0	39	43	83	9	26	0

Panel 11:

Strengthening of management led/required by advancement of science and technology

Implementation of the questionnaires

	Sent	Returned (response rate)
<1st Round>	230	180 (78%)
<2nd Round>	179	156 (87%)

Sex	Male	151	Affiliation	Private enterprise	39
	Female	5		University	94
	N.A.	0		Research Institute	10
generation	20's	0		Association	4
	30's	12		Others	9
	40's	39		N.A.	0
	50's	61	Job category	R&D	104
	60's	37		Others	52
	70's and over	7		N.A.	0
	N.A.	0		Total	156

Survey items

A: Methodology to gain insight into the future based on a small phenomenon

B: Management (Global management) to prevent the decrease of competitiveness in the international market (international management), human resource development to compete with foreign workers, and cross-cultural cooperative management

C: Service management, management in the education and research field, environment business management, governmental institution management

D: Framework for facilitation of social innovation and network building

E: Management of humans (e.g., to cope with disparity and diversity), creation, management, and transfer of knowledge, education, and maintenance of education level by standardization

F: Governance structure, assessment

G: Management enhancement (intellectual properties, technological value evaluation, financial engineering, economical physics, management without mind blanks)

H: Management-supporting technology using engineering techniques, management for flow and stock of data (database) / knowledge structurization (storing knowledge by association)

Time-series tables of topics

<Technological realization>

year	Topic (Leading number represents ID.)
2012	22: Optimization problems related to resource allocation and scheduling will be solved efficiently and this will contribute to corporate cost reductions.
2013	18: A life cycle tracking system for industrial products using IC chips that are embedded in each component of the product and contain the identification information of the component (manufacturer, materials, parts, changes in function and characteristics, users, etc).
2014	21: Methods to clearly specify the definitions of requirements in IT investment management that is needed in the organization of the public sector and corporate sector in Japan.
	33: Information terminal devices and software enabling elderly people and handicapped people to easily join the information network.
	49: Analysis of competition, negotiation and cooperation based on game theory will be promoted and applied to practical policy making and decision making within a corporation.
	51: Knowledge structuring methodologies (for example, methods like a KeyGraph) will be established to enable people to promptly obtain other knowledge that is related to certain knowledge for new creation in the context of corporate management.
	53: Technology and processes that effectively use the knowledge accumulated in databases and in other forms, and technology and processes for quality and quantity evaluation of the use of the first-mentioned technology and processes are established and are effectively used in corporations.
	56: Construction of a framework for skill transmission, by utilizing image digitization and virtual reality technology.
2015	09: Techniques to make comprehensive evaluations on the strength, performance, reliability, environmental characteristics, productivity and so on of a product by using a digital mockup to reduce the R&D and design time and strengthen competitiveness.
	17: In Japan, the medical records containing motion video will be converted into electronic form and entrusted to patients, and the medical information, including the results of examination, will be shared among all medical institutions. Based on this environment, a health care agent business will be formed between patients and medical institutions.
	19: A robot and information system that can replace human service for cash registers, concierges and so on.
	44: A variety of Japanese corporations will institutionalize the regular publication of quantitative business risks and other information related to listed companies, and they will efficiently reduce the quantified risks by establishing the optimum business portfolio and other measures.
2016	14: An efficient demand forecast and production-logistics system almost eliminating opportunity loss caused by excess inventory and/or having no stocks.
	20: In Japan, as people start to place importance on the conservation of historical buildings and scenic areas, legal systems will be arranged to promote funding by individuals and corporations for the maintenance and improvement of the natural environment, public goods and living environment.
	26: The development of the network infrastructure will remove the physical gap between the residence and work place, and virtual offices will enter the mainstream, as opposed to real offices.

year	Topic (Leading number represents ID.)
2016	32: A support system enabling staff to reuse and learn about the judgment process, skills and know-how of skilled staff, through the clear demonstration thereof.
	38: A common and generalized system for the evaluation and management of project risk.
	39: Most corporations will adopt risk management techniques to cope with natural disasters (ex. typhoons, earthquakes, and floods).
	47: In order to reduce market risks caused by fluctuations in currency value and the price of international goods, including energy, major Japanese corporations (more than 30% of the listed companies) will introduce a management scheme that specifies market risk factors beforehand, and calculates the daily amount of such risks.
	52: Techniques to convert tacit knowledge such as basic techniques and skills, know-how, and experience into explicit knowledge with regard to manufacturing and production technology are established, and the tradition of technology is implemented steadily.
	58: Techniques to visualize the background and structure of social issues by recognizing relationships among articles and editorials in newspapers, for the purpose of supporting policy-making.
2017	01: Decision-making prediction techniques that are based on the analysis of personal mindset and sensitivity that is used in the research process of experimental economics, and are used for the institutional design of corporate organization and a market, and for corporate product and technology development.
	08: An advanced virtual manufacturing system supporting productive activities such as design, development, production, operation, maintenance and disposal (by optimization, efficiency improvement, licensing procedure, etc.)
	48: For R&D project management, methodologies will be established for each of planning, operation, control and evaluation of research, and the efficiency thereof will be improved by 20% on average.
	54: Transaction schemes for a database and/or knowledge base accumulated within a corporation will be established inside and outside the corporation, and then the database and/or knowledge base will be actively traded according to economic motivation.
2018	16: Alternative technology for energy intensive transportation devices for humans to cope with global warming and the escalation of environmental problems.
2019	02: Techniques identifying customers' subconscious needs and wants (or, visualizing customers' thoughts and feelings that are hard to be verbalized) based on the theories derived from cognitive psychology and/or brain science, which are to be applied to R&D and marketing.
	55: A coordinated decision-making system involving various stakeholders on the basis of use of a knowledge information platform, such as a database and a knowledge base related to the environment.
2019	57: In the context of risk management techniques, a scheme for long-term impact assessment to evaluate the influence of artificial and natural materials and systems on health and the environment will be established.
2024	23: A system enabling almost exact simulation of the occurrence of innovation in the most probable area for each combination of "knowledge seeds" (i.e. intelligence genes) corresponding to a predetermined objective, by integrating the "knowledge seed" that each university, corporation, research institution and individual researcher holds in a database as a "gene," and matching them with social needs in the optimum way.
2025	36: The higher order mechanism of human intuition and creativity will be revealed thanks to the development of brain science, and it will be used in business practice.

year	Topic (Leading number represents ID.)
2025	50: Economic fluctuations will be further reduced as the elaboration of the economic policy, including the monetary policy, brings good control of inflation and deflation.

<Social realization>

year	Topic (Leading number represents ID.)
2018	22: Optimization problems related to resource allocation and scheduling will be solved efficiently and this will contribute to corporate cost reductions.
	42: Competitiveness in the international market will be further improved by obtaining patents in foreign countries under the major policy change to emphasize international patent applications rather than the national applications.
2019	04: The number of technology partnerships between Japanese and foreign corporations will increase by more than 100%.
	09: Techniques to make comprehensive evaluations on the strength, performance, reliability, environmental characteristics, productivity and so on of a product by using a digital mockup to reduce the R&D and design time and strengthen competitiveness.
	15: Various incentive systems to reduce the peak electric power demand facilitate the leveling of electric power demand and the effective utilization of resources.
	18: A life cycle tracking system for industrial products using IC chips that are embedded in each component of the product and contain the identification information of the component (manufacturer, materials, parts, changes in function and characteristics, users, etc).
	21: Methods to clearly specify the definitions of requirements in IT investment management that is needed in the organization of the public sector and corporate sector in Japan.
	33: Information terminal devices and software enabling elderly people and handicapped people to easily join the information network.
	56: Construction of a framework for skill transmission, by utilizing image digitization and virtual reality technology.
2020	13: A general theory about the value of services will be established and it will begin to be applied to specific cases.
	43: The excessive claim of intellectual property rights will come to be restricted from the perspective of promoting innovation.
2021	06: Along with the improvement of global management abilities premised on foreign cultures, faculty development programs will be carried out to understand the history, culture, language, legislation system, value system and so on of foreign countries.
	08: An advanced virtual manufacturing system supporting productive activities such as design, development, production, operation, maintenance and disposal (by optimization, efficiency improvement, licensing procedure, etc.)
	14: An efficient demand forecast and production-logistics system almost eliminating opportunity loss caused by excess inventory and/or having no stocks.
	30: A management methodology effectively making the functional use of work-sharing, which is capable of securing jobs and reducing social disparity while maintaining competitiveness in the international market, in Japan.
	32: A support system enabling staff to reuse and learn about the judgment process, skills and know-how of skilled staff, through the clear demonstration thereof.
	34: A social environment enabling women to balance marriage, birth and child care with work to promote their social involvement (for example, 30% of listed companies will have a day-care center for children) will be realized.

year	Topic (Leading number represents ID.)
2021	41: To become an advanced patent nation, the patent strategy will be converted to emphasize the importance of basic patents, while the establishment of a patent portfolio in which the patent holder balances the basic patents and the improvement patents appropriately will be incorporated in such strategy, in Japan. 53: Technology and processes that effectively use the knowledge accumulated in databases and in other forms, and technology and processes for quality and quantity evaluation of the use of the first-mentioned technology and processes are established and are effectively used in corporations.
2022	07: A globally networked human resource management system will be established, and it will help high-level experts to transfer freely beyond borders between countries. 19: A robot and information system that can replace human service for cash registers, concierges and so on. 29: To accelerate the speed of discovery or development of new technology, most of the technological issues in companies and in every branch of industry will come to be publicized, and public proposals for solutions will be made and such proposals will be examined in a competition scheme. 31: Human resources will be mobilized according to changes in society and economics against the backdrop of the spread of the recurrent education for job training in graduate schools or later. 40: Building of an information and social system that effectively improves the capacity of disaster prevention and welfare activity under local communities.
2023	01: Decision-making prediction techniques that are based on the analysis of personal mindset and sensitivity that is used in the research process of experimental economics, and are used for the institutional design of corporate organization and a market, and for corporate product and technology development. 20: In Japan, as people start to place importance on the conservation of historical buildings and scenic areas, legal systems will be arranged to promote funding by individuals and corporations for the maintenance and improvement of the natural environment, public goods and living environment. 38: A common and generalized system for the evaluation and management of project risk. 39: Most corporations will adopt risk management techniques to cope with natural disasters (ex. typhoons, earthquakes, and floods). 44: A variety of Japanese corporations will institutionalize the regular publication of quantitative business risks and other information related to listed companies, and they will efficiently reduce the quantified risks by establishing the optimum business portfolio and other measures. 45: In the corporations in Asia, Latin America and Europe, the unique Japanese corporate governance system will be given the definite status of a system different than those of the United States and the UK, which are based on shareholder sovereignty. 47: In order to reduce market risks caused by fluctuations in currency value and the price of international goods, including energy, major Japanese corporations (more than 30% of the listed companies) will introduce a management scheme that specifies market risk factors beforehand, and calculates the daily amount of such risks. 51: Knowledge structuring methodologies (for example, methods like a KeyGraph) will be established to enable people to promptly obtain other knowledge that is related to certain knowledge for new creation in the context of corporate management.

year	Topic (Leading number represents ID.)
2023	52: Techniques to convert tacit knowledge such as basic techniques and skills, know-how, and experience into explicit knowledge with regard to manufacturing and production technology are established, and the tradition of technology is implemented steadily.
	58: Techniques to visualize the background and structure of social issues by recognizing relationships among articles and editorials in newspapers, for the purpose of supporting policy-making.
2024	10: Facilitation of international corporate management due to the global standards that are established on the basis of global integration of the laws related to commercial activities, transactions, taxation, competition and intellectual properties and that are applied to global economic activities.
	17: In Japan, the medical records containing motion video will be converted into electronic form and entrusted to patients, and the medical information, including the results of examination, will be shared among all medical institutions. Based on this environment, a health care agent business will be formed between patients and medical institutions.
	28: Just like the supply method for open source software, a cooperative system enabling customers to act as leaders in developing, producing, selling, and supporting the goods they want will be established for various goods and services regardless of price.
	46: Labor productivity will increase by up to 20% from the present status as a substantial authority transfer becomes possible through the improvement of staff performance evaluation and the payment and promotion system.
	49: Analysis of competition, negotiation and cooperation based on game theory will be promoted and applied to practical policy making and decision making within a corporation.
2025	02: Techniques identifying customers' subconscious needs and wants (or, visualizing customers' thoughts and feelings that are hard to be verbalized) based on the theories derived from cognitive psychology and/or brain science, which are to be applied to R&D and marketing.
	25: A social capital census targeting the social network (consisting of connected individuals) in addition to the conventional census aimed at individuals will be introduced by the national government, where all of the social resources and their networks are investigated to recognize what kind of local social groups and life-supporting organizations exist and how the individuals take part in those organizations beyond the family unit.
	26: The development of the network infrastructure will remove the physical gap between the residence and work place, and virtual offices will enter the mainstream, as opposed to real offices.
	35: In Japan, an employment contract that specifically defines the relationship between personal incentive and reward will be popularized.
	37: A governance structure that monitors, manages, and coordinates within the world-wide framework beyond the framework of each national government's administration will be established to cope with such global issues as excessively speculative money, global warming and exploiting factories.
	48: For R&D project management, methodologies will be established for each of planning, operation, control and evaluation of research, and the efficiency thereof will be improved by 20% on average.
2026	03: About half of the big Japanese corporations will change their official language to English because of the development of globalization.
	16: Alternative technology for energy intensive transportation devices for humans to cope with global warming and the escalation of environmental problems.

year	Topic (Leading number represents ID.)
2026	27: In listed companies, project-style methods to develop products or construct strategies for the company by individuals regardless of their professional affiliation, i.e. individual or freelance, will become the norm.
	54: Transaction schemes for a database and/or knowledge base accumulated within a corporation will be established inside and outside the corporation, and then the database and/or knowledge base will be actively traded according to economic motivation.
2027	55: A coordinated decision-making system involving various stakeholders on the basis of use of a knowledge information platform, such as a database and a knowledge base related to the environment.
2028	11: Big, globalized Japanese enterprises that generate half of their sales overseas will establish a new cooperating system even in their domestic corporations and hire more than 1/3 of management staff and experts from abroad.
	57: In the context of risk management techniques, a scheme for long-term impact assessment to evaluate the influence of artificial and natural materials and systems on health and the environment will be established.
2030	24: A social enterprise that aims to provide solutions for environment conservation, child raising and care support, and the elimination of poverty, that will come to produce more than 15% of GDP at the national level.
2032	05: Economic integration of the East Asia region
	12: More than 20% of students will study abroad or in international schools during their primary education period.
2033	23: A system enabling almost exact simulation of the occurrence of innovation in the most probable area for each combination of "knowledge seeds" (i.e. intelligence genes) corresponding to a predetermined objective, by integrating the "knowledge seed" that each university, corporation, research institution and individual researcher holds in a database as a "gene," and matching them with social needs in the optimum way.
2035	36: The higher order mechanism of human intuition and creativity will be revealed thanks to the development of brain science, and it will be used in business practice.
2036	50: Economic fluctuations will be further reduced as the elaboration of the economic policy, including the monetary policy, brings good control of inflation and deflation.

Area	Topic number	Topic	Round	Responses	Degree of expertise				Importance				Forecasted time of technological realization (to be realized somewhere in the world)						Sectors that will pave the way to technological					Forecasted time of social realization (to become applicable/widely used in Japan)						Sectors that will pave the way to social realization					
					High	Moderate	Low	None	Important for Japan and the rest of the world	Especially important for Japan	Especially important for the world	Low importance/priority	Already realized	2011-2015	2016-2020	2021-2030	2031-2040	2041-	don't know will not be realized	University	Public research organization	Private enterprise	Collaboration of multiple sectors	Others	2011-2015	2016-2020	2021-2030	2031-2040	2041-	don't know will not be realized	University	Public research organization	Private enterprise	Government	Collaboration of multiple sectors	Others
					(%)				(%)				(%)						(%)											(%)						
Methodology to gain insight into the future based on a small phenomenon	1	Decision-making prediction techniques that are based on the analysis of personal mindset and sensitivity that is used in the research process of experimental economics, and are used for the institutional design of corporate organization and a market, and for corporate product and technology development.	1	128	13	30	57	-	55	20	0	25							12	15	58	23	41	25	5						13	17	31	13	72	10	16	5
			2	117	12	29	59	-	56	16	0	28							12	10	59	17	47	24	2						12	14	28	10	78	6	12	2
			E	14	100	0	0	-	57	36	0	7							14	0	62	38	54	23	15						14	0	31	8	69	8	23	8
	2	Techniques identifying customers' subconscious needs and wants (or, visualizing customers' thoughts and feelings that are hard to be verbalized) based on the theories derived from cognitive psychology and/or brain science, which are to be applied to R&D and marketing.	1	135	6	31	63	-	52	24	1	23							9	10	57	21	47	26	3						8	11	30	6	76	3	13	4
			2	123	4	25	71	-	57	17	1	25							8	12	63	19	45	26	2						9	12	28	7	78	2	14	1
			E	5	100	0	0	-	25	75	0	0							0	0	60	20	80	20	0						0	0	40	0	80	0	0	0
Management (Global management) to prevent the decrease of competitiveness in the international market (international management), human resource development to compete with foreign workers, and cross-cultural cooperative management.	3	About half of the big Japanese corporations will change their official language to English because of the development of globalization.	1	148	11	36	53	-	17	54	2	27																			37	7	8	5	84	17	11	8
			2	134	10	34	56	-	14	65	0	21																			37	2	6	2	90	14	10	4
			E	13	100	0	0	-	8	84	0	8																			15	0	15	8	85	15	15	0
	4	The number of technology partnerships between Japanese and foreign corporations will increase by more than 100%.	1	143	21	29	50	-	45	51	1	3																			2	5	2	3	91	9	11	4
			2	132	20	27	53	-	46	52	1	1																			2	5	2	2	95	6	8	2
			E	26	100	0	0	-	58	42	0	0																			4	4	4	4	92	0	15	4
	5	Economic integration of the East Asia region.	1	127	3	23	74	-	55	29	3	13																			21	8	3	2	24	70	23	25
			2	119	3	23	74	-	60	25	3	12																			19	3	1	1	23	74	21	23
			E	3	100	0	0	-	33	67	0	0																			33	0	0	0	33	33	100	0
	6	Along with the improvement of global management abilities premised on foreign cultures, faculty development programs will be carried out to understand the history, culture, language, legislation system, value system and so on of foreign countries.	1	130	12	25	63	-	43	47	2	8																			6	7	30	15	44	22	30	17
			2	119	11	18	71	-	47	46	3	4																			3	6	34	9	61	12	25	11
			E	13	100	0	0	-	50	50	0	0																			0	0	23	8	62	8	23	23
	7	A globally networked human resource management system will be established, and it will help high-level experts to transfer freely beyond borders between countries.	1	142	12	32	56	-	62	31	3	4																			4	6	24	18	61	27	26	20
			2	129	11	28	61	-	72	24	1	3																			2	4	20	12	72	21	26	18
			E	14	100	0	0	-	71	29	0	0																			0	0	14	7	79	14	29	7
	8	An advanced virtual manufacturing system supporting productive activities such as design, development, production, operation, maintenance and disposal (by optimization, efficiency improvement, licensing procedure, etc.)	1	128	17	30	53	-	59	28	4	9							2	3	26	19	81	21	7						2	4	20	12	78	12	23	5
			2	119	13	26	61	-	67	25	3	5							1	4	17	12	88	20	4						1	3	15	10	86	8	22	4
			E	16	100	0	0	-	72	21	0	7							7	0	45	9	91	27	18						0	0	25	13	69	19	38	6

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					High	Moderate	Low	None	Important for Japan and the rest of the world	Especially important for Japan	Especially important for the world	Low importance/priority	Already realized	2011-2015	2016-2020	2021-2030	2031-2040	2041-	don't know	will not be realized	University	Public research organization	Private enterprise	Collaboration of multiple sectors	Others	2011-2015	2016-2020	2021-2030	2031-2040	2041-	don't know	will not be realized	University	Public research organization	Private enterprise	Government	Collaboration of multiple sectors	Others
Management (Global management) to prevent the decrease of competitiveness in the international market (international management), human resource development to compete with foreign workers, and cross-cultural cooperative management.	9	Techniques to make comprehensive evaluations on the strength, performance, reliability, environmental characteristics, productivity and so on of a product by using a digital mockup to reduce the R&D and design time and strengthen competitiveness.	1	121	17	31	52	-	53	43	1	3							0	2	26	20	79	18	3						0	4	16	13	83	5	19	2
			2	110	15	29	56	-	60	37	0	3							0	2	24	15	85	13	1						0	2	14	9	84	2	17	0
			E	17	100	0	0	-	87	13	0	0							0	0	24	0	71	29	0						0	6	13	0	67	0	33	0
	10	Facilitation of international corporate management due to the global standards that are established on the basis of global integration of the laws related to commercial activities, transactions, taxation, competition and intellectual properties and that are applied to global economic activities.	1	122	11	27	62	-	81	13	3	3																			11	5	10	12	36	60	25	35
			2	113	9	25	66	-	86	10	2	2																			6	4	8	7	35	74	21	32
			E	10	100	0	0	-	90	10	0	0																			10	10	10	10	10	60	20	20
	11	Big, globalized Japanese enterprises that generate half of their sales overseas will establish a new cooperating system even in their domestic corporations and hire more than 1/3 of management staff and experts from abroad.	1	137	12	26	62	-	19	61	4	16																			16	8	2	2	90	20	8	8
			2	126	9	28	63	-	10	73	2	15																			21	5	2	2	94	17	6	5
			E	11	100	0	0	-	9	91	0	0																			36	0	9	9	73	9	18	0
	12	More than 20% of students will study abroad or in international schools during their primary education period.	1	113	9	19	72	-	8	43	0	49																			43	12	11	7	15	44	28	19
			2	110	7	12	81	-	6	46	0	48																			48	6	7	4	11	62	24	15
			E	8	100	0	0	-	13	49	0	38																			38	0	0	25	13	50	13	0
Service management, management in the education and research field, environment business management, governmental institution management	13	A general theory about the value of services will be established and it will begin to be applied to specific cases.	1	136	25	34	41	-	56	25	1	18																			13	10	57	15	53	9	23	3
			2	123	19	33	48	-	64	18	0	18																			14	8	63	12	58	5	23	2
			E	23	100	0	0	-	65	35	0	0																			9	0	65	22	52	4	30	0
	14	An efficient demand forecast and production-logistics system almost eliminating opportunity loss caused by excess inventory and/or having no stocks.	1	141	21	30	49	-	66	21	3	10							14	7	29	7	87	13	2						17	7	11	3	88	5	17	2
			2	124	18	32	50	-	74	15	2	9							12	3	23	3	88	20	0						13	4	8	1	89	2	18	2
			E	22	100	0	0	-	90	5	0	5							20	0	42	11	84	32	0						19	0	19	0	86	5	29	0
	15	Various incentive systems to reduce the peak electric power demand facilitate the leveling of electric power demand and the effective utilization of resources.	1	141	16	35	49	-	75	19	4	2																			2	1	16	27	58	48	36	7
			2	125	16	30	54	-	83	13	1	3																			2	1	9	19	71	57	41	3
			E	20	100	0	0	-	90	10	0	0																			0	0	10	15	75	55	45	0
	16	Alternative technology for energy intensive transportation devices for humans to cope with global warming and the escalation of environmental problems.	1	137	12	36	52	-	89	6	3	2							2	3	40	44	58	42	10						3	5	22	23	57	34	41	7
			2	122	11	30	59	-	92	4	2	2							1	0	36	38	64	38	7						0	3	20	20	66	34	47	3
			E	14	100	0	0	-	93	7	0	0							0	0	29	36	43	21	0						0	0	21	14	50	14	36	0

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Service management, management in the education and research field, environment business management, governmental institution management	17	In Japan, the medical records containing motion video will be converted into electronic form and entrusted to patients, and the medical information, including the results of examination, will be shared among all medical institutions. Based on this environment, a health care agent business will be formed between patients and medical institutions.	1	122	8	27	65	-	36	52	1	11							4	3	29	37	50	39	4							7	7	17	24	45	45	39	3
			2	112	6	25	69	-	34	56	0	10							5	2	24	37	58	41	2							6	5	12	22	49	56	44	2
			E	7	100	0	0	-	29	57	0	14							29	0	14	29	43	57	0							29	0	29	29	29	29	57	0
	18	A life cycle tracking system for industrial products using IC chips that are embedded in each component of the product and contain the identification information of the component (manufacturer, materials, parts, changes in function and characteristics, users, etc).	1	140	16	39	45	-	64	21	2	13							3	2	20	15	86	20	4							6	4	12	13	79	23	23	6
			2	127	13	38	49	-	76	11	1	12							3	1	18	10	87	18	5							5	2	11	8	87	21	23	6
			E	16	100	0	0	-	74	13	0	13							6	0	33	7	80	13	0							7	0	14	0	79	29	21	7
	19	A robot and information system that can replace human service for cash registers, concierges and so on.	1	125	9	38	53	-	34	33	2	31							5	6	38	26	77	16	1							8	8	15	12	86	8	17	1
			2	115	5	36	59	-	32	35	0	33							3	4	32	15	81	16	1							7	6	14	6	88	7	19	1
			E	6	100	0	0	-	50	17	0	33							0	17	83	67	67	0	0							17	17	33	50	67	17	0	0
	20	In Japan, as people start to place importance on the conservation of historical buildings and scenic areas, legal systems will be arranged to promote funding by individuals and corporations for the maintenance and improvement of the natural environment, public goods and living environment.	1	96	8	21	71	-	19	65	2	14							5	13	21	43	7	40	23							6	19	9	12	13	74	30	10
			2	90	8	16	76	-	10	77	0	13							2	7	16	57	2	49	16							7	13	6	11	9	81	29	6
			E	7	100	0	0	-	43	57	0	0							0	14	17	83	0	17	17							0	14	17	50	0	33	33	17
	21	Methods to clearly specify the definitions of requirements in IT investment management that is needed in the organization of the public sector and corporate sector in Japan.	1	112	22	32	46	-	30	49	0	21							5	9	27	29	73	18	2							6	10	14	17	75	25	16	4
			2	97	22	30	48	-	29	53	0	18							6	3	22	24	81	11	1							6	6	9	11	82	23	11	2
			E	21	100	0	0	-	47	43	0	10							10	0	19	14	86	10	0							11	0	10	15	75	10	10	0
	22	Optimization problems related to resource allocation and scheduling will be solved efficiently and this will contribute to corporate cost reductions.	1	139	19	35	46	-	59	22	2	17							4	5	42	18	77	14	1							5	4	15	15	86	8	13	2
			2	121	17	34	49	-	67	18	2	13							2	4	35	14	84	15	0							3	4	13	13	91	4	10	1
			E	20	100	0	0	-	78	11	0	11							0	0	47	5	84	11	0							0	0	20	10	95	5	10	0
Framework for facilitation of social innovation and network building	23	A system enabling almost exact simulation of the occurrence of innovation in the most probable area for each combination of "knowledge seeds" (i.e. intelligence genes) corresponding to a predetermined objective, by integrating the "knowledge seed" that each university, corporation, research institution and individual researcher holds in a database as a "gene," and matching them with social needs in the optimum way.	1	119	13	32	55	-	47	16	1	36							36	10	72	41	23	21	2							35	13	55	36	32	13	23	2
			2	113	9	29	62	-	53	8	0	39							34	8	75	38	15	22	3							34	10	66	33	29	8	19	3
			E	10	100	0	0	-	78	11	0	11							40	0	89	44	0	0	0							40	0	67	22	22	11	0	0
	24	A social enterprise that aims to provide solutions for environment conservation, child raising and care support, and the elimination of poverty, that will come to produce more than 15% of GDP at the national level.	1	103	9	30	61	-	66	21	7	6																				15	11	11	10	39	49	45	14
			2	102	5	25	70	-	78	13	6	3																				12	11	8	4	39	58	46	14
			E	5	100	0	0	-	60	40	0	0																				0	20	40	40	40	20	40	0

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					High	Moderate	Low	None	Important for Japan and the rest of the world	Especially important for Japan	Especially important for the world	Low importance/priority	Already realized	2011-2015	2016-2020	2021-2030	2031-2040	2041-	don't know will not be realized	University	Public research organization	Private enterprise	Collaboration of multiple sectors	Others	2011-2015	2016-2020	2021-2030	2031-2040	2041-	don't know will not be realized	University	Public research organization	Private enterprise	Government	Collaboration of multiple sectors	Others
Framework for facilitation of social innovation and network building	25	A social capital census targeting the social network (consisting of connected individuals) in addition to the conventional census aimed at individuals will be introduced by the national government, where all of the social resources and their networks are investigated to recognize what kind of local social groups and life-supporting organizations exist and how the individuals take part in those organizations beyond the family unit.	1	101	9	34	57	-	20	34	0	46																		35	17	18	22	3	65	28	2
			2	90	3	31	66	-	19	27	0	54																		40	10	11	15	3	78	24	1
			E	3	100	0	0	-	0	33	0	67																		67	0	0	50	0	50	0	0
	26	The development of the network infrastructure will remove the physical gap between the residence and work place, and virtual offices will enter the mainstream, as opposed to real offices.	1	148	18	32	50	-	46	22	3	29						12	6	30	23	73	25	2						19	13	18	15	74	15	24	1
			2	131	15	28	57	-	54	15	0	31						13	4	15	14	84	23	1						21	7	11	9	86	14	23	2
			E	19	100	0	0	-	50	17	0	33						11	0	13	19	88	19	0						33	0	12	18	82	24	24	0
	27	In listed companies, project-style methods to develop products or construct strategies for the company by individuals regardless of their professional affiliation, i.e. individual or freelance, will become the norm.	1	129	15	26	59	-	26	29	0	45																		39	12	10	7	79	10	21	3
			2	116	12	26	62	-	26	25	0	49																		38	6	6	4	86	10	18	2
			E	14	100	0	0	-	35	36	0	29																		15	8	15	15	85	31	8	0
	28	Just like the supply method for open source software, a cooperative system enabling customers to act as leaders in developing, producing, selling, and supporting the goods they want will be established for various goods and services regardless of price.	1	128	15	33	52	-	49	17	1	33																		18	15	12	9	72	11	27	4
			2	113	11	32	57	-	57	14	1	28																		13	10	9	7	78	6	30	3
			E	12	100	0	0	-	55	18	0	27																		33	0	44	11	67	0	22	0
	29	To accelerate the speed of discovery or development of new technology, most of the technological issues in companies and in every branch of industry will come to be publicized, and public proposals for solutions will be made and such proposals will be examined in a competition scheme.	1	125	19	34	47	-	41	28	1	30																		23	13	18	22	61	26	35	6
			2	115	12	36	52	-	48	22	1	29																		18	6	10	15	70	29	32	3
			E	14	100	0	0	-	57	29	0	14																		31	8	42	33	75	25	17	8
Management of humans (e.g., to cope with disparity and diversity), creation, management, and transfer of knowledge, education, and maintenance of education level by standardization	30	A management methodology effectively making the functional use of work-sharing, which is capable of securing jobs and reducing social disparity while maintaining competitiveness in the international market, in Japan.	1	121	13	31	56	-	22	68	1	9																		17	10	12	15	57	52	29	4
			2	118	10	26	64	-	16	79	2	3																		13	8	6	9	70	58	25	2
			E	12	100	0	0	-	27	55	9	9																		18	0	0	0	80	40	0	0
	31	Human resources will be mobilized according to changes in society and economics against the backdrop of the spread of the recurrent education for job training in graduate schools or later.	1	137	26	36	38	-	16	70	1	13																		8	4	53	14	51	40	30	3
			2	126	23	36	41	-	10	81	1	8																		5	4	61	7	60	38	25	2
			E	29	100	0	0	-	21	76	0	3																		4	0	64	11	68	39	18	4
	32	A support system enabling staff to reuse and learn about the judgment process, skills and know-how of skilled staff, through the clear demonstration thereof.	1	140	20	34	46	-	33	56	0	11						9	5	40	34	66	21	0						9	5	27	21	67	12	28	1
			2	129	17	30	53	-	26	64	1	9						3	3	38	27	79	15	0						5	4	26	18	76	8	24	1
			E	22	100	0	0	-	33	62	0	5						5	5	40	35	75	15	0						10	0	43	33	67	5	19	0

Area	Topic number	Topic	Round	Responses	Degree of expertise (%)				Importance (%)				Forecasted time of technological realization (to be realized somewhere in the world) (%)							Sectors that will pave the way to technological (%)					Forecasted time of social realization (to become applicable/widely used in Japan) (%)							Sectors that will pave the way to social realization (%)						
					High	Moderate	Low	None	Important for Japan and the rest of the world	Especially important for Japan	Especially important for the world	Low importance/priority	Already realized	2011-2015	2016-2020	2021-2030	2031-2040	2041-	don't know will not be realized	University	Public research organization	Private enterprise	Collaboration of multiple sectors	Others	2011-2015	2016-2020	2021-2030	2031-2040	2041-	don't know will not be realized	University	Public research organization	Private enterprise	Government	Collaboration of multiple sectors	Others
Management of humans (e.g. to cope with disparity and diversity), creation, management, and transfer of knowledge, education, and maintenance of education level by standardization	33	Information terminal devices and software enabling elderly people and handicapped people to easily join the information network.	1	126	17	29	54	-	61	34	1	4							0 2	49	44	63	24	1						0 3	30	21	63	31	29	1
			2	113	16	26	58	-	68	29	1	2							0 1	54	46	67	23	0						0 1	27	18	73	27	29	0
			E	18	100	0	0	-	78	22	0	0							0 0	50	61	61	28	0						0 0	39	28	72	22	39	0
	34	A social environment enabling women to balance marriage, birth and child care with work to promote their social involvement (for example, 30% of listed companies will have a day-care center for children) will be realized.	1	106	9	31	60	-	15	81	0	4																		3 5	5	9	64	61	27	1
			2	105	8	25	67	-	12	86	0	2																		3 1	4	5	73	67	22	0
			E	8	100	0	0	-	25	75	0	0																		0 0	0	0	50	50	63	0
	35	In Japan, an employment contract that specifically defines the relationship between personal incentive and reward will be popularized.	1	110	18	26	56	-	13	55	2	30																		32 15	5	8	76	30	15	5
			2	109	14	23	63	-	6	59	1	34																		35 5	3	5	82	34	14	2
			E	15	100	0	0	-	7	60	0	33																		64 7	0	0	86	21	14	0
	36	The higher order mechanism of human intuition and creativity will be revealed thanks to the development of brain science, and it will be used in business practice.	1	115	8	34	58	-	43	11	2	44							25 15	74	44	30	19	3						35 18	53	29	50	9	22	5
			2	107	7	28	65	-	42	12	0	46							31 8	84	37	27	12	1						38 7	65	24	51	4	13	5
			E	8	100	0	0	-	75	25	0	0							0 38	100	63	50	25	0						0 38	63	25	75	13	25	0
Governance structure, assessment	37	A governance structure that monitors, manages, and coordinates within the world-wide framework beyond the framework of each national government's administration will be established to cope with such global issues as excessively speculative money, global warming and exploiting factories.	1	113	10	34	56	-	90	1	5	4																		23 8	7	13	16	62	28	51
			2	106	7	31	62	-	91	2	4	3																		21 4	6	7	9	70	25	52
			E	7	100	0	0	-	100	0	0	0																		14 14	0	14	29	86	0	43
	38	A common and generalized system for the evaluation and management of project risk.	1	124	15	33	52	-	58	21	4	17							13 9	42	29	60	31	10						14 11	29	22	63	19	32	6
			2	118	13	31	56	-	71	15	2	12							12 4	40	21	68	23	5						12 5	25	19	74	11	24	1
			E	15	100	0	0	-	86	7	7	0							7 0	64	7	64	14	7						7 0	47	20	80	7	13	0
	39	Most corporations will adopt risk management techniques to cope with natural disasters (ex. typhoons, earthquakes, and floods).	1	126	19	25	56	-	59	31	1	9							6 2	32	36	66	23	6						11 3	17	23	71	36	25	11
			2	117	16	26	58	-	77	17	0	6							5 0	25	36	80	12	4						10 0	10	18	81	32	19	5
			E	19	100	0	0	-	69	26	0	5							0 0	28	44	72	11	11						11 0	11	21	79	32	21	5
	40	Building of an information and social system that effectively improves the capacity of disaster prevention and welfare activity under local communities.	1	117	15	28	57	-	35	58	1	6																		3 9	12	23	26	74	33	2
			2	110	12	26	62	-	34	62	0	4																		0 5	8	21	20	77	40	2
			E	13	100	0	0	-	69	31	0	0																		0 8	15	38	23	69	23	0

Area	Topic number	Topic	Round	Responses	Degree of expertise (%)				Importance (%)				Forecasted time of technological realization (to be realized somewhere in the world) (%)							Sectors that will pave the way to technological (%)				Forecasted time of social realization (to become applicable/widely used in Japan) (%)							Sectors that will pave the way to social realization (%)					
					High	Moderate	Low	None	Important for Japan and the rest of the world	Especially important for Japan	Especially important for the world	Low importance/priority	don't know will not be realized	2041-	2031-2040	2021-2030	2016-2020	2011-2015	Already realized	Others	Collaboration of multiple sectors	Private enterprise	Public research organization	University	don't know will not be realized	2041-	2031-2040	2021-2030	2016-2020	2011-2015	Others	Collaboration of multiple sectors	Private enterprise	Government	Public research organization	University
Management enhancement (intellectual properties, technological value evaluation, financial engineering, economical physics, management without mind blanks)	41	To become an advanced patent nation, the patent strategy will be converted to emphasize the importance of basic patents, while the establishment of a patent portfolio in which the patent holder balances the basic patents and the improvement patents appropriately will be incorporated in such strategy, in Japan.	1	113	19	35	46	-	12	83	0	5													12	15					14	21	73	39	17	6
			2	105	17	35	48	-	7	90	0	3													10	12					9	17	85	45	8	6
			E	18	100	0	0	-	22	61	0	17													29	12					7	7	73	33	7	7
	42	Competitiveness in the international market will be further improved by obtaining patents in foreign countries under the major policy change to emphasize international patent applications rather than the national applications.	1	115	17	37	46	-	14	77	2	7													4	10					13	17	80	34	17	9
			2	108	16	33	51	-	10	85	0	5													4	12					8	11	89	33	11	7
			E	17	100	0	0	-	29	59	0	12													13	6					0	7	93	7	13	7
	43	The excessive claim of intellectual property rights will come to be restricted from the perspective of promoting innovation.	1	121	23	32	45	-	57	21	6	16													12	13					12	18	39	68	19	20
			2	116	18	32	50	-	71	14	4	11													8	14					12	12	42	77	13	21
			E	21	100	0	0	-	76	19	5	0													16	5					26	16	42	79	37	32
	44	A variety of Japanese corporations will institutionalize the regular publication of quantitative business risks and other information related to listed companies, and they will efficiently reduce the quantified risks by establishing the optimum business portfolio and other measures.	1	119	17	29	54	-	32	38	0	30			15	8					29	29	66	20	10						16	9	12	22	65	31	20	11
			2	110	15	27	58	-	30	40	0	30			16	5					19	20	79	14	8						18	8	7	15	78	25	14	9
			E	16	100	0	0	-	33	47	0	20			13	0					0	20	87	13	13						21	0	0	20	80	20	20	7
	45	In the corporations in Asia, Latin America and Europe, the unique Japanese corporate governance system will be given the definite status of a system different than those of the United States and the UK, which are based on shareholder sovereignty.	1	98	14	32	54	-	53	17	14	16													13	14					7	7	67	30	18	22
			2	93	10	28	62	-	66	13	9	12													9	14					5	3	74	28	10	26
			E	9	100	0	0	-	100	0	0	0													0	0					0	13	75	25	25	25
	46	Labor productivity will increase by up to 20% from the present status as a substantial authority transfer becomes possible through the improvement of staff performance evaluation and the payment and promotion system.	1	117	13	28	59	-	20	57	2	21													19	23					8	13	79	17	19	3
			2	113	11	26	63	-	15	65	1	19													20	14					4	5	90	10	13	2
			E	12	100	0	0	-	42	50	0	8													27	27					0	10	80	10	30	0
	47	In order to reduce market risks caused by fluctuations in currency value and the price of international goods, including energy, major Japanese corporations (more than 30% of the listed companies) will introduce a management scheme that specifies market risk factors beforehand, and calculates the daily amount of such risks.	1	95	15	26	59	-	41	44	1	14			12	8					30	23	74	10	14						12	11	9	13	79	18	13	13
			2	89	10	22	68	-	44	46	0	10			8	5					25	13	86	9	10						9	7	7	12	87	12	12	11
			E	9	100	0	0	-	78	22	0	0			13	0					25	13	88	25	0						0	11	25	25	75	13	25	0
	48	For R&D project management, methodologies will be established for each of planning, operation, control and evaluation of research, and the efficiency thereof will be improved by 20% on average.	1	141	24	34	42	-	45	39	1	15			13	13					40	31	70	25	3						15	17	29	23	75	10	27	4
			2	127	20	37	43	-	49	39	0	12			10	7					43	27	85	16	1						13	11	31	22	85	5	22	2
			E	25	100	0	0	-	54	42	0	4			13	0					50	18	91	18	0						9	4	48	17	91	9	17	4

Area	Topic number	Topic	Round	Responses	Degree of expertise (%)				Importance (%)				Forecasted time of technological realization (to be realized somewhere in the world) (%)						Sectors that will pave the way to technological (%)					Forecasted time of social realization (to become applicable/widely used in Japan) (%)						Sectors that will pave the way to social realization (%)					
					High	Moderate	Low	None	Important for Japan and the rest of the world	Especially important for the world	Especially important for Japan	Low importance/priority	Already realized	2011-2015	2016-2020	2021-2030	2031-2040	2041-	will not be realized	don't know	Others	Collaboration of multiple sectors	Private enterprise	Public research organization	University	2011-2015	2016-2020	2021-2030	2031-2040	2041-	will not be realized	don't know	Others	Collaboration of multiple sectors	Government	Private enterprise	Public research organization	University
Management enhancement (intellectual properties, technological value evaluation, financial engineering, economical physics, management without mind blocks)	49	Analysis of competition, negotiation and cooperation based on game theory will be promoted and applied to practical policy making and decision making within a corporation.	1	130	20	28	52	-	41	14	2	43							19	10	67	19	38	18	4						22	12	47	14	55	15	17	7
			2	116	18	27	55	-	44	10	1	45							22	7	71	13	40	15	4						26	10	48	8	63	8	14	5
			E	21	100	0	0	-	40	15	0	45							29	10	74	21	32	26	0						30	15	68	16	42	5	21	0
	50	Economic fluctuations will be further reduced as the elaboration of the economic policy, including the monetary policy, brings good control of inflation and deflation.	1	99	12	25	63	-	83	7	1	9							51	9	42	45	15	32	31						54	8	31	31	18	54	25	28
			2	94	11	23	66	-	93	3	0	4							50	10	55	49	14	28	20						55	11	34	24	13	62	17	21
			E	10	100	0	0	-	90	10	0	0							40	10	80	70	10	30	20						44	11	70	40	10	40	20	20
Management-supporting technology using engineering techniques, management for flow and stock of data (database) / knowledge structurization (storing knowledge by association)	51	Knowledge structuring methodologies (for example, methods like a KeyGraph) will be established to enable people to promptly obtain other knowledge that is related to certain knowledge for new creation in the context of corporate management.	1	129	16	33	51	-	51	27	0	22							9	4	63	21	64	12	1						11	4	37	17	74	7	16	2
			2	118	14	31	55	-	63	16	0	21							5	3	66	12	67	9	0						9	2	35	9	84	4	10	1
			E	16	100	0	0	-	68	19	0	13							19	0	56	6	75	6	0						19	0	33	7	73	0	13	0
	52	Techniques to convert tacit knowledge such as basic techniques and skills, know-how, and experience into explicit knowledge with regard to manufacturing and production technology are established, and the tradition of technology is implemented steadily.	1	150	23	39	38	-	27	65	1	7							12	10	47	24	68	20	1						14	10	25	17	79	8	21	2
			2	129	24	40	36	-	23	71	1	5							9	5	42	17	79	16	1						11	6	27	13	87	5	16	2
			E	31	100	0	0	-	30	57	3	10							10	0	45	13	81	13	0						10	0	33	17	80	3	17	3
	53	Technology and processes that effectively use the knowledge accumulated in databases and in other forms, and technology and processes for quality and quantity evaluation of the use of the first-mentioned technology and processes are established and are effectively used in corporations.	1	143	16	40	44	-	57	29	1	13							6	4	38	18	83	14	1						8	5	25	12	88	6	15	2
			2	125	14	40	46	-	68	21	0	11							2	4	33	10	90	8	0						5	5	24	8	95	3	9	1
			E	18	100	0	0	-	83	6	0	11							0	0	33	11	94	11	0						0	6	44	22	94	6	11	0
	54	Transaction schemes for a database and/or knowledge base accumulated within a corporation will be established inside and outside the corporation, and then the database and/or knowledge base will be actively traded according to economic motivation.	1	139	16	33	51	-	51	21	1	27							17	11	35	17	73	13	9						19	16	23	13	79	8	16	6
			2	123	14	33	53	-	58	15	1	26							15	8	32	8	79	7	3						17	11	21	7	83	7	11	4
			E	17	100	0	0	-	58	24	0	18							18	0	38	19	88	13	6						20	7	31	19	81	13	19	6
	55	A coordinated decision-making system involving various stakeholders on the basis of use of a knowledge information platform, such as a database and a knowledge base related to the environment.	1	121	16	32	52	-	70	11	1	18							17	12	44	33	42	37	23						16	14	28	25	45	35	33	25
			2	110	14	33	53	-	82	6	0	12							13	7	55	31	47	35	15						14	9	31	25	51	39	25	24
			E	15	100	0	0	-	80	7	0	13							7	7	53	67	47	20	13						7	7	47	47	60	33	13	7
	56	Construction of a framework for skill transmission, by utilizing image digitization and virtual reality technology.	1	131	15	33	52	-	43	44	0	13							2	3	50	33	67	17	1						3	4	31	21	75	10	21	1
			2	121	13	34	53	-	46	41	0	13							3	2	56	27	71	14	0						3	3	29	17	82	5	16	0
			E	16	100	0	0	-	62	25	0	13							6	0	53	27	87	7	0						7	0	33	27	100	0	7	0

Area	Topic number	Topic	Round	Responses	Degree of expertise				Importance				Forecasted time of technological realization (to be realized somewhere in the world)										Sectors that will pave the way to technological					Forecasted time of social realization (to become applicable/widely used in Japan)										Sectors that will pave the way to social realization					
					High	Moderate	Low	None	Important for Japan and the rest of the world	Especially important for Japan	Especially important for the world	Low importance/priority	Already realized	2011-2015	2016-2020	2021-2030	2031-2040	2041-	don't know	will not be realized	University	Public research organization	Private enterprise	Collaboration of multiple sectors	Others	2011-2015	2016-2020	2021-2030	2031-2040	2041-	don't know	will not be realized	University	Government	Private enterprise	Public research organization	Collaboration of multiple sectors	Others
					(%)				(%)				(%)								(%)												(%)					
Management: supporting technology using engineering techniques, management for flow and stock of data (database) / knowledge structurization (storing knowledge by association)	57	In the context of risk management techniques, a scheme for long-term impact assessment to evaluate the influence of artificial and natural materials and systems on health and the environment will be established.	1	104	13	31	56	-	79	11	1	9							8	7	66	61	29	26	21							8	11	44	46	33	41	31	23
			2	97	11	32	57	-	87	9	0	4							6	4	72	65	24	22	9							6	6	52	54	29	37	24	9
			E	11	100	0	0	-	91	9	0	0							9	9	82	73	45	18	9							10	10	60	80	50	50	10	0
	58	Techniques to visualize the background and structure of social issues by recognizing relationships among articles and editorials in newspapers, for the purpose of supporting policy-making.	1	111	13	33	54	-	38	20	0	42							11	10	65	36	25	23	1							15	12	49	26	30	31	26	2
			2	106	13	25	62	-	40	17	0	43							12	8	79	37	20	17	1							18	8	68	25	31	30	22	0
			E	14	100	0	0	-	62	0	0	38							17	8	91	55	45	27	0							25	0	82	27	45	45	36	0

Panel 12:

Infrastructure technologies supporting daily life base and industrial base

Implementation of the questionnaires

	Sent	Returned (response rate)
<1st Round>	272	227 (83%)
<2nd Round>	227	207 (91%)

Sex	Male	202	Affiliation	Private enterprise	84
	Female	5		University	77
	N.A.	0		Research Institute	21
generation	20’s	0		Association	14
	30’s	7		Others	11
	40’s	55		N.A.	0
	50’s	88	Job category	R&D	147
	60’s	52		Others	60
	70’s and over	5		N.A.	0
	N.A.	0		Total	207

Survey items

A: Land use strategy

B: Life support strategy

C: Production support strategy (primary, secondary, tertiary industries)

D: Exchange and transaction strategy (transportation and communication)

E: Strategy for maintenance of infrastructures

Time-series tables of topics

<Technological realization>

year	Topic (Leading number represents ID.)
2014	22: Promotion of systems automatically detecting the current location of people by the daily use of a mobile terminal, and choosing and delivering the information required at that time according to circumference information (facilities, weather, environmental data, etc.) and the attribute information of the relevant person (age, sex, handicap and health status, etc.).
	48: Promotion of roads covered by plants in urban areas through the application of a surface material that is permeable and reflects less radiant heat.
2016	02: Fundamental information maps of 1:10,000 to 1:25,000 scales containing data about nature (vegetation, topography and geology, water systems, plants and animals, etc.) and artifacts (buildings, communities, commercial areas, etc.), as well as data maps of 1:2,500 scale, for urban and farming areas, that are linked with the urban planning basic survey have been prepared and accumulated by regular observations, and they will be provided free of charge.
	38: A system to record, examine and verify the transportation and storage history of materials and goods by automatically measuring temperature, impact, changes in components and so on (the traceability for production, transportation, storage, use and disposal within the context of intermodal transportation will be realized by this system).
2017	01: Technology and a system for national-scale planning and management will be put into practical use as a result of the establishment of the information infrastructure that integrates the national geographical data, and the information of basins and ecosystems, and disaster risk distribution data.
	09: Technology that detects signs suggesting a sudden change in the regional environment due to the alteration in the use of the land, where the remote sensing technology that uses satellites and aircraft, and the techniques for environmental impact assessment such as strategic assessment are integrated.
	19:Diffusion of road structure, signs and signals that are developed while considering functional deterioration (dynamic visual acuity, time required to make a judgment, misjudging risk, etc.) due to aging.
	20: Diffusion of logistics services that deliver medicine and food for medical treatment, without requiring a hospital visit, to support the lives of elderly persons and patients of lifestyle diseases living in inconveniently located areas, such as mountainous regions, by establishing a remote consultation system and health care system using IT technologies.
	33: Development of technology to organize and activate the citizen-driven regional movement for preservation and improvement of regional environment and scenery.
	36: Promotion of a driver assistance system not only to prevent rear-end crashes and collisions due to sudden encounters but also to forecast any trouble with the engine and/or tires by using various sensors installed in the car.
	37: A danger forecast, alarm and avoidance system to reduce the number of maritime accidents such as capsizings, collisions and groundings by 50%.
	54: A design method for separating the skeleton (structural framework) and infill (equipment and interior furnishing) on the assumption that long-life structure design required for promoting buildings to be stocked, and related equipment and interior furnishing will be disseminated (50% or more).

year	Topic (Leading number represents ID.)
2018	16: Establishment of real-time damage recognition and forecast technology enabling the national and municipal emergency operation center to take emergency measures immediately and effectively in the case of a large-scale natural disaster that requires prefecture-level measures. 17: A system is working to support the evacuation of citizens, elderly persons, patients and injured persons in the case of a disaster exceeding that forecasted. 30: Commercialization of technology enabling the recovery of more than 90% of rare metals such as lithium, beryllium, tantalum, cobalt and so on from waste. 32: Promotion of methods for reevaluating traditional and natural symbiotic systems in countries all over the world, such as the SATOYAMA initiative, against the backdrop of the expansion of citizens' movements related to environmental issues. 35: Diffusion of a radio communication system covering all of Japan by using technology such as satellite communication that can transfer movie data of the same quality as television without interruption or congestion even in the case of disaster. 41: Development of a flight control system enabling the doubling of the take-off and landing capacity of Haneda Airport. 44: Promotion of vehicles that control the speed and operation of the engine to minimize fuel consumption by detecting the timing of traffic signals, as well as a traffic control system enabling the operation of such vehicles. 49: Technology providing information on evacuation and recovery assuming the concurrence of storm and flood and earthquake damage will be disseminated. 50: A unified database (extending over business units such as railways, roads, electric power, and local public entities) of infrastructure investment history and deterioration data will be constructed to allow management of infrastructure assets at entire city and regional levels. 53: Semipermanent recessed sensor technology, and an alarm and evacuation support system providing advance notification of slopes collapse, landslides, and the destabilization of embankments will come into practical use. 62: A cross-sectional system for maintaining and preserving both forest and urban infrastructural functions will come into practical use through the application of timber thinned from forests in the process of forest preservation as members and elements of semipermanent structures, such as foundation piles.
2019	03: Sustainable maintenance of cultural scenery that is unique to the region will be considered upon the preparation of the regional and urban planning process; the judgment related to the land and space use and preservation will be carried out according to the evaluation of both quality of life and disaster risks, and in addition, the control based on the results of such judgment will be made. 10: Quantitative forecasting of the impact on nature (topography, geology, groundwater, plants and animals, etc.) caused by development becomes available, and the impact of certain development projects will be evaluated based on a simulation considering the scale of the project, alternative options, mitigation measures, and speed of nature restoration. 11: Constant environment management based on the environmental monitoring and simulation of the water cycle and material transportation in the mesoscale (approx. several hundreds km), treating the basins and waters as a whole, becomes possible and the results thereof will be presented publicly to citizens.

year	Topic (Leading number represents ID.)
2019	13: Nation-wide high-precision observation systems for the atmosphere, hydrosphere and geosphere will be established to prevent harm to humans caused by large-scale natural disasters (floods, landslides, debris flow, avalanches, etc.) caused by some weather phenomena (precipitation, typhoon, heavy rain, snowfall, etc.) requiring prefecture-level measures, enabling the alarm, evacuation, and control based on the prediction of (approx. 1 hour in advance) the disaster.
	34: Promotion of a high-precision monitoring and forecasting system to inform airplanes of fine-scale meteorological conditions while taking off and landing.
	46: Development of a next-generation environmentally-friendly ship (green ship) with 50% less CO_2 emissions and approx. 80% less NO_x emissions than present ships.
	51: High-precision modeling of deterioration environments based on design and construction technology for infrastructure deterioration prevention, repair, and establishment will become feasible, and sufficiently precise life-cycle management and asset management will come into practical use.
	52: Semipermanent recessed sensor technology notifying the degree of deterioration, lifespan, and time for replacement of structures will be disseminated.
	56: A system for evaluation of design systems, structural performance, and asset value, allowing the functional extension, renewal, removal, and reuse of large-scale structures will be disseminated.
	60:Technology allowing the recovery of water-power energy productivity together with the recovery of river environments by returning dam sediment to rivers under low environmental burden will be disseminated
2020	04: Technology for comprehensive analysis of both the natural and artificial systems related to material circulation between urban and rural areas and in local areas, as well as of industrial structure and disaster risks, will be established, thereby enabling the analysis and forecast of such material circulation, industrial structure and disaster risks.
	08: Regeneration of agriculture and forestry, and wide-area nature management will be realized by returning the incomes generated in urban areas to rural areas based on the quantitative evaluation of rural areas' contribution to urban society obtained by using the accounting techniques related to natural stocks, such as forestry accounting.
	12:Robots that have better senses of sight, smell, hearing, etc. than human beings are placed in local governments and the police force to rapidly find explosives, weapons, poison and so on to prevent terrorism and environmental pollution, or to speedily find and rescue victims in the event of a disaster.
	40: Diffusion of a bicycle at a practical price that is provided with various sensors and a danger avoidance system to enable the people, including elderly people or those riding with a child, to ride safely on the road at high speed.
	42: Development of a system to reduce by 50% the time, cost and environmental load at each node that links a railway and road, road and port/airport as well as a railway and port/airport so as to improve the efficiency of freight transportation between cities.
	58: Technology and a legal system for making the most of natural and renewable energy by region or district and realizing, for goods and material circulation, local production for local consumption will be developed.
	59:A material and energy circulation system will be constructed on a prefectural or larger administrative bloc levels, based on material correlation of biomass energy from forest resources, animal excrement, and unused material from cereal, as well as on that of by-products and functional materials.

year	Topic (Leading number represents ID.)
2022	28: A marine city on an inexpensive and durable foundation supported by legs or floating (used as a base for transportation, communication, research, production, resource mining, and leisure activities), which is compatible with sea environments including fishing grounds and currents.
	39: Promotion of a transportation system seamlessly covering various sizes of areas, from a district to a wide area, which enables elderly persons to move directly from their residences to their destinations alone and without anxiety, in an ultra-aging society.
	43: Promotion of a mobility management system to cover hundreds of thousands of people through the establishment of a commuter organization to facilitate smooth commuting in urban areas in both ordinary times and emergencies (ex. temporary interruption because of disaster or failure).
2023	55: Technology for constructing and manufacturing heavy structures, such as buildings, bridges, electric generating facilities, and ships, with light-weight, high-strength materials replacing conventional steel materials and concrete materials will come into practical use.
2024	45: Implementation of a system to deliver packages and letters to each floor of a building from the track terminal or delivery center by using unused space in subways and common ducts and pipe space in buildings in the center districts of big cities.
	57: Junction technology with disassembility will come into practical use by using physical, thermal, or chemical characteristics to facilitate future disassembly, repair, and functional extension in large-scale structures such as super high-rise buildings and bridges.
2025	61: A system to ensure quality and design considering durability in the order of one to ten-thousand years will be established by proving technology for the geological disposal of radioactive waste at any underground depth.
2030	47: Development of an airplane with a propulsion system that does not rely on fossil fuels.
2031	14: Establishment of technology to predict the timing (several months to 1 year in advance), scale, region of occurrence, and dimension of damage caused by a magnitude 6 or larger earthquake.
2035	29: Space travel that costs less than one million yen (calculated on the present value) and is as safe as present overseas travel.
2038	31: Commercialization of technology enabling the mining of more than 50% of the required amount of rare metals such as nickel and cobalt from other planets or satellites.

<Social realization>

year	Topic (Leading number represents ID.)
2019	22: Promotion of systems automatically detecting the current location of people by the daily use of a mobile terminal, and choosing and delivering the information required at that time according to circumference information (facilities, weather, environmental data, etc.) and the attribute information of the relevant person (age, sex, handicap and health status, etc.).
2020	20: Diffusion of logistics services that deliver medicine and food for medical treatment, without requiring a hospital visit, to support the lives of elderly persons and patients of lifestyle diseases living in inconveniently located areas, such as mountainous regions, by establishing a remote consultation system and health care system using IT technologies.
	21: Cooperative framework involving citizens and administration for disaster prevention and mitigation based on communication and education, enabling local residents to recognize the risk of natural phenomena such as volcanic eruptions, earthquakes and floods, and human-caused accidents.

year	Topic (Leading number represents ID.)
2021	02: Fundamental information maps of 1:10,000 to 1:25,000 scales containing data about nature (vegetation, topography and geology, water systems, plants and animals, etc.) and artifacts (buildings, communities, commercial areas, etc.), as well as data maps of 1:2,500 scale, for urban and farming areas, that are linked with the urban planning basic survey have been prepared and accumulated by regular observations, and they will be provided free of charge.
	33: Development of technology to organize and activate the citizen-driven regional movement for preservation and improvement of regional environment and scenery.
	38: A system to record, examine and verify the transportation and storage history of materials and goods by automatically measuring temperature, impact, changes in components and so on (the traceability for production, transportation, storage, use and disposal within the context of intermodal transportation will be realized by this system).
	48: Promotion of roads covered by plants in urban areas through the application of a surface material that is permeable and reflects less radiant heat.
2022	01: Technology and a system for national-scale planning and management will be put into practical use as a result of the establishment of the information infrastructure that integrates the national geographical data, and the information of basins and ecosystems, and disaster risk distribution data.
	17: A system is working to support the evacuation of citizens, elderly persons, patients and injured persons in the case of a disaster exceeding that forecasted.
	26: Promotion of a support framework for such matters as U-/I-/J-turn and multi-habitation among urban and rural areas to maintain conservation of farmland and other lands.
2023	09: Technology that detects signs suggesting a sudden change in the regional environment due to the alteration in the use of the land, where the remote sensing technology that uses satellites and aircraft, and the techniques for environmental impact assessment such as strategic assessment are integrated.
	19:Diffusion of road structure, signs and signals that are developed while considering functional deterioration (dynamic visual acuity, time required to make a judgment, misjudging risk, etc.) due to aging.
	25: Establishment of new legal systems and social consensus on the importance of water resource management (flood control, use of water, water environment) for the conservation and rehabilitation of farmlands and forests.
	27: Establishment of a support system (promoting technological innovation, education to pass on know-how by turning it into software, economic support, inheritance as a culture) for the mature manufacturing industry as a measure against depopulation in local regions.
	36: Promotion of a driver assistance system not only to prevent rear-end crashes and collisions due to sudden encounters but also to forecast any trouble with the engine and/or tires by using various sensors installed in the car.
	37: A danger forecast, alarm and avoidance system to reduce the number of maritime accidents such as capsizings, collisions and groundings by 50%.
	41: Development of a flight control system enabling the doubling of the take-off and landing capacity of Haneda Airport.
	49: Technology providing information on evacuation and recovery assuming the concurrence of storm and flood and earthquake damage will be disseminated.
2024	07: The citizen-driven "New Public" leads the regional strategy and carries out the regional management for the maintenance of security, safety and vitality of the region (for example, an NGO will prepare the agenda for a committee and lead the discussion).

year	Topic (Leading number represents ID.)
2024	16: Establishment of real-time damage recognition and forecast technology enabling the national and municipal emergency operation center to take emergency measures immediately and effectively in the case of a large-scale natural disaster that requires prefecture-level measures. 23: Provision options (ex. electric vehicle for elderly people, residential area where people can live without vehicles, etc.) will be provided to cope with the increase of elderly people who cannot walk due to health reasons or cannot drive a car due to functional deterioration. 30: Commercialization of technology enabling the recovery of more than 90% of rare metals such as lithium, beryllium, tantalum, cobalt and so on from waste. 32: Promotion of methods for reevaluating traditional and natural symbiotic systems in countries all over the world, such as the SATOYAMA initiative, against the backdrop of the expansion of citizens' movements related to environmental issues. 34: Promotion of a high-precision monitoring and forecasting system to inform airplanes of fine-scale meteorological conditions while taking off and landing. 35: Diffusion of a radio communication system covering all of Japan by using technology such as satellite communication that can transfer movie data of the same quality as television without interruption or congestion even in the case of disaster. 53: Semipermanent recessed sensor technology, and an alarm and evacuation support system providing advance notification of slopes collapse, landslides, and the destabilization of embankments will come into practical use.
2025	05: Promotion of high-quality and long-life block planning (for architecture and infrastructure planning) in urban and rural areas, for the formation of a community in which people from various generations can interact, and for the improvement of quality of life (QoL) within the block and cluster as a result. 44: Promotion of vehicles that control the speed and operation of the engine to minimize fuel consumption by detecting the timing of traffic signals, as well as a traffic control system enabling the operation of such vehicles. 50: A unified database (extending over business units such as railways, roads, electric power, and local public entities) of infrastructure investment history and deterioration data will be constructed to allow management of infrastructure assets at entire city and regional levels. 51: High-precision modeling of deterioration environments based on design and construction technology for infrastructure deterioration prevention, repair, and establishment will become feasible, and sufficiently precise life-cycle management and asset management will come into practical use. 54: A design method for separating the skeleton (structural framework) and infill (equipment and interior furnishing) on the assumption that long-life structure design required for promoting buildings to be stocked, and related equipment and interior furnishing will be disseminated (50% or more). 62: A cross-sectional system for maintaining and preserving both forest and urban infrastructural functions will come into practical use through the application of timber thinned from forests in the process of forest preservation as members and elements of semipermanent structures, such as foundation piles.
2026	03: Sustainable maintenance of cultural scenery that is unique to the region will be considered upon the preparation of the regional and urban planning process; the judgment related to the land and space use and preservation will be carried out according to the evaluation of both quality of life and disaster risks, and in addition, the control based on the results of such judgment will be made.

year	Topic (Leading number represents ID.)
2026	04: Technology for comprehensive analysis of both the natural and artificial systems related to material circulation between urban and rural areas and in local areas, as well as of industrial structure and disaster risks, will be established, thereby enabling the analysis and forecast of such material circulation, industrial structure and disaster risks.
	15: Completion of nationwide stockpiling of food, medicines, daily commodities and other goods, and reinforcement of the functions of infrastructure such as roads, electricity and communications to prepare against a large-scale natural disaster that requires prefecture-level measures.
	18: Establishment of an institution supporting the improvement of urban function, the control of social and economic activities, food stockpiling, and priority precedent evacuation of some citizens in accordance with the establishment of forecasting technology for a magnitude 6 or larger earthquake.
	46: Development of a next-generation environmentally-friendly ship (green ship) with 50% less CO_2 emissions and approx. 80% less NO_x emissions than present ships.
	52: Semipermanent recessed sensor technology notifying the degree of deterioration, lifespan, and time for replacement of structures will be disseminated.
	60:Technology allowing the recovery of water-power energy productivity together with the recovery of river environments by returning dam sediment to rivers under low environmental burden will be disseminated
2027	06:In the case of downsizing the urban area because of population decline, a land use strategy will be established while considering the sustainability of the water cycle, ecosystem and lifestyles, and in addition, a natural symbiotic urban area based on a compact infrastructure plan will be constructed.
	10: Quantitative forecasting of the impact on nature (topography, geology, groundwater, plants and animals, etc.) caused by development becomes available, and the impact of certain development projects will be evaluated based on a simulation considering the scale of the project, alternative options, mitigation measures, and speed of nature restoration.
	11: Constant environment management based on the environmental monitoring and simulation of the water cycle and material transportation in the mesoscale (approx. several hundreds km), treating the basins and waters as a whole, becomes possible and the results thereof will be presented publicly to citizens.
	12:Robots that have better senses of sight, smell, hearing, etc. than human beings are placed in local governments and the police force to rapidly find explosives, weapons, poison and so on to prevent terrorism and environmental pollution, or to speedily find and rescue victims in the event of a disaster.
	13: Nation-wide high-precision observation systems for the atmosphere, hydrosphere and geosphere will be established to prevent harm to humans caused by large-scale natural disasters (floods, landslides, debris flow, avalanches, etc.) caused by some weather phenomena (precipitation, typhoon, heavy rain, snowfall, etc.) requiring prefecture-level measures, enabling the alarm, evacuation, and control based on the prediction of (approx. 1 hour in advance) the disaster.
	40: Diffusion of a bicycle at a practical price that is provided with various sensors and a danger avoidance system to enable the people, including elderly people or those riding with a child, to ride safely on the road at high speed.
	42: Development of a system to reduce by 50% the time, cost and environmental load at each node that links a railway and road, road and port/airport as well as a railway and port/airport so as to improve the efficiency of freight transportation between cities.

year	Topic (Leading number represents ID.)
2027	56: A system for evaluation of design systems, structural performance, and asset value, allowing the functional extension, renewal, removal, and reuse of large-scale structures will be disseminated.
	58: Technology and a legal system for making the most of natural and renewable energy by region or district and realizing, for goods and material circulation, local production for local consumption will be developed.
2028	59:A material and energy circulation system will be constructed on a prefectural or larger administrative bloc levels, based on material correlation of biomass energy from forest resources, animal excrement, and unused material from cereal, as well as on that of by-products and functional materials.
2029	08: Regeneration of agriculture and forestry, and wide-area nature management will be realized by returning the incomes generated in urban areas to rural areas based on the quantitative evaluation of rural areas' contribution to urban society obtained by using the accounting techniques related to natural stocks, such as forestry accounting.
	43: Promotion of a mobility management system to cover hundreds of thousands of people through the establishment of a commuter organization to facilitate smooth commuting in urban areas in both ordinary times and emergencies (ex. temporary interruption because of disaster or failure).
2030	24: Promotion of efficient large-scale corporate agriculture that produces more than the 50% of agricultural products in Japan ("50%" is the national total including the production in foreign countries and indoor environments).
	39: Promotion of a transportation system seamlessly covering various sizes of areas, from a district to a wide area, which enables elderly persons to move directly from their residences to their destinations alone and without anxiety, in an ultra-aging society.
2032	28: A marine city on an inexpensive and durable foundation supported by legs or floating (used as a base for transportation, communication, research, production, resource mining, and leisure activities), which is compatible with sea environments including fishing grounds and currents.
	55: Technology for constructing and manufacturing heavy structures, such as buildings, bridges, electric generating facilities, and ships, with light-weight, high-strength materials replacing conventional steel materials and concrete materials will come into practical use.
	57: Junction technology with disassembility will come into practical use by using physical, thermal, or chemical characteristics to facilitate future disassembly, repair, and functional extension in large-scale structures such as super high-rise buildings and bridges.
2033	45: Implementation of a system to deliver packages and letters to each floor of a building from the track terminal or delivery center by using unused space in subways and common ducts and pipe space in buildings in the center districts of big cities.
2034	61: A system to ensure quality and design considering durability in the order of one to ten-thousand years will be established by proving technology for the geological disposal of radioactive waste at any underground depth.
2037	14: Establishment of technology to predict the timing (several months to 1 year in advance), scale, region of occurrence, and dimension of damage caused by a magnitude 6 or larger earthquake.
2038	47: Development of an airplane with a propulsion system that does not rely on fossil fuels.
2041-	29: Space travel that costs less than one million yen (calculated on the present value) and is as safe as present overseas travel.
	31: Commercialization of technology enabling the mining of more than 50% of the required amount of rare metals such as nickel and cobalt from other planets or satellites.

Area	Topic number	Topic	Round	Responses	Degree of expertise (%)				Importance (%)				Forecasted time of technological realization (to be realized somewhere in the world) (%)							Sectors that will pave the way to technological (%)					Forecasted time of social realization (to become applicable/widely used in Japan) (%)							Sectors that will pave the way to social realization (%)					
					High	Moderate	Low	None	Important for Japan and the rest of the world	Especially important for Japan	Especially important for the world	Low importance/priority	Already realized	2011-2015	2016-2020	2021-2030	2031-2040	2041-	will not be realized	don't know	University	Public research organization	Private enterprise	Collaboration of multiple sectors	Others	2011-2015	2016-2020	2021-2030	2031-2040	2041-	will not be realized	don't know	University	Public research organization	Private enterprise	Government	Collaboration of multiple sectors	Others
Land use strategy	1	Technology and a system for national-scale planning and management will be put into practical use as a result of the establishment of the information infrastructure that integrates the national geographical data, and the information of basins and ecosystems, and disaster risk distribution data.	1	158	9	41	50	-	50	44	2	4							1	5	32	67	17	44	7						1	6	13	35	15	65	32	5
			2	145	8	37	55	-	56	41	0	3							1	1	28	72	11	45	4						1	1	9	41	11	73	29	2
			E	11	100	0	0	-	73	27	0	0							0	0	55	82	18	27	0						0	0	36	36	9	91	18	0
	2	Fundamental information maps of 1:10,000 to 1:25,000 scales containing data about nature (vegetation, topography and geology, water systems, plants and animals, etc.) and artifacts (buildings, communities, commercial areas, etc.), as well as data maps of 1:2,500 scale, for urban and farming areas, that are linked with the urban planning basic survey have been prepared and accumulated by regular observations, and they will be provided free of charge.	1	146	8	35	57	-	40	47	1	12							1	4	24	65	25	40	4						3	6	9	39	27	53	30	3
			2	134	5	35	60	-	38	52	0	10							1	3	19	71	18	40	3						2	2	7	39	18	70	30	1
			E	7	100	0	0	-	43	57	0	0							0	0	14	86	29	14	0						0	0	14	43	14	71	43	0
	3	Sustainable maintenance of cultural scenery that is unique to the region will be considered upon the preparation of the regional and urban planning process; the judgment related to the land and space use and preservation will be carried out according to the evaluation of both quality of life and disaster risks, and in addition, the control based on the results of such judgment will be made.	1	142	11	30	59	-	36	55	0	9							3	6	34	55	10	48	5						3	7	14	32	16	57	38	4
			2	130	9	28	63	-	32	63	0	5							1	4	28	61	6	54	2						1	4	12	31	12	71	39	1
			E	12	100	0	0	-	58	42	0	0							0	0	50	75	17	42	0						0	0	25	25	33	75	42	0
	4	Technology for comprehensive analysis of both the natural and artificial systems related to material circulation between urban and rural areas and in local areas, as well as of industrial structure and disaster risks, will be established, thereby enabling the analysis and forecast of such material circulation, industrial structure and disaster risks.	1	137	7	34	59	-	45	42	2	11							4	8	42	52	17	42	9						6	9	18	37	18	48	37	5
			2	126	6	30	64	-	44	45	2	9							2	7	37	63	10	42	3						4	8	17	41	14	60	38	0
			E	8	100	0	0	-	87	13	0	0							0	0	63	63	25	38	0						0	0	50	38	38	63	38	0
	5	Promotion of high-quality and long-life block planning (for architecture and infrastructure planning) in urban and rural areas, for the formation of a community in which people from various generations can interact, and for the improvement of quality of life (QoL) within the block and cluster as a result.	1	122	11	31	58	-	16	67	2	15																			10	11	20	21	28	56	37	3
			2	113	10	30	60	-	11	78	1	10																			7	6	15	20	25	72	45	0
			E	11	100	0	0	-	36	55	0	9																			11	0	33	22	56	78	22	0
	6	In the case of downsizing the urban area because of population decline, a land use strategy will be established while considering the sustainability of the water cycle, ecosystem and lifestyles, and in addition, a natural symbiotic urban area based on a compact infrastructure plan will be constructed.	1	138	12	30	58	-	12	76	1	11																			8	9	17	20	21	64	40	3
			2	125	10	30	60	-	11	81	0	8																			7	7	15	17	16	75	46	0
			E	12	100	0	0	-	33	67	0	0																			10	0	10	20	40	70	60	0
	7	The citizen-driven "New Public" leads the regional strategy and carries out the regional management for the maintenance of security, safety and vitality of the region (for example, an NGO will prepare the agenda for a committee and lead the discussion).	1	116	10	28	62	-	12	56	0	32																			16	17	13	14	24	40	63	5
			2	107	9	27	64	-	9	60	0	31																			13	12	14	6	16	47	77	2
			E	10	100	0	0	-	40	60	0	0																			0	0	22	22	33	44	67	0
	8	Regeneration of agriculture and forestry, and wide-area nature management will be realized by returning the incomes generated in urban areas to rural areas based on the quantitative evaluation of rural areas' contribution to urban society obtained by using the accounting techniques related to natural stocks, such as forestry accounting.	1	95	4	21	75	-	29	58	0	13							9	7	35	63	19	38	12						11	9	19	27	19	58	41	6
			2	90	3	18	79	-	21	72	0	7							6	3	32	76	12	45	4						7	5	16	20	17	70	47	2
			E	3	100	0	0	-	67	33	0	0							0	0	33	100	33	0	0						0	0	33	33	33	67	33	0

Area	Topic number	Topic	Round	Responses	Degree of expertise (%)				Importance (%)				Forecasted time of technological realization (to be realized somewhere in the world)							Sectors that will pave the way to technological (%)					Forecasted time of social realization (to become applicable/widely used in Japan)							Sectors that will pave the way to social realization (%)					
					High	Moderate	Low	None	Important for Japan and the rest of the world	Especially important for Japan	Especially important for the world	Low importance/priority	Already realized	2011-2015	2016-2020	2021-2030	2031-2040	2041-	will not be realized	don't know	University	Public research organization	Private enterprise	Collaboration of multiple sectors	Others	2011-2015	2016-2020	2021-2030	2031-2040	2041-	will not be realized	don't know	University	Public research organization	Private enterprise	Government	Collaboration of multiple sectors	Others
Land use strategy	9	Technology that detects signs suggesting a sudden change in the regional environment due to the alteration in the use of the land, where the remote sensing technology that uses satellites and aircraft, and the techniques for environmental impact assessment such as strategic assessment are integrated.	1	151	5	32	63	-	77	11	9	3							0	4	51	62	24	29	16							1	3	30	51	26	36	29	14
			2	144	5	24	71	-	88	4	4	4							0	3	54	67	18	26	9							0	2	30	58	22	37	29	6
			E	7	100	0	0	-	86	14	0	0							0	0	43	57	14	29	0							0	0	14	57	29	43	29	14
	10	Quantitative forecasting of the impact on nature (topography, geology, groundwater, plants and animals, etc.) caused by development becomes available, and the impact of certain development projects will be evaluated based on a simulation considering the scale of the project, alternative options, mitigation measures, and speed of nature restoration.	1	147	9	31	60	-	78	12	5	5							3	5	56	58	19	35	13							4	7	31	44	22	45	35	12
			2	140	6	32	62	-	89	7	1	3							1	4	58	64	13	32	7							1	5	31	47	17	51	39	7
			E	9	100	0	0	-	89	11	0	0							0	0	67	56	22	44	0							0	0	38	63	50	38	63	0
	11	Constant environment management based on the environmental monitoring and simulation of the water cycle and material transportation in the mesoscale (approx. several hundreds km), treating the basins and waters as a whole, becomes possible and the results thereof will be presented publicly to citizens.	1	122	7	24	69	-	69	14	9	8							0	8	51	61	10	41	16							1	8	35	49	17	36	35	19
			2	115	6	18	76	-	82	9	5	4							0	4	56	65	6	38	6							0	3	37	53	9	40	37	10
			E	7	100	0	0	-	100	0	0	0							0	0	83	67	17	33	0							0	0	50	17	0	67	33	17
Life support strategy	12	Robots that have better senses of sight, smell, hearing, etc. than human beings are placed in local governments and the police force to rapidly find explosives, weapons, poison and so on to prevent terrorism and environmental pollution, or to speedily find and rescue victims in the event of a disaster.	1	110	3	26	71	-	65	8	19	8							2	5	47	43	37	33	11							3	6	21	29	45	38	30	12
			2	113	2	23	75	-	77	4	12	7							1	2	51	46	39	34	3							3	5	17	26	56	44	30	5
			E	2	100	0	0	-	100	0	0	0							0	0	100	100	50	0	0							50	0	50	50	100	50	0	0
	13	Nation-wide high-precision observation systems for the atmosphere, hydrosphere and geosphere will be established to prevent harm to humans caused by large-scale natural disasters (floods, landslides, debris flow, avalanches, etc.) caused by some weather phenomena (precipitation, typhoon, heavy rain, snowfall, etc.) requiring prefecture-level measures, enabling the alarm, evacuation, and control based on the prediction of (approx. 1 hour in advance) the disaster.	1	165	11	32	57	-	53	44	1	2							2	3	44	66	19	40	7							3	4	21	45	19	50	35	9
			2	158	8	29	63	-	60	38	1	1							2	1	51	76	13	37	3							2	2	19	47	11	65	37	4
			E	13	100	0	0	-	77	23	0	0							0	0	46	77	15	31	8							0	0	31	46	31	62	31	8
	14	Establishment of technology to predict the timing (several months to 1 year in advance), scale, region of occurrence, and dimension of damage caused by a magnitude 6 or larger earthquake.	1	151	14	34	52	-	51	43	1	5							25	17	67	58	4	28	6							27	16	40	45	7	46	25	5
			2	149	13	32	55	-	65	32	0	3							26	10	72	62	2	21	3							24	10	43	52	3	52	20	3
			E	19	100	0	0	-	72	28	0	0							26	0	89	67	0	11	6							28	0	39	44	11	50	17	11
	15	Completion of nationwide stockpiling of food, medicines, daily commodities and other goods, and reinforcement of the functions of infrastructure such as roads, electricity and communications to prepare against a large-scale natural disaster that requires prefecture-level measures.	1	153	15	27	58	-	23	71	1	5																				5	5	10	19	19	83	26	3
			2	148	14	28	58	-	18	80	0	2																				3	3	7	13	16	89	27	0
			E	21	100	0	0	-	29	71	0	0																				5	5	5	10	38	81	52	0
	16	Establishment of real-time damage recognition and forecast technology enabling the national and municipal emergency operation center to take emergency measures immediately and effectively in the case of a large-scale natural disaster that requires prefecture-level measures.	1	160	18	26	56	-	25	71	1	3							1	5	41	64	21	49	6							1	4	24	38	20	68	33	4
			2	151	17	25	58	-	22	77	0	1							1	3	37	70	15	52	3							2	3	17	38	15	80	31	1
			E	25	100	0	0	-	44	52	0	4							0	0	48	64	24	52	0							0	4	24	40	20	72	40	0

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Life support strategy	17	A system is working to support the evacuation of citizens, elderly persons, patients and injured persons in the case of a disaster exceeding that forecasted.	1	130	8	23	69	-	44	44	2	10							4	10	22	54	22	56	11						4	11	12	27	17	74	34	8
			2	123	8	19	73	-	54	37	0	9							4	8	16	58	17	62	6						4	7	7	24	12	78	34	4
			E	10	100	0	0	-	67	33	0	0							0	0	33	56	22	56	0						0	0	25	38	13	75	38	0
	18	Establishment of an institution supporting the improvement of urban function, the control of social and economic activities, food stockpiling, and priority precedent evacuation of some citizens in accordance with the establishment of forecasting technology for a magnitude 6 or larger earthquake.	1	143	12	27	61	-	29	62	1	8							9	12	12	21	11	77	33	5						9	12	12	21	11	77	33	5
			2	134	11	24	65	-	29	65	0	6							7	9	7	17	8	86	35	2						7	9	7	17	8	86	35	2
			E	15	100	0	0	-	50	36	0	14							21	0	7	29	7	71	57	0						21	0	7	29	7	71	57	0
	19	Diffusion of road structure, signs and signals that are developed while considering functional deterioration (dynamic visual acuity, time required to make a judgment, misjudging risk, etc.) due to aging.	1	123	6	27	67	-	26	61	1	12							3	3	36	62	40	38	2						3	3	14	32	28	64	30	1
			2	122	4	23	73	-	18	72	0	10							1	1	29	74	37	35	1						2	2	8	29	23	78	30	0
			E	5	100	0	0	-	0	100	0	0							0	0	20	60	20	40	0						0	0	0	0	0	80	20	0
	20	Diffusion of logistics services that deliver medicine and food for medical treatment, without requiring a hospital visit, to support the lives of elderly persons and patients of lifestyle diseases living in inconveniently located areas, such as mountainous regions, by establishing a remote consultation system and health care system using IT technologies.	1	113	7	19	74	-	25	65	2	8							2	2	24	46	52	58	3						4	4	11	22	43	55	48	2
			2	111	6	14	80	-	19	72	0	9							2	1	17	39	51	63	1						1	3	7	13	44	67	46	0
			E	7	100	0	0	-	50	50	0	0							0	0	29	43	71	71	0						0	0	0	0	67	67	17	0
	21	Cooperative framework involving citizens and administration for disaster prevention and mitigation based on communication and education, enabling local residents to recognize the risk of natural phenomena such as volcanic eruptions, earthquakes and floods, and human-caused accidents.	1	146	15	33	52	-	36	59	2	3							1	5	14	26	18	69	51	4						1	5	14	26	18	69	51	4
			2	134	14	27	59	-	33	64	0	3							1	3	8	26	14	77	53	2						1	3	8	26	14	77	53	2
			E	19	100	0	0	-	53	47	0	0							0	0	11	22	22	67	61	0						0	0	11	22	22	67	61	0
	22	Promotion of systems automatically detecting the current location of people by the daily use of a mobile terminal, and choosing and delivering the information required at that time according to circumference information (facilities, weather, environmental data, etc.) and the attribute information of the relevant person (age, sex, handicap and health status, etc.).	1	133	4	32	64	-	37	29	1	33							3	5	26	29	74	31	2						5	5	13	14	70	26	32	2
			2	133	2	27	71	-	40	28	0	32							2	5	15	24	81	29	1						2	4	7	10	77	20	31	0
			E	3	100	0	0	-	67	0	0	33							0	0	0	33	67	33	0						0	0	0	0	67	33	67	0
	23	Provision options (ex. electric vehicle for elderly people, residential area where people can live without vehicles, etc.) will be provided to cope with the increase of elderly people who cannot walk due to health reasons or cannot drive a car due to functional deterioration.	1	118	5	25	70	-	17	70	1	12							4	5	13	21	55	55	37	2						4	5	13	21	55	55	37	2
			2	116	3	20	77	-	13	78	0	9							4	2	6	14	59	61	34	0						4	2	6	14	59	61	34	0
			E	3	100	0	0	-	0	100	0	0							0	0	0	33	33	67	33	0						0	0	0	33	33	67	33	0
Production support strategy (primary sector)/ Tertiary industries)	24	Promotion of efficient large-scale corporate agriculture that produces more than the 50% of agricultural products in Japan ("50%" is the national total including the production in foreign countries and indoor environments).	1	82	4	13	83	-	12	75	2	11							11	11	9	24	50	68	30	7						11	11	9	24	50	68	30	7
			2	89	2	12	86	-	7	84	0	9							7	8	6	16	50	71	27	0						7	8	6	16	50	71	27	0
			E	2	100	0	0	-	0	50	0	50							50	0	0	0	100	100	0	0						50	0	0	0	100	100	0	0

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Production support strategy (primary, secondary, tertiary industries)	25	Establishment of new legal systems and social consensus on the importance of water resource management (flood control, use of water, water environment) for the conservation and rehabilitation of farmlands and forests.	1	104	5	24	71	-	36	48	8	8							7	11										18	27	10	79	33	13
			2	103	2	17	81	-	39	51	4	6							5	5										15	23	7	87	29	7
			E	2	100	0	0	-	0	50	50	0							0	0										50	50	0	50	50	0
	26	Promotion of a support framework for such matters as U-/I-/J-turn and multi-habitation among urban and rural areas to maintain conservation of farmland and other lands.	1	68	3	26	71	-	7	77	0	16							5	8										12	18	23	80	35	2
			2	73	1	14	85	-	3	83	0	14							3	1										11	11	14	90	31	0
			E	1	100	0	0	-	0	100	0	0							0	0										0	0	100	100	0	0
	27	Establishment of a support system (promoting technological innovation, education to pass on know-how by turning it into software, economic support, inheritance as a culture) for the mature manufacturing industry as a measure against depopulation in local regions.	1	75	4	23	73	-	5	77	0	18							11	14										20	20	30	68	32	3
			2	80	3	15	82	-	5	82	0	13							5	5										13	9	27	77	35	3
			E	2	100	0	0	-	0	100	0	0							0	0										0	0	100	50	0	0
	28	A marine city on an inexpensive and durable foundation supported by legs or floating (used as a base for transportation, communication, research, production, resource mining, and leisure activities), which is compatible with sea environments including fishing grounds and currents.	1	134	12	39	49	-	21	50	0	29						8	5	23	45	53	49	4						12	12	10	24	42	44	42	5
			2	126	11	38	51	-	17	59	0	24						6	3	19	37	60	49	2						8	7	10	19	51	49	42	1
			E	14	100	0	0	-	7	79	0	14						0	0	7	36	64	57	0						7	0	14	29	64	57	21	0
	29	Space travel that costs less than one million yen (calculated on the present value) and is as safe as present overseas travel.	1	71	3	13	84	-	15	1	1	83						16	14	11	33	64	17	16						22	17	6	19	70	10	17	17
			2	79	3	6	91	-	11	0	1	88						16	16	1	23	81	7	7						24	16	4	13	85	6	11	10
			E	2	100	0	0	-	100	0	0	0						0	0	0	50	50	50	0						0	0	0	50	100	0	0	0
	30	Commercialization of technology enabling the recovery of more than 90% of rare metals such as lithium, beryllium, tantalum, cobalt and so on from waste.	1	66	2	23	75	-	57	41	0	2						0	6	40	35	80	18	2						0	6	21	26	88	8	20	6
			2	73	1	16	83	-	67	32	0	1						0	3	41	34	85	11	0						0	3	21	22	92	6	19	0
			E	1	100	0	0	-	100	0	0	0						0	0	0	0	100	0	0						0	0	0	0	100	0	0	0
	31	Commercialization of technology enabling the mining of more than 50% of the required amount of rare metals such as nickel and cobalt from other planets or satellites.	1	45	4	11	85	-	65	5	7	23						16	20	19	49	35	33	33						18	22	14	33	44	23	33	33
			2	53	2	9	89	-	63	6	2	29						23	13	14	63	39	24	27						24	14	4	37	53	22	31	24
			E	1	100	0	0	-	100	0	0	0						##	0	0	0	100	0	0						##	0	0	0	0	100	0	0
	32	Promotion of methods for reevaluating traditional and natural symbiotic systems in countries all over the world, such as the SATOYAMA initiative, against the backdrop of the expansion of citizens' movements related to environmental issues.	1	93	4	20	76	-	49	34	1	16						1	3	40	36	30	62	15						2	3	18	26	27	39	58	13
			2	91	3	18	79	-	55	29	0	16						2	3	43	39	24	70	8						2	2	18	27	20	39	74	7
			E	3	100	0	0	-	67	33	0	0						0	0	67	33	67	67	33						0	0	33	0	67	67	33	0

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Exchange and transaction strategy (transportation and communication)	33	Development of technology to organize and activate the citizen-driven regional movement for preservation and improvement of regional environment and scenery.	1	101	8	29	63	-	30	49	0	21							5	10	42	36	23	57	7						5	9	27	20	25	41	60	3
			2	101	7	27	66	-	24	56	0	20							1	10	43	36	19	65	3						2	8	27	19	20	34	73	3
			E	7	100	0	0	-	57	29	0	14							0	0	43	29	43	86	0						0	0	29	14	43	57	86	0
	34	Promotion of a high-precision monitoring and forecasting system to inform airplanes of fine-scale meteorological conditions while taking off and landing.	1	73	4	16	80	-	80	3	3	14							3	7	40	53	49	28	4						1	10	17	33	56	28	21	11
			2	80	4	14	82	-	91	0	0	9							0	3	37	67	52	20	4						0	3	13	37	69	26	18	9
			E	3	100	0	0	-	100	0	0	0							0	0	33	100	67	0	0						0	0	0	33	100	33	0	0
	35	Diffusion of a radio communication system covering all of Japan by using technology such as satellite communication that can transfer movie data of the same quality as television without interruption or congestion even in the case of disaster.	1	90	3	19	78	-	51	39	0	10							1	5	24	40	66	34	3						2	5	12	26	58	41	26	3
			2	93	3	18	79	-	62	29	0	9							0	2	19	42	77	24	1						0	2	11	28	78	40	19	2
			E	3	100	0	0	-	100	0	0	0							0	0	33	33	67	0	0						0	0	0	0	67	33	0	0
	36	Promotion of a driver assistance system not only to prevent rear-end crashes and collisions due to sudden encounters but also to forecast any trouble with the engine and/or tires by using various sensors installed in the car.	1	121	6	27	67	-	67	19	2	12							3	3	22	23	90	18	0						2	3	12	19	85	20	15	0
			2	118	3	25	72	-	80	9	0	11							1	2	16	21	92	15	0						1	2	7	15	90	18	14	0
			E	3	100	0	0	-	100	0	0	0							0	0	0	0	67	33	0						0	0	0	0	100	0	0	0
	37	A danger forecast, alarm and avoidance system to reduce the number of maritime accidents such as capsizings, collisions and groundings by 50%.	1	85	12	24	64	-	89	5	1	5							0	1	23	49	63	22	11						0	0	14	33	63	29	26	12
			2	89	10	16	74	-	93	1	0	6							0	2	16	51	75	21	6						1	0	11	35	78	21	24	7
			E	9	100	0	0	-	100	0	0	0							0	0	44	67	56	22	11						0	0	25	50	75	38	13	25
	38	A system to record, examine and verify the transportation and storage history of materials and goods by automatically measuring temperature, impact, changes in components and so on (the traceability for production, transportation, storage, use and disposal within the context of intermodal transportation will be realized by this system).	1	89	8	24	68	-	69	21	0	10							0	3	21	35	80	25	2						2	3	13	18	74	22	26	7
			2	88	6	20	74	-	79	13	0	8							0	1	18	32	89	21	1						0	1	8	13	88	14	27	4
			E	5	100	0	0	-	100	0	0	0							0	0	0	20	100	0	0						0	0	0	0	80	0	40	0
	39	Promotion of a transportation system seamlessly covering various sizes of areas, from a district to a wide area, which enables elderly persons to move directly from their residences to their destinations alone and without anxiety, in an ultra-aging society.	1	108	7	28	65	-	17	67	2	14							7	9	29	44	52	43	0						11	7	17	23	48	41	48	1
			2	106	5	22	73	-	13	77	0	10							3	5	22	43	59	41	1						6	3	15	21	63	43	52	2
			E	5	100	0	0	-	0	100	0	0							0	0	0	20	60	60	0						0	0	0	0	40	0	100	0
	40	Diffusion of a bicycle at a practical price that is provided with various sensors and a danger avoidance system to enable the people, including elderly people or those riding with a child, to ride safely on the road at high speed.	1	100	4	25	71	-	26	41	1	32							12	7	23	24	82	17	1						15	9	15	17	77	23	18	1
			2	100	3	17	80	-	19	43	0	38							8	6	17	18	88	13	0						10	7	10	13	89	21	16	0
			E	3	100	0	0	-	0	67	0	33							0	0	0	33	67	33	0						33	0	0	0	100	0	50	0

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Exchange and transaction strategy (transportation and communication)	41	Development of a flight control system enabling the doubling of the take-off and landing capacity of Haneda Airport.	1	81	4	28	68	-	16	75	0	9							8	10	10	49	55	36	3							9	10	8	31	43	38	32	1
			2	81	1	22	77	-	11	83	0	6							4	6	5	51	61	33	3							4	8	4	29	62	35	29	1
			E	1	100	0	0	-	0	100	0	0							0	0	0	100	0	0	0							0	0	0	100	0	100	0	0
	42	Development of a system to reduce by 50% the time, cost and environmental load at each node that links a railway and road, road and port/airport as well as a railway and port/airport so as to improve the efficiency of freight transportation between cities.	1	134	8	35	57	-	50	45	4	1							2	6	23	49	47	47	4							2	5	9	29	48	42	45	4
			2	130	4	32	64	-	51	47	1	1							1	4	16	55	50	51	2							1	3	6	29	56	44	47	2
			E	5	100	0	0	-	60	40	0	0							0	20	25	50	25	75	0							0	0	0	25	25	50	50	0
	43	Promotion of a mobility management system to cover hundreds of thousands of people through the establishment of a commuter organization to facilitate smooth commuting in urban areas in both ordinary times and emergencies (ex. temporary interruption because of disaster or failure).	1	95	4	27	69	-	22	67	0	11							8	6	32	48	38	52	0							10	5	14	25	38	46	48	1
			2	96	1	24	75	-	14	78	0	8							6	2	24	58	36	53	0							5	2	12	26	40	52	54	0
			E	1	100	0	0	-	100	0	0	0							0	0	0	100	0	0	0							0	0	0	0	0	0	100	0
	44	Promotion of vehicles that control the speed and operation of the engine to minimize fuel consumption by detecting the timing of traffic signals, as well as a traffic control system enabling the operation of such vehicles.	1	110	7	24	69	-	35	46	2	17							8	5	20	36	73	27	3							11	5	12	19	64	36	29	1
			2	104	4	18	78	-	32	52	1	15							6	2	16	36	77	28	0							6	2	8	19	74	37	29	0
			E	4	100	0	0	-	50	50	0	0							0	0	0	50	75	25	0							25	0	0	25	50	25	25	0
	45	Implementation of a system to deliver packages and letters to each floor of a building from the track terminal or delivery center by using unused space in subways and common ducts and pipe space in buildings in the center districts of big cities.	1	111	5	30	65	-	9	50	0	41							20	7	16	35	56	39	1							24	9	8	20	51	38	42	1
			2	104	3	23	74	-	12	51	1	36							15	5	13	37	68	36	0							20	5	5	17	68	35	39	0
			E	3	100	0	0	-	0	67	0	33							0	0	0	33	100	0	0							33	0	0	0	67	33	33	0
	46	Development of a next-generation environmentally-friendly ship (green ship) with 50% less CO_2 emissions and approx. 80% less NOx emissions than present ships.	1	95	20	18	62	-	85	11	2	2							2	4	22	41	71	24	2							3	5	11	25	72	19	27	3
			2	93	15	16	69	-	87	7	3	3							1	4	18	39	78	22	0							1	3	7	25	84	19	24	3
			E	14	100	0	0	-	86	7	7	0							7	0	21	36	71	36	0							7	0	8	23	77	15	31	8
	47	Development of an airplane with a propulsion system that does not rely on fossil fuels.	1	75	8	13	79	-	88	0	7	5							11	10	39	30	58	32	4							13	11	19	25	69	19	31	7
			2	74	4	14	82	-	92	0	0	8							12	5	39	30	75	24	1							13	7	16	26	84	17	30	6
			E	3	100	0	0	-	100	0	0	0							0	0	33	33	33	33	0							0	0	0	33	67	0	33	0
	48	Promotion of roads covered by plants in urban areas through the application of a surface material that is permeable and reflects less radiant heat.	1	161	6	39	55	-	40	44	3	13							7	5	38	53	61	31	2							6	5	14	31	46	56	25	1
			2	152	5	36	59	-	39	50	1	10							4	2	28	58	69	25	2							4	1	8	26	53	67	17	1
			E	7	100	0	0	-	0	83	0	17							0	14	0	71	71	0	0							0	0	0	50	33	50	0	0

Area	Topic number	Topic	Round	Responses	Degree of expertise (%)				Importance (%)				Forecasted time of technological realization (to be realized somewhere in the world)								Sectors that will pave the way to technological (%)					Forecasted time of social realization (to become applicable/widely used in Japan)								Sectors that will pave the way to social realization (%)					
					High	Moderate	Low	None	Important for Japan and the rest of the world	Especially important for Japan	Especially important for the world	Low importance/priority	Already realized	2011-2015	2016-2020	2021-2030	2031-2040	2041-	will not be realized	don't know	University	Public research organization	Private enterprise	Collaboration of multiple sectors	Others	2011-2015	2016-2020	2021-2030	2031-2040	2041-	will not be realized	don't know	University	Public research organization	Private enterprise	Government	Collaboration of multiple sectors	Others
Strategy for maintenance of infrastructures	49	Technology providing information on evacuation and recovery assuming the concurrence of storm and flood and earthquake damage will be disseminated.	1	146	14	36	50	-	32	55	0	13							6	6	39	61	26	36	2						6	8	21	38	20	61	34	1
			2	139	15	33	52	-	31	59	0	10							4	2	35	74	18	37	1						4	3	18	35	14	76	34	2
			E	21	100	0	0	-	57	43	0	0							0	0	71	95	14	24	0						0	0	43	48	24	81	48	5
	50	A unified database (extending over business units such as railways, roads, electric power, and local public entities) of infrastructure investment history and deterioration data will be constructed to allow management of infrastructure assets at entire city and regional levels.	1	154	21	42	37	-	34	59	0	7							3	3	28	59	40	47	1						4	3	19	38	34	59	41	1
			2	144	22	42	36	-	30	64	0	6							1	1	19	68	31	46	1						3	2	11	38	29	65	40	1
			E	31	100	0	0	-	39	55	0	6							3	0	24	69	24	52	3						7	3	14	41	21	72	45	0
	51	High-precision modeling of deterioration environments based on design and construction technology for infrastructure deterioration prevention, repair, and establishment will become feasible, and sufficiently precise life-cycle management and asset management will come into practical use.	1	162	31	38	31	-	49	47	0	4							2	2	48	60	40	40	2						1	3	24	43	38	56	36	1
			2	156	30	33	37	-	49	48	0	3							1	1	43	66	38	38	1						1	1	18	43	34	63	34	1
			E	47	100	0	0	-	53	47	0	0							0	0	48	63	39	41	2						0	0	29	42	33	62	38	0
	52	Semipermanent recessed sensor technology notifying the degree of deterioration, lifespan, and time for replacement of structures will be disseminated.	1	163	29	41	30	-	47	41	0	12							7	4	52	47	57	31	2						9	5	24	30	56	37	25	1
			2	152	28	40	32	-	56	36	0	8							3	3	52	45	68	21	2						4	4	20	25	68	38	24	1
			E	42	100	0	0	-	68	22	0	10							5	2	58	38	73	20	3						5	5	33	33	68	35	30	0
	53	Semipermanent recessed sensor technology, and an alarm and evacuation support system providing advance notification of slopes collapse, landslides, and the destabilization of embankments will come into practical use.	1	149	19	37	44	-	34	60	1	5							3	5	47	54	54	31	1						4	5	23	32	46	49	28	1
			2	139	17	37	46	-	33	64	1	2							2	1	44	62	65	23	0						3	1	17	32	55	58	20	0
			E	24	100	0	0	-	50	50	0	0							0	0	38	71	71	25	0						0	5	17	46	58	63	13	0
	54	A design method for separating the skeleton (structural framework) and infill (equipment and interior furnishing) on the assumption that long-life structure design required for promoting buildings to be stocked, and related equipment and interior furnishing will be disseminated (50% or more).	1	118	19	34	47	-	32	60	1	7							0	3	38	44	71	30	2						3	3	15	28	59	35	31	3
			2	111	18	33	49	-	25	69	1	5							0	1	34	50	82	23	1						3	0	14	25	73	35	25	1
			E	20	100	0	0	-	30	65	0	5							0	0	20	35	80	30	0						5	0	5	25	55	45	35	0
	55	Technology for constructing and manufacturing heavy structures, such as buildings, bridges, electric generating facilities, and ships, with light-weight, high-strength materials replacing conventional steel materials and concrete materials will come into practical use.	1	145	36	38	26	-	57	25	1	17							10	17	52	44	61	31	1						9	20	26	27	69	23	30	1
			2	139	33	38	29	-	67	17	0	16							7	12	50	43	70	25	1						7	15	25	24	77	23	27	1
			E	46	100	0	0	-	68	15	0	17							13	7	52	39	73	23	0						15	9	25	23	77	20	30	0
	56	A system for evaluation of design systems, structural performance, and asset value, allowing the functional extension, renewal, removal, and reuse of large-scale structures will be disseminated.	1	141	28	37	35	-	45	45	0	10							4	3	42	52	57	32	1						2	5	19	38	54	36	36	1
			2	138	25	39	36	-	51	43	0	6							2	1	44	55	63	28	2						1	3	19	40	64	37	32	1
			E	34	100	0	0	-	75	25	0	0							3	0	42	48	61	23	3						0	3	12	36	67	21	39	0

Area	Topic number	Topic	Round	Responses	Degree of expertise (%)				Importance (%)				Forecasted time of technological realization (to be realized somewhere in the world) (%)						Sectors that will pave the way to technological (%)					Forecasted time of social realization (to become applicable/widely used in Japan) (%)						Sectors that will pave the way to social realization (%)					
					High	Moderate	Low	None	Important for Japan and the rest of the world	Especially important for Japan	Especially important for the world	Low importance/priority	Already realized	2011-2015	2016-2020	2021-2030	2031-2040	2041-	will not be realized	don't know	University	Public research organization	Private enterprise	Collaboration of multiple sectors	Others	2011-2015	2016-2020	2021-2030	2031-2040	2041-	will not be realized	don't know	University	Public research organization	Private enterprise	Government	Collaboration of multiple sectors	Others
Strategy for maintenance of infrastructures	57	Junction technology with disassembility will come into practical use by using physical, thermal, or chemical characteristics to facilitate future disassembly, repair, and functional extension in large-scale structures such as super high-rise buildings and bridges.	1	130	28	39	33	-	47	35	0	18							6	9	52	45	65	27	1						7	10	25	31	66	23	31	1
			2	128	27	38	35	-	55	33	0	12							4	5	53	45	73	18	1						6	6	25	28	80	19	25	1
			E	34	100	0	0	-	64	24	0	12							9	0	55	24	73	15	0						9	0	18	12	79	21	24	0
	58	Technology and a legal system for making the most of natural and renewable energy by region or district and realizing, for goods and material circulation, local production for local consumption will be developed.	1	123	11	28	61	-	41	54	1	4							2	4	35	45	35	60	5						2	4	19	28	36	58	48	3
			2	115	7	27	66	-	39	59	0	2							2	3	27	42	27	71	3						1	3	12	24	33	69	49	2
			E	8	100	0	0	-	38	62	0	0							13	0	43	43	57	14	0						0	0	14	57	71	86	14	0
	59	A material and energy circulation system will be constructed on a prefectural or larger administrative bloc levels, based on material correlation of biomass energy from forest resources, animal excrement, and unused material from cereal, as well as on that of by-products and functional materials.	1	117	7	29	64	-	44	50	3	3							4	1	39	48	40	52	3						7	3	22	33	36	49	50	2
			2	109	6	27	67	-	41	55	1	3							5	0	29	54	34	58	1						5	1	14	27	38	50	55	0
			E	7	100	0	0	-	29	71	0	0							0	0	43	43	57	57	0						0	0	14	14	43	71	71	0
	60	Technology allowing the recovery of water-power energy productivity together with the recovery of river environments by returning dam sediment to rivers under low environmental burden will be disseminated.	1	115	17	36	47	-	19	73	1	7							5	4	36	70	39	31	1						5	4	17	34	34	61	25	0
			2	106	15	39	46	-	12	84	1	3							0	4	30	77	35	28	0						1	3	12	30	29	75	22	0
			E	16	100	0	0	-	19	81	0	0							0	0	38	63	50	13	0						0	0	19	38	44	56	13	0
	61	A system to ensure quality and design considering durability in the order of one to ten-thousand years will be established by proving technology for the geological disposal of radioactive waste at any underground depth.	1	102	18	35	47	-	65	33	1	1							8	10	39	67	44	36	6						8	11	22	46	32	48	37	4
			2	100	15	34	51	-	74	21	3	2							7	8	30	75	39	32	4						7	7	13	51	27	62	29	3
			E	15	100	0	0	-	69	31	0	0							13	0	29	71	50	43	0						7	0	14	50	29	36	50	0
	62	A cross-sectional system for maintaining and preserving both forest and urban infrastructural functions will come into practical use through the application of timber thinned from forests in the process of forest preservation as members and elements of semipermanent structures, such as foundation piles.	1	112	12	25	63	-	29	50	1	20							12	11	42	54	41	41	4						12	13	24	41	42	39	40	1
			2	107	9	27	64	-	20	65	1	14							8	8	33	62	39	39	2						9	11	19	45	45	41	43	0
			E	10	100	0	0	-	10	50	0	40							10	0	30	70	60	20	0						20	0	10	40	70	20	40	0

How to read the survey results

Topic number	Topic	Round	Responses	Degree of expertise (%)				Importance (%)			
				High	Moderate	Low	None	Important for Japan and the rest of the world	Especially important for Japan	Especially important for the world	Low importance/priority
1	Hierarchic system LSIs which take full advantage of the on-chip network technology that can scalably take advantage of highly integrated semiconductors.	1	152	14	28	58	-	72	18	2	8
		2	127	14	26	60	-	77	17	2	4
		E	18	100	0	0	-	94	6	0	0

(a) (b) (c) (d) (e)

Forecasted time of technological realization (to be realized somewhere in the world) (%)							Sectors that will pave the way to technological realization (%)					Forecasted time of social realization (to become applicable/widely used in Japan) (%)					Sectors that will pave the way to social realization (%)					
Already realized	2011-2015	2016-2020	2021-2030	2031-2040	2041-	don't know will not be realized	University	Public research organization	Private enterprise	Collaboration of multiple sectors	Others	2011-2015	2016-2020	2021-2030	2031-2040	2041-	don't know will not be realized	University	Public research organization	Private enterprise	Government	Collaboration of multiple sectors	Others
						0 7	29	24	68	35	1						0 7	7	14	81	8	18	2
						0 5	23	22	77	33	1						0 4	6	15	90	6	17	2
						0 0	33	17	78	33	0						0 0	11	11	89	11	17	0

(f) (g) (h) (i)

(a) Topic column

Description of the theme being surveyed.

(b) Questionnaire category

This shows the results of questionnaire categories "1," "2," and "E" as follows.

1: Results of Round 1 questionnaire (those responding "High," "Moderate," or "Low" on degree of expertise

2: Results of Round 2 questionnaire (those responding "High," "Moderate," or "Low" on degree of expertise

E: Results of Round 2 questionnaire for those responding "High" on degree of expertise

(c) Number of respondents

Numbers for questionnaire categories "1" and "2" show the total of those answering "High," "Moderate," or "Low" on degree of expertise. (Those answering "None" are instructed not to answer subsequent questions and thus are not included.)

The number of responses for questionnaire category "E" shows the number of respondents to the Round 2 questionnaire with a "High" degree of expertise.

(d) Degree of expertise

Degree of expertise is the ratio, expressed as percentages, of respondents in (c) choosing "High," "Moderate," and "Low" as their degree of expertise. Respondents selected one of the following as their degree of expertise.

High: I posses specialized knowledge regarding the topic because I am currently engaged in research or work in the area (may include survey research based on documents).

Moderate: I possess some specialized knowledge regarding the topic because I have engaged in research or work in the area in the past or because I engage in research or work in a neighboring area.

Low: I have read specialist books and papers and/or listened to specialists in the relevant area, etc.

None: I have no specialized knowledge of the topic.

Those selecting "None" did not need to answer the remaining questions.

(e) Importance

This shows as percentages the ratios of those selecting "Important for Japan and the rest of the world," "Especially important for Japan," "Especially important for the world", and “Low importance/priority”.

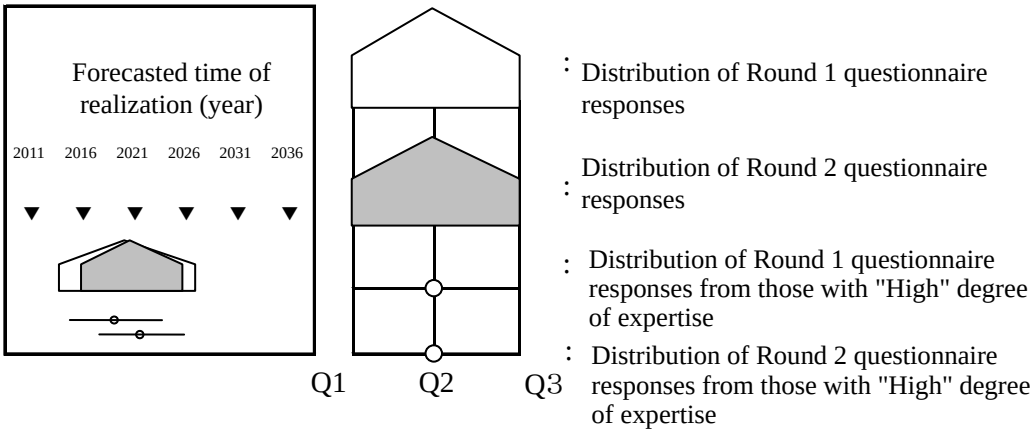
(f), (h) Forecasted time of technological realization (to be realized somewhere in the world) / social realization (to become applicable/widely used in Japan)

This shows the distribution of predicted periods. The following method is used to calculate them from responses selecting one of the choices.

The width of the pentagon (the distance from Q1 to Q3) represents the middle one-half of responses on time of realization, with the first and last fourths removed. A narrow pentagon indicates a strong consensus among respondents.

In addition, when times of realization are used in timelines and so on, Q2 is the value used.

The ratio responding "It will not be realized" and "I don’t know" are expressed as percentages of all responses.



<How to read forecasted time of realization>

Q1 : With responses on dates of realization and application in order from the earliest, the first one-fourth of all answers

Q2 : The median point of those answers

Q3 : The three-quarter point of those answers

(g), (i) Sector that will pave the way to technological/social realization <multiple answers allowed>

Regarding the topic, the ratios of respondents selecting from university, public research institute, private enterprise, (government), cooperation, and other as the organization that promote realization.

Panel members

as of March 2010

<Panel 1>

Leader	Yasuhiko ARAKAWA	The University of Tokyo
Member	Makoto IWATA	Kochi University of Technology
	Takahiro ONAI	Hitachi, Ltd.
	Ryohei ORIHARA	Toshiba Corporation
	Yoshiaki KATO	Aisin Seiki Co. , Ltd.
	Norio SHIRATORI	Tohoku University
	Tetsuomi SOGAWA	Nippon Telegraph and Telephone Corporation
	Hideaki TAKAYANAGI	Tokyo University of Science
	Hiroshi NAKAMURA	The University of Tokyo
	Yasushi HIBINO	Japan Advanced Institute of Science and Technology
	Toshiro HIRAMOTO	The University of Tokyo
	Hiroyuki FUJITA	The University of Tokyo
	Mitsuji MATSUMOTO	Waseda University
	Mitiko MIURA	Hiroshima University

<Panel 2>

Leader	Tadao SAITO	Toyota Info Technology Center, Co., Ltd
Member	Kaoru ARAKAWA	Meiji University
	Yoshikazu IKEDA	Otani University
	Kazumasa ENAMI	National Institute of Information and Communications Technology
	Toshikazu KATO	Chuo University
	Yoichi KATO	Nippon Telegraph and Telephone Corporation
	Akihiko TAKANO	National Institute of Informatics
	Mario TOKORO	Sony Computer Science Laboratories, Inc.
	Toyoaki NISHIDA	Kyoto University
	Masayuki HIRAYAMA	Toshiba Corporation
	Hiroyuki MORIKAWA	The University of Tokyo
	Hiroshi YAMAGUCHI	Komazawa University
	Atsushi YOSHIKAWA	Tokyo Institute of Technology

<Panel 3>

Leader	Kenji OKONOGI	Osaka University
Member	Hideharu ANAZAWA	Japan Bioindustry Association
	Keiko ABE	The University of Tokyo
	Motoichiro KATO	Keio University
	Takashi GOJOBORI	National Institute of Genetics
	Mitsuru HASHIDA	Kyoto University
	Kiyoshi FURUICHI	Astellas Pharma Inc.
	Kei-ichiro MAEDA	Nagoya University
	Ryuichi MORISHITA	Osaka University

<Panel 4>

Leader	Hiroshi TANAKA	Tokyo Medical and Dental University
Member	Hiroshi ISEKI	Tokyo Women's Medical University
	Hiroshi OYAMA	The University of Tokyo
	Norihiro KATO	International Medical Center of Japan
	Akio KIMURA	Keio University
	Toshiaki TSUBOI	NTT IT Corporation
	Makoto HASHIZUME	Kyusyu University
	Hiroyuki MATSUURA	National Center for Geriatrics and Gerontology
	Takami YAMAGUCHI	Tohoku University

<Panel 5>

Leader	Yasunori MATOGAWA	Japan Aerospace Exploration Agency
Member	Tamaki URA	The University of Tokyo
	Hajimu KINOSHITA	Japan Agency for Marine-Earth Science and Technology
	Eiichiro KOKUBO	National Astronomical Observatory of Japan
	Hideshi KOZAWA	Japan Aerospace Exploration Agency
	Fumihiko TAKASAKI	High Energy Accelerator Research Organization
	Kensaku TAMAKI	The University of Tokyo
	Satoshi TSUZUKIBASHI	Nippon Keidanren
	Teruyuki NAKAJIMA	The University of Tokyo
	Takeshi FUWA	(ex-Executive Director of National Maritime Research Institute)
	Saburo MATUNAGA	Tokyo Institute of Technology
	Tetsuo YAMAMOTO	Hokkaido University

Writer	Ken TAKAI	Japan Agency for Marine-Earth Science and Technology

<Panel 6>

Leader	Takao KASHIWAGI	Tokyo Institute of Technology
Member	Hiroshi ASANO	Central Research Institute of Electric Power Industry
	Akihiro IIYAMA	Nissan Motor Co. , Ltd.
	Tetsuya IMAI	Mitsubishi Heavy Industries, Ltd.
	Takamichi IWAMURA	Japan Atomic Energy Agency
	Hiroyuki KUDO	The Energy Conservation Center, Japan
	Kinya SAKANISHI	National Institute of Advanced Industrial Science and Technology
	Kazunari SASAKI	Kyushu University
	Yasuhito NAKAGAWA	Sharp Corporation
	Shoichi MUTO	The Tokyo Electric Power Company
	Masahiro YOSHIDA	Nippon Oil & Energy Corporation
	Hiroshi YOSHINO	Tohoku University
	Hisao WATANABE	Tokyo Gas Co. , Ltd.

<Panel 7>

Leader	Isao MOCHIDA	Kyusyu University
Member	Kei’ichiro IGUCHI	Fisheries Research Agency
	Norio ISHIHARA	Japan Coal Energy Center
	Tomoko OGI	National Institute of Advanced Industrial Science and Technology
	Hidekazu KATO	International Institute for Mining Technology
	Kozo SATO	The University of Tokyo
	Akio SHIBATA	Marubeni Corporation
	Kazunori TANIGUCHI	Idemitsu Kosan Co. , Ltd.
	Ken-ichi NAGANO	Nippon Steel Corporation
	Hikari FUJII	Kyushu University
	Naomichi MORI	Hitachi Plant Technologies, Ltd.

<Panel 8>

Leader	Yukihiro NOJIRI	National Institute for Environmental Studies

Member	Takashi KAMEYA	Yokohama National University
	Mariko KAWAGUCHI	Daiwa Institute of Research Ltd.
	Koichi KURIYAMA	Kyoto University
	Ryo KOHSAKA	Nagoya City University
	Tsutomu SUZUKI	University of Tsukuba
	Akira TANAKA	Tokyo City University
	Hiroshi NAKAMURA	Ebara Corporation
	Seiji HAYASHI	National Institute for Environmental Studies
	Hiroyuki MATSUDA	Yokohama National University
	Masaru MIZOGUCHI	The University of Tokyo

<Panel 9>

Leader	Naoki KISHIMOTO	National Institute for Materials Science
Member	Yoshiyasu ITOH	Toshiba Corporation Power Systems Company
	Toshihiko KANAYAMA	National Institute of Advanced Industrial Science and Technology
	Akihiko KITANO	Toray Industries, Inc.
	Takashi GOTO	Tohoku University.
	Mitsuo SAWAMOTO	Kyoto University
	Atsushi SUZUKI	Yokohama National University
	Isao TANAKA	Kyoto University
	CHUN, Wang-Jae	International Christian University
	Yasuhiko FUJII	Japan Atomic Energy Agency
	Tetsuji YAMAOKA	National Cardiovascular Center Research Institute

<Panel 10>

Leader	Takehiko KITAMORI	The University of Tokyo
Member	Tatsuya OHIRA	Mitsubishi Heavy Industries, Ltd.
	Satoshi TADOKORO	International Rescue System Institute
	Masao TOYODA	Japan Science and Technology Agency
	Shinji HASEBE	Kyoto University
	Kikuo FUJITA	Osaka University
	Masahiro FUJITA	Sony Corporation
	Kazuyoshi FURUTA	Seiko Instruments Inc.
	Norio MATSUKI	National Institute of Advanced Industrial Science and Technology
	Ryo MIYAKE	Hiroshima University

	Jun YANAGIMOTO	The University of Tokyo

<Panel 11>

Leader	Yasushi Masuda	Keio University
Member	Yasuo IKAWA	Japan Advanced Institute of Science and Technology
	Jun UNO	Waseda University
	Jun KANAMITSU	Kyoto Sangyo University
	Koichi SUMIKURA	National Graduate Institute for Policy Studies
	Yutaka HAMAOKA	Keio University
	Kazuyoshi HIDAKA	Japan Advanced Institute of Science and Technology
	Toshimi YAMANOI	Nissan Motor Co. , Ltd.

<Panel 12>

Leader	Yoshitsugu HAYASHI	Nagoya University
Member	Mikiko ISHIKAWA	The University of Tokyo
	Masaya ICHIKAWA	Mitsubishi Heavy Industries, Ltd.
	Yuichiro USUDA	Research Institute for Earth Science and Disaster Prevention
	Taikan OKI	The University of Tokyo
	Yoshiaki KODAMA	National Maritime Research Institute
	Ikuo SUGIYAMA	Nikken Sekkei Civil Engineering Ltd.
	Kazuo TATEISHI	Nagoya University
	Kenji DOI	Kagawa University
	Satoshi TOGARI	Kajima Corporation
	Seigo NASU	Kochi University of Technology
	Tetsuro HYODO	Tokyo University of Marine Science and Technology
	Koichi MAEKAWA	The University of Tokyo

Staff list

National Institute of Science and Technology Policy was responsible for overall implementation of the survey and Institute for Future Technology was in charge of operating panels and conducting questionnaire survey.

(As of March 2010)

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