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

Capability of Local Regions for the Green Innovation

(Summary)

March 2010

Science and Technology Foresight Center

National Institute of Science and Technology Policy

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Ministry of Education, Culture, Sports, Science and Technology

Contents

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

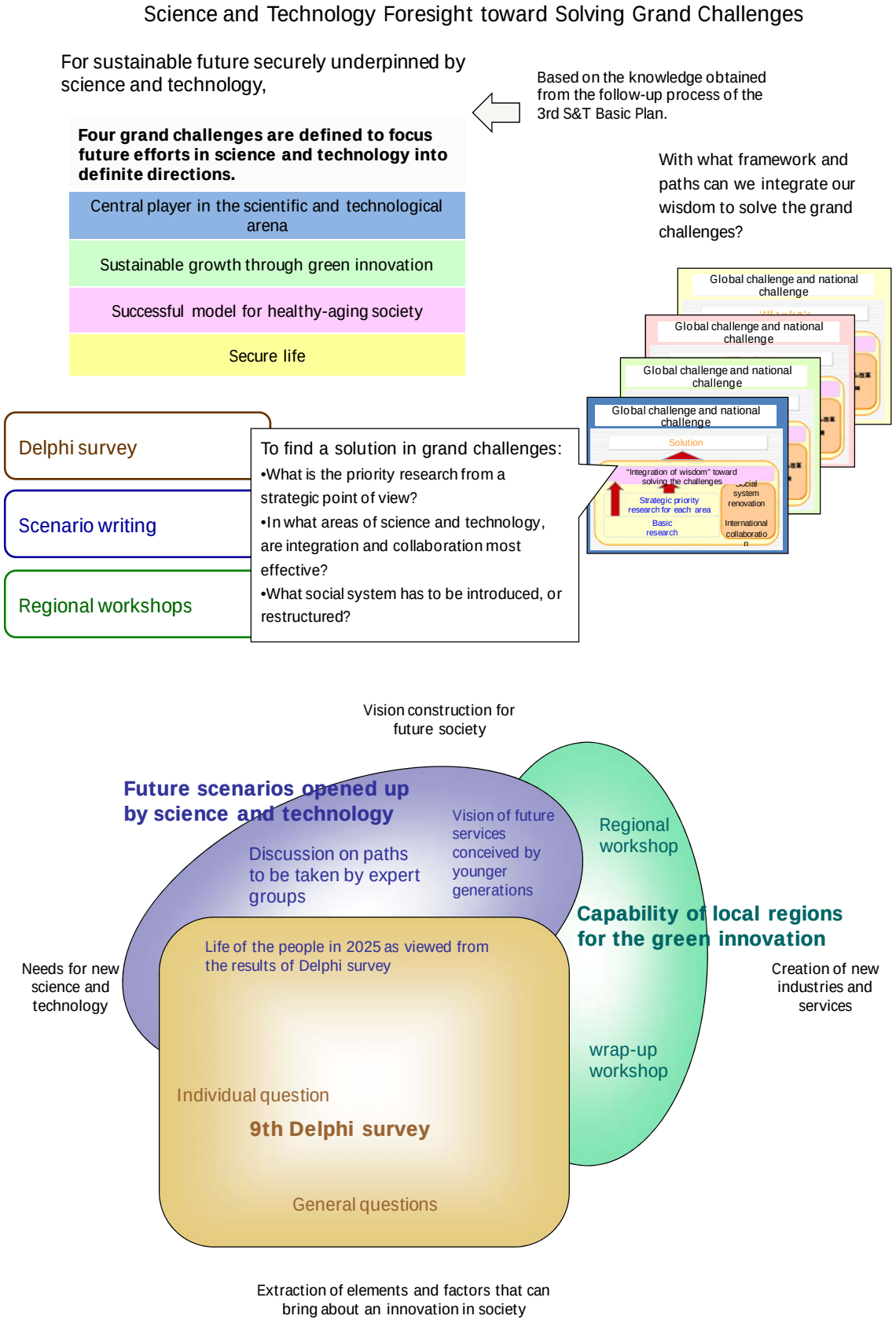
[Scenario writing]

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 Regional Workshops

This investigative research placed focus on green innovation, one of the global challenges that we have to address most urgently. Green innovation embraces all aspects of new industry and job creation accompanying the process of constructing a low-carbon society, rather than the simple idea of forming a low-carbon society. Considering this concept, deliberations were made on the ideal social model of each region to be realized in the future (Figure 2). As a concrete procedure, workshops were held in eight regions across Japan, where the representatives of the region — researchers, business people, civil servants, and general citizens — discussed a wide range of issues from the viewpoint of realizing the ideal future society (Figure 3, 4). In the concluding workshop that was set up based on the results of the regional workshops, the focus of the discussion was placed on the industries and services, as well as the science and technology relating thereto, conducive to the realization of the ideal social models.

Figure 2: Flow of the survey

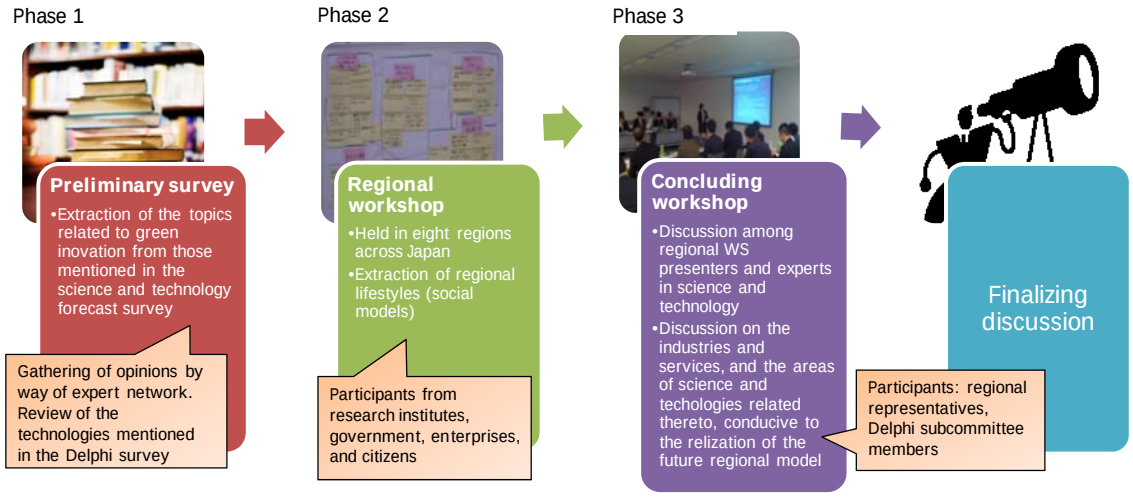
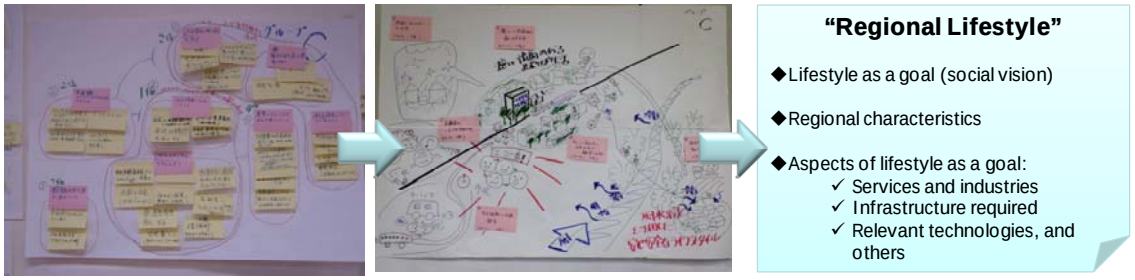


Figure 3: The discussion process in regional workshops



All participants imagined scenes of life in their regions 20 years and 40 years from now (living, shopping, working, child raising, healing, playing, learning, and social interactions), and described them on a card.
These cards were classified and compiled based on their inherent associations, and then labeled.

Based on the results of discussion, the group made a picture, "Regional lifestyle" (see above).
AHP (Analytic Hierarchy Process) was performed on the extracted items to arrange them in order of priority in view of attaining the targeted lifestyle.

Based on the outcomes from the group discussions, a plenary session was held to discuss the ideal lifestyle in the region.

Figure 4: The host regions of the regional workshops

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Shichinohe town (Aomori pref.; population: approximately 18,000)
"A convivial town that is in harmony with nature and attracts people"

Kazumaki town (Iwate pref.; population: approximately 8,000)
"Community renovation: turning deficiencies into strengths"

Kaminoyama city (Yamagata pref.; population: approximately 34,000)
"Japan's No. 1 life-long lively community"

Tsukuba city (Ibaraki pref.; population: approximately 210,000)
* Reference: Number of foreign residents: approximately 73,000
"Global-minded research and university town with an established low-carbon lifestyle"

Nagoya city (Aichi pref.; population: approximately 2,258,000)
"Urban life compatible with nature (wind, water, and greenery)"

Tsuruga city (Fukui pref.; population: approximately 68,000)
"Town full of vigor with affluent electric power"

Miyazaki pref. (population: approximately 1,132,000)
*Miyazaki city (approximately 370,000)
"A society letting you live in affluence, with mutual independence and coexistence"

Okinawa pref. (population: approximately 1,380,000)
*Naha city (approximately 318,000)
"An affluent society blessed with bright sunshine, the wide open sea, and an assortment of new energy sources"

2-1. The vision of the ideal future society

The following ideal social models were developed through the discussion in the workshops held in eight regions.

1) Shichinohe town (Aomori pref.)

Desired society in 2050
"Harmony with nature. Convivial town that attracts people"

- Located on the foot of Mt. Hakkoda and surrounded by rich nature, Shichinohe city is gaining popularity as a sightseeing destination utilizing a castle ruin and ruins from the Jomon period.
- It has a station on the Tohoku Shinkansen line (Shichinohe-Towada), which provides the population with easy access to nearby cities, as well as a convenient intra-city transport system. It attracts citizens and visitors alike owing to the convenient infrastructure.
- It utilizes such nuisances as snow and garbage wisely as the untapped energy resources for positive use.
- Active cultivation of human resources that think wisely of nature and ecology.
- A city where you can live safely and comfortably with spiritual richness, and with a rich supply of water and food.

Results of group discussions (ordering of priority; AHP scores are shown in [ ])

	Group A	Group B	Group C	Group D
1	Production/utilization of regional energy [11.0]	Most advanced morning sightseeing services in Japan [16.0]	Good environment for both working and living, contributing to more of the population living comfortably [13.0]	Well preserved Water of Life (clear water) [14.0]

	Group A	Group B	Group C	Group D
2	Education in general [9.0]	A compact city with well-developed public transportation, providing citizens and visitors with an easy means of transport [8.5]	Enhanced amenities attract people to Shichinohe [12.3]	Local production for local consumption [9.3]
		Sightseeing services utilizing historical heritage and horses [8.5]	Easier access to nearby and remote regions [12.3]	
3	Population increase through the well-developed transportation modes [7.0]	High value-added food product utilizing nature (snow) [3.9]	Making agriculture a more exciting job [11.7]	Life with a rich flow of communication [4.6]
4	Nature-friendly living/environment [6.3]	Potential establishment of an agriculture and nature learning system, embracing a range of participants from children to university students (from large cities) [3.7]	Turn the nuisances into benefits: effective use of snow and garbage [1.6]	Means of high-speed transportation (migration, conveyance) [1.7]
5	Establishment of a sightseeing route activated the city [2.9]			

2) Kazumaki town (Iwate pref.)

Desired society in 2050

"Community renovation: turning deficiencies into strengths"

- Energy sources from the blessings of nature (solar energy, wind, river, forest, livestock, energy-conservation, systems).
- Education, welfare, a place for people to gather (educational collaboration, place for gaining experience, ICT, medical care, community, housing, jobs, high value-added agricultural products, settlement-type nature school).
- Infrastructure and value creation (public transport infrastructure, information infrastructure, new affluence, safety and security in the Kazumaki brand)

Results of group discussions (ordering of priority; AHP scores are shown in [ ])

	Group A	Group B	Group C	Group D
1	Efficient use of energy [26.0]	Environment in general [21.0]	Value creation that money can't buy [12.0]	Housing and regions in harmony with nature in Kazumaki [21.0]
2	Realization of high value-added agricultural products [24.0]	High-profit industry based on the locally available resources [17.0]	Affluent living in the province [12.0]	Availability of houses elderly people can live in safely [12.2]
3	Charming town that attracts people [14.1]	Self-sufficiency ratio of locally available renewable energy to other energy is much larger than 100 : 1 [12.6]	Utilization of resources available in Kazumaki [2.4]	Availability of means of transportation elderly people can use comfortably [7.5]
4	Improved job opportunities [5.5]	Medical care, community renovation, education [13.0]	Making money (jobs) [2.4]	Japan's top agricultural and welfare university [4.7]
5	Learn ecology within nature [3.8]	Optical fiber network [12.3]		Increasing job opportunities in the welfare sector [2.1]
6	Safety and security infrastructure is in place [3.8]	Affluent living environ-ment utilizing the local resource (timber) [11.4]		
7		Recreational opportunities [1.9]		

3) Kaminoyama city (Yamagata pref.)

Desired society in 2050

"Japan's No. 1 life-long lively community"

Kaminoyama-onsen "Kurort" project takes root firmly, and:

- the local population enjoys a lifestyle that helps them be healthy both in body and mind (fostering of lively "bodies and minds")
- the local population inherits and learns the merits of the region across the generations (lively "local links" are fostered)
- many visitors from all across Japan come in search of "health in body and mind" (lively local economy)

Results of group discussions (ordering of priority; AHP scores are shown in [ ])

	Group A	Group B	Group C	Group D
1	Kaminoyama "Kurort" is realized (including institutional design) [17.0]	Pervasion of facilities and institutions that make life easier [19.0]	Education that cherishes local values. [19.0]	Local production for local consumption [23.0]
2	Local vitality is pervasive and centered on the hot spring [12.6]	Living without anxiety in body and mind (reliable and comfortable town) [14.2]	Healthy way of community renovation based on local merits (the hot spring, agricultural produce) [12.2]	Establishment of individual lifestyles backed up by Kaminoyama resources [17.0]
3	The local population makes full use of local products [10.3]	Various lifestyle conveniences [9.4]	Comfortable town that attracts people [11.0]	Ecological infrastructure encouraging people to settle down for child-raising [15.2]
4	Learning opportunities are in place for receiving foreign visitors (enhanced local style) [4.6]	The local population enjoys life-long learning (various learning opportunities) [7.5]	Ecological town (energy, 3R) [4.8]	Education on the recycling environment [9.2]
5	Established transport infrastructure making Bodaira (Zao) accessible [2.0]	Lively town teeming with sightseers [2.5]	A bridge between regions [1.7]	Effective utilization of hot springs and snow [1.4]

4) Tsukuba city (Ibaraki pref.)

Desired society in 2050

"Global-minded research and university town with an established low-carbon lifestyle"

- The citizens are living in a compact and smart town in well-organized collaboration among a variety of sectors (green house gas emissions will be reduced by 80% compared to today)
- An established lifestyle that supports the regional environment and cultural evolution based on scientific of thinking.
- Various occupations, in addition to researcher, are available for the next generation.
- Internationally compatible education is pervasive, and citizens are leading healthy and stress-free lives with ease of communication.

Results of group discussions (ordering of priority; AHP scores are shown in [ ])

	Group A	Group B	Group C	Group D
1	Social health policy [17.0]	Compact city plan [19.3]	Communities, education, work [10.0]	Scientific lifestyle make it stylish [15.0]
2	Energy [14.3]	Healthy and stress-free social life [16.2]	The environment [9.3]	The city makes collaborative efforts to reduce CO2, CFCs, CO [14.3]
3	Lifestyle Education Communication [7.5]	Clean energy and high efficiency [15.3]	Smart city [8.0]	Work-life balance [10.2]

	Group A	Group B	Group C	Group D
4	Eco-friendly food recycling and waste [4.6]	Eco-friendly public transportation and bicycles: “Give up my car” [6.3]	Sport and health [1.5]	Education (more efficient and flexible) [6.8]
5	Transportation Infrastructure [2.8]	International communication and education [1.7]		Local, natural, and organic food [1.8]

5) Nagoya city (Aichi pref.)

Desired society in 2050

“Urban life compatible with nature (wind, water, and greenery)”

- Realization of a disaster-tolerant and environmentally-friendly lifestyle, with effective use of wind, water, and greenery, inside and outside the urban area.
- Realization of internationally compatible education and cultural life — with a sophisticated taste for cultural assets and art — making Nagoya a well known metropolis around the world.
- Well-established cooperation between the local government and citizens enables the provision of energy, a recycling system, food, and water (including clean rivers).
- The public transport system, with wise use of automobiles, enables citizens to move to their work sites within 30 minutes, and move anywhere in the urban area within 15 minutes.
- Wide diffusion of welfare and medical services provides citizens with the environment for secure child-raising and centenarian longevity.

Results of group discussions (ordering of priority; AHP scores are shown in [ ])

	Group A	Group B	Group C	Group D
1	Disaster resistant city [21.0]	Solid basis of medical care [23.0]	Lifestyle in harmony with nature (wind, water, greenery) [22.0]	Substantial array of public transportation [19.0]
2	Rich array of public services [12.3]	Substantial level of education [17.0]	City where citizens lead eco-friendly lifestyles through collaboration [21.3]	Education and child raising [10.3] Science and technology, environment, and energy [10.3]
3	Charming city that attracts people from around Japan and abroad [8.2]	Improvement of energy, transportation, and infrastructure [7.3]	Comfortable urban life with healing [12.5]	Living, life, nursing care [4.9]
4	A model city for saving and creating energy, recycling, and reuse [4.7]	Conversion of lifestyle [4.6]	Wise car usage compatible with public transportation [7.6]	Recreational opportunities [1.8]
5	Beautiful Nagoya [2.0]		Comfortable, low-energy life [3.0]	

6) Tsuruga city (Fukui pref.)

Desired society in 2050

“Town full of vigor with affluent electric power”

- Industries related to nuclear power and research organizations are operating actively, and there is a positive job environment in terms of both quality and quantity.
- Tsuruga, as a town of electricity, is aiming at becoming an attractive town utilizing its affluent supply of electricity.
- A downsized town that is oriented toward safety and security and allows spiritually affluent lives across three generations. This compact town attracts people by its own merits.
- A substantial range of infrastructures (public transport, hospitals, education), backed up by the affluent supply of electricity, enables citizens to lead lives that value nature and historical heritage.

Results of group discussions (ordering of priority; AHP scores are shown in [ ])

	Group A	Group B	Group C
1	Town of electricity [19.0]	A town that cultivates diverse human resources [23.1]	Industry: based on nuclear power (employment) [6.0]
2	Improved job opportunities [10.0]	A town with well-established security [22.0]	Safety: security and safety [3.3]
3	A compact town where three generations live together comfortably [7.5]	Infrastructure building [16.5]	Living: urban planning/town [0.6]
4	A town where you can live with nature [6.3]	Busy and lively town [8.3]	
5	A town with a rich array of infrastructures [2.5]	Nuclear power related industries [1.9]	

7) Miyazaki prefecture

Desired society in 2050

"A society where you can live in affluence, with mutual independence and coexistence"

- Comfortable life, with a well-ordered environment for both working and staying healthy
- Seamless symbiosis between humans and nature, while maintaining independence.
- Well-organized separate areas (forest, farmland, residential area) are bustling with a variety of people leading various lifestyles.
- Ecological society that allows cooperation both within and beyond the region, conducive to eliminating alienation.

Results of group discussions (ordering of priority; AHP score is shown in [ ])

	Group A	Group B	Group C	Group D
1	Healthy and economical life [13.0]	Food [23.0]	Reinvention of rural energy [19.0]	Comfortable society both in terms of working and maintaining health [12.0]
2	Independent individuals support each other [11.0]	Area design [17.0]	Miyazaki as a health farm [10.3]	Society that allows independent but symbiotic existence of humans and nature [9.3]
3	Utilization and stable supply of local energy sources [5.7] Realization of zero-emission agriculture [5.7]	Human resource cultivation [16.3]	Town teeming with a variety of people (visiting sports enthusiasts, etc.) [9.6]	Ecological society conducive to eliminating feelings of alienation [8.0]
4	Construction of environmentally-friendly public transportation system [2.2]	New energy resources [11.0]	Green-region renovation (elimination of concrete buildings) [4.8]	Society that has attained such a level of ecology that ordinary ways of living automatically translate into further enhancement of ecology [1.5]
5		ICT [6.1]	Elimination of dependence on automobiles [1.9]	
6		Migration [3.9]		
7		Natural environment [3.7]		

8) Okinawa prefecture

Desired society in 2050

"An affluent society blessed with bright sunshine, the wide open sea, and an assortment of new energy sources"

- The lifestyle, tourism, and work aspects of Okinawa are all in harmony with its environment and gain the spotlight.

- An educational system that fosters independence and has a strong international flavor is established, and it produces material results.
- With full work and education options, and with traditional spirits maintained, Okinawa provides an environment in which you can lead an active life.
- Okinawa receives attention for its characteristic production and utilization of natural energy resources, such as deep-sea water, solar power, and solar heat.

Results of group discussions (ordering of priority; AHP scores are shown in [ ])

	Group A	Group B	Group C	Group D
1	A society in which citizens feel happy [17.0]	Community [15.0]	Work to link cities with agricultural communities (links between medicine, diet, and tourism) [18.0]	Utilization of deep sea water as an alternative to petroleum energy [25.0]
2	Preservation of the natural environment [15.0]	Energy [8.3]	International education, Okinawan style (increasing motivation) [14.0]	Utilization of a variety of natural energy in Okinawa receives widespread attention [16.2]
3	Energy-saving, safe living [7.0]	Health [7.6]	High technology, region-specific food products [9.9]	Steady conservation of native ecosystem has boosted tourism, and lifestyles became affluent [7.3]
4	Work-education cycle [6.4]	Education [7.4]	Fuel-free transport network covering a wide area [7.9]	Traditional spirit everywhere in Okinawa has gained recognition [4.6]
5	Energy utilization, Okinawan style [1.9]	Industry, tourism, employment [2.8]	Okinawa as an environmental theme park that gathers the world' s attention (tourism) [7.7]	Variety of lifestyles that allow family and friends to work together [2.1]
6			Realization of sustainable living and life, Okinawan style [2.3]	

2-2. Essential industries and services to make the future social model into reality

In the concluding workshop, many views were put forward, in terms of industries and services, aiming at the realization of regional ideal models of future society. The views are listed in Table 1, and graphically summarized in Table 2. The industries and services essential for the purpose described above are broadly classified into four categories: “Effective utilization of energy,” “Regional model and social infrastructure,” “Health care of body and mind,” and “Emerging industries and services.”

Table 1: The points that received recognition from other regions

1) Effective utilization of energy:

Region	Points mentioned
Shichinohe	[High diffusion ratio of new energy] ● Realization of new energy industry → EV town ● Subsidy to promote the introduction of new energy and energy saving.
Kazumaki	[High self-sufficiency ratio of food and energy] ● Self-sufficiency ratio for food: 180%; for energy: 160% ● High self-sufficiency ratios for energy and food ● Wind-power generation ● Biomass ⇔ manure ⇔ live stock – meadow, forest, dairy farming, alcohol (wine) ● Respectable achievements in introduction and development of various types of clean energy ● Local people's understanding of clean energy

Region	Points mentioned
Tsukuba	[A society with fewer cars] ● Promotion of bicycle use over automobiles ● “Give up my car”
Tsuruga	[Energy-source town: understanding of nuclear power generation] ● Citizen’s viewpoint toward the town embracing an energy-generation facility ● Community renovation focusing on the characteristics of the “electric energy town” ● Affluent town with the supply of nuclear power. Does the large number of out-migrants threaten the establishment of research facilities? ● Very high local understanding and expectations of the nuclear power plant ● Dependency on the electric industry is similar to Nagoya’s dependency on the automobile industry ● Self-contained town: local city that does not rely on other cities.
Miyazaki	[Utilization of new energy] ● Solar power, small-scale hydropower
Okinawa	[Energy farm] ● Energy farm ● Energy industry that considers the sea as a energy source ● Solar, wind, deep seawater, wave, and tidal power. CO2 fixation by marine biomass ● Approached leveraging the wealth of the natural environment ● Independence in terms of energy

2) Regional model and social infrastructure:

Region	Points mentioned
Shichinohe	[Rendering historical and natural heritage into tourism/service resources] ● Emphasis on the link with neighboring areas (e.g. Sannai-Maruyama) ● Route connecting Jomon ruins ● Highly attractive, magnificent nature ⇒ great tourist attraction ● Attentive preservation of nature ● Tsutsuji road aims to be Japan’s No. 1 attraction ● Approached nature conservation and consolidation of population [High value-added food industry and agriculture] ● High value-added food industry that takes advantage of the local specialty (i.e. snow) ● Secure and safe food supply ● “Agriculture with motivation”
Kazumaki	[High value-added agricultural product] ● Heightening of added value during the production process: shiitake mushroom production utilizing electricity ● Heightening of added value in agriculture by application of new technology
Kaminoyama	[Formation of regional community] ● Emphasis on kizuna (emotional ties) [Professionalization of guides] ● Professionalization of guides ● Professionalization of guides for regional development and cyclical form of education
Tsukuba	[Creation of internationally compatible town: acceptance of foreigners] ● Internationally compatible town ● A town highly responsive to changes ● A town that embraces foreigners as community members ● Foreigner’s stay
Nagoya	[Well balanced city design between urban functionality and natural environment] ● Emphasis on nature in the large city: city keywords include “wind, water, and greenery”. ● Well balanced link between urban functionalities and the natural environment ● Affinity to the river (water) ● Easy access to promotion locations (e.g. nature) ● Public relations approach for industries and local culture
Tsuruga	[Compact town: zoning] ● Safety and security in a compact town ● Zoning concept within the town ● A compact city where three generations can live comfortably. An approach to area zoning.
Miyazaki	[Invigoration of primary industry and collaboration with NPO] ● New “3K” (smart, profitable, and exciting) ● Primary industry: the approach of the local government to link each area to enhance the whole prefecture activities, and linkage strategy with NOPs. ● Self-sufficiency ratio of food: 246% (ranked top in Japan) ● Agricultural power, self-sufficiency ratio of food
Okinawa	[Design of town and community] ● Community oriented zoning: miniaturized version of a compact city

Region	Points mentioned
	● Car traffic is banned within the community ● ARUKU (walking) community ● Light-rail train ● Fuel-free transportation network ● New approach for community formation

3) Health care of body and mind:

Region	Points mentioned
Shichinohe	[Energy-saving oriented lifestyle] ● Morning-type sightseeing service
Kaminoyama	[Kurort: a stay-in-nature approach for health care and preventive medicine] ● An idea of rendering nature into an exercise course ● Preventive medicine by field-trekking approach (Terrainkur) and health food ● Geological environment and local resources (i.e. hot spring) serve to promote health and create local attraction. ● “Terrainkur” course ● A health promotion approach utilizing local resource (i.e. hot spring) ● Health resort therapy ● Medical care system without a hospital ● Spa therapy — a viewpoint toward longevity [Health related technology] ● New technologies inspired by the processes toward health promotion
Tsukuba	[Social evolution through the acceptance of overseas wisdom] ● Analysis form an international viewpoint ● Tsukuba is in the process of creating an international region through proactive acceptance of wisdom from overseas. ● Contact with citizens and students in the open laboratories ● Internationally compatible (common) education ● Opportunities to be exposed to science and technology [Creation of internationally-minded civic society] ● Courteous greetings, and respectful attitudes ● Permeation of “Tsukuba people” concept ● Local-people concept of “Tsukuba people” ● Preserved countryside environment --- Rich in spirit, and courteous attitude
Nagoya	[Sense of balance] ● Regional renovation balancing various aspects of the region ● Region with a sense of balance [Securement of comfortable life for citizens in a large city] ● Realization of a comfortable life for citizens in a metropolis ● Renewed attention to the magnitude of difference in regional characteristics between big cities and rural areas.
Tsuruga	[Town renovation toward intercommunication across three generations] ● Town renovation toward intercommunication across three generations ● A town that enables spiritually rich lives across three generations
Miyazaki	[Stabilization of intermediate and mountainous area] ● The group activities of volunteers (“Chu-sankanchi Moriage-Tai”) have the effect of preventing suicides, and promoting regional activation. ● Disaster-tolerant region — enlivenment of intermediate and mountainous areas ● The problem of the high suicide rate can not be resolved only by symbiosis with nature
Okinawa	[Community formation around large families: inheritance of culture and natural features] ● Community formation based on large families ● Inheritance of Ryukyu culture, and cooperation within the community

4) Emerging industries and services:

Region	Points mentioned
Shichinohe	[Subsidies according to the amount of CO2 absorption] ● Subsidy system for emission reduction ● Subsidy for CO2 absorption by the forest [Cutting-edge technology] ● Interesting concepts such as portable nuclear power, and agricultural robots.
Kazumaki	● Joint public-private ventures turned a profit
Kaminoyama	[Various purchasing benefits (Eco-points)] ● Introduction of various types “Eco-points” ● Insurance for preventive medicine ● “Agricultural product eco-points” to promote local production for local consumption ● “Health eco-points” system

Table 2: Industries and services conducive to the realization of the ideal regional social model

Industries and services conducive to the realization of the ideal social model	**Effective utilization of energy**	**Regional model and social infrastructure**	**Health maintenance of body and mind**	**New industrial service**
Related keywords	LCA, agricultural produce, logistics, food factory, ICT, compact city, etc.	Traffic, tourism, agriculture, family, local time, new "3K" (dirty, dangerous, difficult jobs), lifestyle, etc.	Health, Onsen (hot spring), sports, ICT, life style, etc.	High-value added agriculture, farmstay, health maintenance, educational hub, etc.
Shichinohe town (Aomori pref.)	□●	●	□	
Kazumaki town (Iwate pref.)	□●		□●	
Kaminoyama city (Yamagata pref.)	□		□●	□●
Tsukuba city (Ibaraki pref.)	□●	●	□●	
Nagoya city (Aichi pref.)			□●	□
Tsuruga city (Fukui pref.)	□●	□●		
Miyazaki pref.	□●		●	□
Okinawa pref.	□●	●	□●	

□: Industries and services mentioned as having priority in the regional WS, from the viewpoint of "regional life style."
●: Industries and services highly evaluated by the experts in science and technology from the viewpoint of having "potential for future evolution (industry)."

2-3. General discussion

The science and technology that are instrumental for the realization of each region's future social model, as well as the schemes for promoting them, are shown in Figure 5.

In all the target regions of this survey, the need for technical development for energy with zero CO_2 emissions was commonly mentioned. Also mentioned was the importance of integration with conventional technologies, as well as the development of technology management schemes and business models. To facilitate actual realization of these technologies, a detailed discussion is necessary on the institutional bottleneck that will impede the diffusion and utilization of them.

Who will take the lead in the processes toward realizing the ideal models in society? This is the most important issue to be discussed. To build a society wherein citizens live comfortably, an essential step of the processes consists of drawing up a regional model fully compatible with the environmental conditions of the region. For this purpose, a platform for consensus building must be set up involving the general public, and social infrastructure improvements will have to proceed. The improvement of environmental conditions according to the needs of many citizens requires a continued investment from public resources, and this, in turn, will necessitate the securing of financial resources by such measures as the creation of new industries and services to expand job opportunities, and the enhancement of value added products of the region.

The establishment of new industries and services requires, first of all, self-reliant effort on the part of the enterprising body, and a large-scale investment may be unfeasible for some regions. To construct a society with low environmental load, it is necessary to consider the introduction of a system that allows inter-regional CO_2 cap & trade to secure financial resources, as well as support, through investment and financing, for self-sustaining growth of new industries and services. Along with the continued regional effort to establish a self-reliant social infrastructure, in terms of both energy and food, collaborations between distant regions (for example, Tohoku and Kyushu), as well as between neighboring regions, should be considered proactively in the future. In the course toward the construction of a low carbon society, yet another challenge lies in providing the social foundation that embraces an aging society.

Figure 5: Science and technology relating to the emerging industries and services, and promotion measures to be taken

"Effective utilization of energy"

Related science and technology

- Full use of regional characteristics (industry, climate, geological features):
  — Biomass power generation (manure, forest)
  —Snow, cool energy, geothermal heat, underground geothermal energy
  —Ocean thermal energy conversion, tidal power generation, cool energy of deep sea water, algae utilization (fuel production, CO_2 fixation)
- Development of power grid networks and telecommunication networks. Advanced utilization of them.

etc.

Institutional requirements for promotion

1. Fund support, and preferential taxation
2. Subsidies for forest fixation of CO_2, self-contained systems of new energy and energy-saving. System building for inter-regional cap & trade.

etc.

	Relevant topics in the 9th Delphi survey (Forecasted years of social realization)
Industries and services that utilize waste (from forestry and stockbreeding) for the generation and selling of electric power.	A co-production process for bio fuels and hydrogen through biomass fermentation and gasification (2025)
	A co-production system of chemicals and energies under biorefinery (2028)
Plant factories that utilize water and new energy	(a proposal that was not covered by the Delphi survey)
Utilization of snow and cool energy for the cool storage of vegetables.	(a proposal that was not covered by the Delphi survey)

"Regional model and social infrastructure"

Related science and technology

- Transport system for the elderly population, system for road accident prevention, high-speed transport network, advanced use of GPS, and public transport system with low environmental load.
- Urban planning, housing technology compatible with heavy snow.
- Energy utilization of rivers and snow in residential areas

etc.

Institutional requirements for promotion

1. Regional investment in public transport
2. Car sharing — electric vehicles
3. Improvement of public transport system: consolidation and integration.

etc.

	Relevant topics in the 9th Delphi survey (Forecasted years of social realization)
Transportation and related areas	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 (2023)
Electric power and related areas	Distributed energy system including garbage processing technology that effectively uses household waste while promoting resident participation (2020)
Infrastructure and related areas	In the case of downsizing the urban area because of population decline, a compact infrastructure plan will be constructed in view toward a natural symbiotic urban area with due consideratio to sustainability of the water cycle, ecosystem and lifestyles (2027)
Management	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 (2027)

“Health maintenance of body and mind”

Related science and technology

- Health management technology utilizing ICT (e.g. Web doctor)
- Medical care system based on health data: elimination of the need for hospitals
- Wellness medicine, sports medicine
- Rehabilitation technology

etc.

Institutional requirements for promotion technology

1. Self-reliant effort for maintaining the health of body and mind, including the application of the insurance system to preventive medicine.
2. Tax benefits for the businesses that provide health care (body and mind) services

etc.

	Relevant topics in the 9th Delphi survey (Forecasted years of social realization)
Web doctor	(a proposal that was not covered by the Delphi survey)
Urban renovation technology (normalization of urban area)	Promotion of high-quality and long-life block 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 (2025)
Utilization of thermal energy from hot springs	(a proposal that was not covered by the Delphi survey)
Wellness medicine, sports medicine	(a proposal that was not covered by the Delphi survey)
Rehabilitation technology	(a proposal that was not covered by the Delphi survey)
ICT supported health management technology	(a proposal that was not covered by the Delphi survey)
Medical care system based on health data: elimination of the need for hospitals	(a proposal that was not covered by the Delphi survey)

“New industries and services”

Related science and technology

•Enhancement of added values in agricultural products
•Element technologies for utilization of natural-resources (snow, deep-sea water…), small electric vehicles for agricultural use, environmentally-friendly logistics, and plant factories.
etc.

Institutional requirements for promotion

1. Communication from the regions for the widespread knowledge of ecological health services and local tourism
2. One-stop service for production, logistics, and sales
3. Cultivation of human resources capable of communicating with the customers
4. Regional development of vehicles (e.g. a lightweight truck), and the measures to support endeavors such as public purchase and tax benefits.

etc.

	Relevant topics in the 9th Delphi survey (Forecasted years of social realization)
Life, education, and culture	An evaluation method for local environment preservation activities, including traditional festival and cultural behavior, which is impossible to evaluated with economical indicators (2025)
Management	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 (2026)
	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 (2022)
	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 (2024)

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