

2 R&D Contribution to the Recovery and Reconstruction of Businesses in Disaster-hit Area

The 4th Basic Plan states that “the creation of new industries is indispensable. Aiming towards this, the national government needs to play a positive role by promoting R&D of non-continuous innovative technology, that aims to renovate the economic and social systems, not only by the development of existing technology, but also by new principles and organizations.” Namely, a big role is expected from S&T to lead the reconstruction and revival of the industries of afflicted regions, and concrete actions have been started including the utilization of the supplementary budget for FY 2011. Hereafter, we will introduce major measures for these matters.

(1) Implementation of Existing R&D Results

1) Biotreatment of spilled oil by Bark Compost

For the reconstruction of regions that suffered large damages from the tsunami, not only the restoration of fishery industry and port facilities are indispensable, but also the rehabilitation of its coastal area and sea area that were contaminated by the tsunami.

On one of the coasts afflicted by the tsunami, complex contaminants that contain oil and salt spilled from a fuel tank are piled up. Conventionally, these contaminants were disposed of only by incineration, but a demonstration experiment that decomposes and disposes of such contaminants using microbes of “bark compost¹⁾” was implemented at the Bay of Ofunato, where 1,000 liters of heavy oil drifted, by the Oita Industrial Research Institute Center in October 2011 (Figure 1-2-12). In the demonstration experiment performed, approximately 250 liters of spilled oil, recovered by volunteers with the cooperation from the Ofunato City, were put into bark compost of the volume of 100 m³ (about 50 tons) and decomposition of the oil was confirmed. Finally, most oil was decomposed to a fertilizer that can be used as a greening material. (“The Implementation-Support Program” under the JST Strategic Basic Research Programs by the Japan Science and Technology Agency (the Research Institute of Science and Technology for Society) (adopted in 2007).

Figure 1-2-12 / Demonstration Experiment of Bio-Disposition of Collected Drifted Oil in the Bay of Ofunato



Microbes decomposing the oil (length approx. 2 to 3μm)



Bark compost piled up in cone that contains spilled contaminants

Supplied by: (left photo) Hiroshima University, (right photo) the Oita Industrial Research Institute Center

¹⁾ Compost widely and generally used in mixing of barks of larches and poultry manures. In the process of making composts to ferment and pile it up in cone, it is characteristic that the temperature inside the compost rises to 50 to 70 degrees C°. As microbes that decompose the oil are present in the compost, when recovered oil is put in the compost, the high temperature and active microbes decompose the oil, and after the decomposition, it becomes usable as a kind of fertilizer. When this is utilized, compared with incineration disposal, the emission of carbon dioxide will be decreased by 1/3 or so.

2) Improvement of the Marine Environment by the Micro Bubble Technique

Due to the tsunami that occurred during the GEJE, soils and sands as well as slimes that had been piled on the seabed for long time were rolled up, lots of oil and contaminated water and rubbles flew into the closed sea areas, and the deterioration of water quality particularly in summer was of great concern. In the Bay of Ofunato, famous for oyster cultivation, cases of shellfish poison and temporarily red tide were reported. In this Bay, an experiment to increase the density of dissolved oxygen in the water, purify water quality and grow marine organisms by supplying very small air bubbles (1/4 or so of a hair) called “micro-bubbles” was done by the team of Professor Hirofumi Ohnari of Tokuyama College of Technology from August 2011 to March 2012. At Takonoura of the Bay of Ofunato, at the beginning of August, 104 micro-bubbles generation equipment was set around scarcely left seed oysters and cultivation rafts. Since then, after supplying micro-bubbles of approximately 150cm³ a day, the oysters grew about double the original size (shell length of 8 through 13 cm, and average shell length of 10cm) in 3 months and a half and the cultivation period is shortened greatly (Figure 1-2-13). In addition, the experiment made it possible to cultivate non-spawn oysters (oysters that deliver and contain meat without ovulation) for the first time. Furthermore, it was confirmed that the diffusion influence range of the micro-bubbles was about 300 m radius horizontally by the JST Strategic Basic Research Programs by the Japan Science and Technology Agency (“The Application Support Program of the Results of Emergent Research and Development in Response to the Great East Japan Earthquake” by the Research Institute of Science and Technology for Society) (adopted in 2011).

Figure 1-2-13 / Utilization of Micro-Bubbles in Oyster Cultivation



Grown Oyster at Cultivation Place Where Micro-Bubbles Was Used (as of November 14, 2011)

(Photo: by Ms. Yuka Ohnari)



32 Micro-Bubble Generation Equipment

Photos were supplied by Professor Hirofumi Ohnari of Tokuyama College of Technology

(2) Construction of R&D Bases

Hereafter, we will introduce measures for building of R&D bases to match social needs, such as the rehabilitation of industries and the securing of employment in the afflicted regions (Figure 1-2-14).

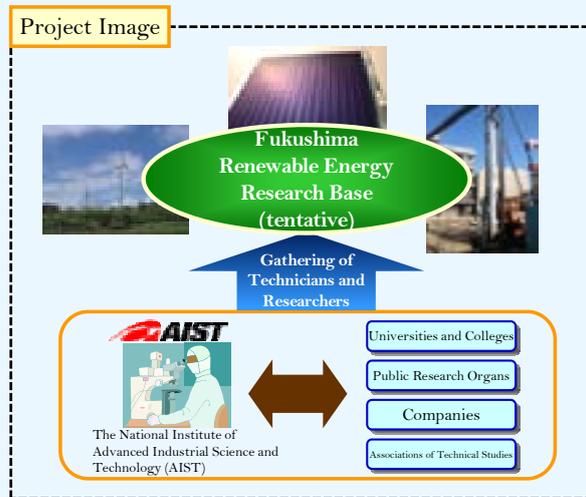
Figure 1-2-14 / Cases of the Building of Bases for R&D Matching to Social Needs

1) Fukushima Renewable Energy Research Base (tentative)

In order to prevent the falling of manufacturing industries in Japan and foreign companies from leaving the country, and in response to the need of securing stable supply of electric power, a world class R&D base related to renewable energy and to promote the related industrial accumulation has been built.

The National Institute of Advanced Industrial Science and Technology (AIST) arranged the early building of a Business-Academia-Government common use R&D base in Fukushima Prefecture to aim at the application of the technology in the field of renewable energy technology, utilizing the third supplementary budget for FY 2011 (10.1 billion Yen). In this base, it is scheduled that public research organizations, companies and universities and colleges gather together and perform the building of the demonstration line of R&D of the next generation solar battery, R&D related to wind power generation technology, the design and demonstration of the geothermal utilization system, and the demonstration and experiments of diffused type energy management.

Together with the above, the Institute will promote consistent R&D from basics to actual application through the R&D concerning hyper-efficient solar battery by inviting world class researchers of solar battery, utilizing this base.



Source: Created by the Ministry of Economy, Trade and Industry

2) Tohoku Medical Megabank Project

In Tohoku region where the shortage of physicians was clear prior to the GEJE, further flow-out of human resources of medical profession that support regional medical care is of concern. For the reconstruction of Tohoku region, not only is the recovery of the regional medical care of great importance, but also the establishment of the next generation medical care system to supply the residents of the afflicted regions with cutting-edge medical care. At the 6th Reconstruction Design Council in response to the Great East Japan Earthquake held on June 11, 2011, Mr. Murai, the governor of Miyagi Prefecture proposed the creation of “The Tohoku Medical Megabank” and the necessity of tackling from the afflicted regions was requested.

Taking these movements into account and closely collaborating with an information communication system promoted mainly by the local government of Miyagi Prefecture¹ and the building of an information communication system (the collaboration base of regional medical care information), the government of Japan started the “Tohoku Medical Megabank Project,” utilizing the third supplementary budget for FY 2011 (approximately 15.8 billion Yen). In this work, mainly led by Tohoku University, the promotion of health of the residents of the afflicted regions through dispatching of human resources and the circulation of the results of health checks, a large scale study of genome cohort² is to be conducted mainly for the afflicted regions and the study related to the next generation medical care like personalized medicine³ is to be promoted, utilizing the information on genes related to diseases obtained from these activities. This tackling aims not only at the supply of the next generation medical care ahead of the world to the residents of the afflicted regions, but also to perform R&D aiming at the creation of new industries such as making of new drugs.



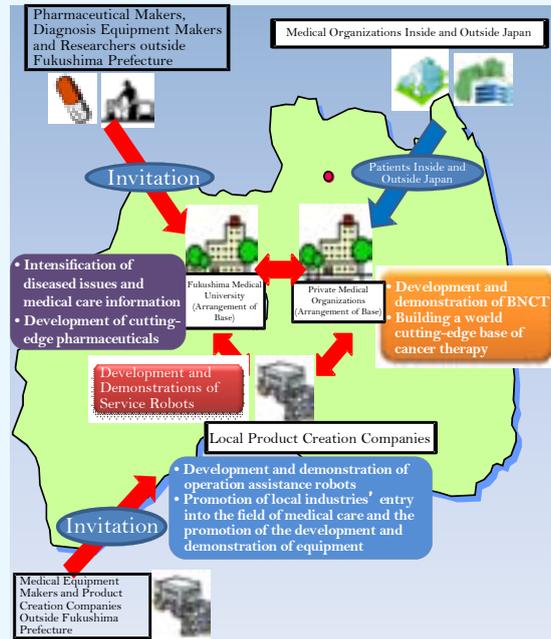
Source: Created by MEXT

¹ The system can store medical care information in a standard file format and share the information through networks
² A study to identify gene elements and environmental elements related to diseases and drug kinetics by collecting biological specimens, health information and diagnosis information from the residents who consented and by analyzing these with genome information obtained from biological specimens.
³ Based on the knowledge obtained from cohort study, to select and supply therapies that are considered to be most suitable from the genome information of individuals.

3) R&D Base for Medical/Welfare Equipment and Medicine Industry in Fukushima Prefecture.

From before the happening of the GEJE, main plants of competitive companies in the field of medical equipment are located in Tohoku region. Utilizing part of the Fukushima Nuclear Power Disaster Reconstruction Fund¹ for Fukushima Prefecture (the 3rd supplementary budget for FY 2011 with the amount of approximately 39.5 billion Yen), mainly led by Fukushima Medical University, the local government of Fukushima Prefecture will arrange the R&D base of drugs and medical equipment, and together with this, build a R&D base of cancer therapies by use of boron-neutron capture therapy (BNCT²), as well as developing new drugs, medical equipment and medical robots supplied by the collaboration among the companies and medical organs in Fukushima Prefecture.

Concretely, 1) Fukushima Medical University and regional medical organs will collaborate, and collect the information on disease tissues and medical information and analyze the data. The companies will utilize gathering of the data and arrange a drug discovery base to search targeted protein, 2) develop and demonstrate BNCT toward the building of a base of cutting-edge cancer therapies, and 3) implement the development and demonstration of medical equipment and robots produced by the collaboration among the product creation companies and medical organs in Fukushima Prefecture. This measure aims to improve the quality of medical care, welfare and life of the residents of Fukushima Prefecture who suffered from the nuclear power incident and at the creation of new industries and employment.



Source: Created by the Ministry of Economy, Trade and Industry

4) R&D Base for Radiation and Decontamination



Radiopharmaceutical Manufacturing Facility

Supplied by the National Institute of Radiological Sciences



Scene of Lecture Meeting on Decontamination in Fukushima Prefecture

Supplied by the JAEA

In order to reconstruct and rehabilitate after the accident at TEPCO Fukushima NPS, utilizing part of the Fukushima Nuclear Power Disaster Reconstruction Fund (the 3rd supplementary budget: approximately 22.3 billion Yen) and gathering talents both in Japan and from abroad, the local government of Fukushima Prefecture will implement to arrange a R&D base related to radiology and cutting-edge diagnosis and a R&D base to develop decontamination technology.

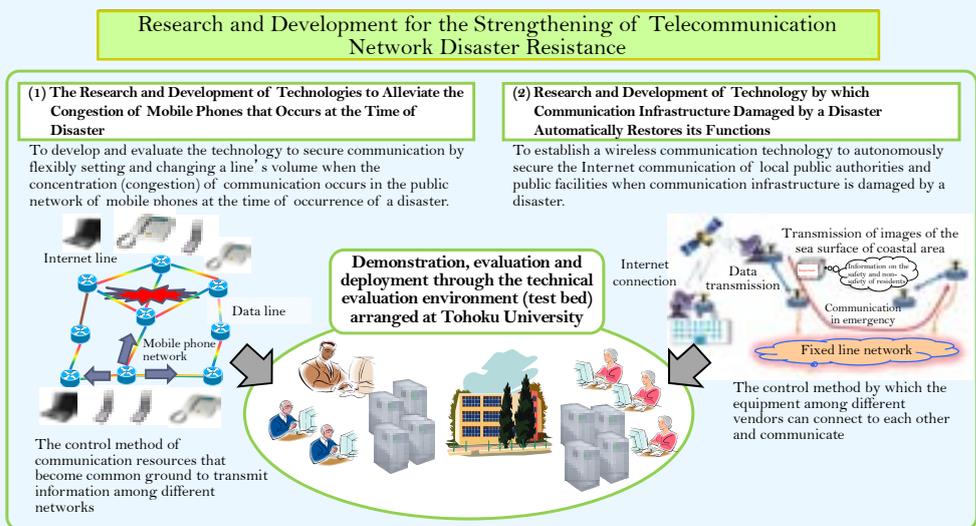
Concretely, to contribute to the maintenance and promotion of health of the Fukushima Prefecture residents, to arrange the R&D base of cutting-edge diagnosis using radiopharmaceuticals³, and to contribute to dissolve the unrest of the residents, the local government of Fukushima Prefecture will implement the tackling with the elucidation of influence of the radioactive substances released by the accident on the people through the ecology. Furthermore, to early recover the environment contaminated by the radioactive substances, the local government will arrange "The Fukushima Environment Creation Center (provisionary name)" as the facility of a R&D base and implement the information transmission concerning the investigation, research and decontamination of the environment recovery and creation technology as well as the radiation.

¹ The Fund is set based on the Fukushima Prefecture Nuclear Power Disaster Fund Ordinance (dated December 28, 2011) to accumulate funds required for the assistance of restoration of the lives of the afflicted people by the Great East Japan Earthquake, the arrangement of the research organs concerning radiology, assistance of companies' location and other business that contributes to the reconstruction from the nuclear power disaster as well as the work done by cities, towns and villages to recover from the nuclear power disaster.

² A therapy to invest boron (¹⁰B) compound that tends to gather in cancer cells to patients beforehand, and selectively destroy the cancer cells by alpha particles and atomic nucleus of lithium arising from the irradiation of neutral beams.

³ A diagnosis for the existence and non-existence of cancer by investing a radioactive drug that has a characteristic to gather in the cancer cells to a human body and using equipment that enables to visualize the distribution of the drug in the human body.

5) R&D Base to Strengthen Disaster-resistance of the Information and Communication Network



Source: Created by the Ministry of Internal Affairs and Communications

Taking into account the congestion of the communication lines caused by the concentration of the confirmation of safety status of afflicted people and the situation of the communication stoppage caused by the affliction in the GEJE, and to build a new international base of the innovation of R&D by Business-Academia-Government collaboration in the telecommunication field through the National Institute of Information and Communications Technology, utilizing the 3rd supplementary budget for FY 2011 (15.9 billion Yen), the Ministry of Internal Affairs and Communications is arranging the facility of R&D and demonstration experiments in Tohoku University.

In the future, the Ministry will implement R&D experiments for the strengthening of the disaster resistance in telecommunication network at the above base, fully utilizing the knowledge and strong points of private companies, universities and colleges in the afflicted regions. It aims at develop a telecommunication network that is strong against disasters and contribute to the rehabilitation of the regional economic activities by the creation of new industries and employment.

6) Tohoku Marine Science Center

FORMATION OF TOHOKU MARINE SCIENCE CENTER

- With the 2011 off the Pacific coast of Tohoku Earthquake and Tsunami, large amounts of piled-up rubble, the loss of algae sites, and the piling-up of sand and mud in rock reefs drastically changed the marine ecology, including the fishery grounds of coastal areas.
- Aiming for the reconstruction of the Tohoku region, MEXT will build the Tohoku Marine Science Center as a network for reconstruction support from universities, colleges, and research organizations, and through collaboration with local authorities and associated Ministries and Agencies, will implement the technical development that will lead to investigation and research on marine ecosystem and the creation of new industries.

Investigation and Research on Marine Ecology

Making the Otsuchi Bay, Onagawa Bay and Sendai Bay for which investigations and research had been implemented since before the earthquake disaster as the model, MEXT continuously investigated the physical and chemical environment and biological kinetics from coastal areas to offshore areas.

- Elucidation of the fluctuation mechanism of ecosystem off the Pacific coast of Tohoku
- Supply of scientific knowledge that contributes to the recovery of fishery grounds

- **Tohoku University (Representative Organization):** Elucidation of the change process of the environment of fishery places
Investigation of mainly the ecology of algae places and land reclamation concerning the Onagawa Bay and Sendai Bay
- **The University of Tokyo (Sub-Representative Organization):** Elucidation of the fluctuation mechanism of marine ecosystem
Observation of the physical and chemical environment and living organisms in land areas, coastal areas and offshore areas as for Otsuchi Bay and analysis on the interactive action among them
- **The Japan Agency for Marine-Earth Science and Technology (JAMSTEC) (Sub-Representative Organization):** Elucidation of the fluctuation mechanism of offshore seabed ecology
Implementation of investigations and research on the rubble mapping and kinetics of biological resources at offshore seabed and the accumulation of chemical substances

- **Gathering of nationwide researchers mainly led by these 3 Organizations**
- **Publication of information to fishermen, arranging the data base**

Technical Development That Leads to the Creation of New Industries

In order to nourish industries that effectively utilize the sea resources in coastal areas off the Pacific coast of the Tohoku Region, development of innovative technologies based on technical seeds held by the universities will be implemented. Feasibility studies will be implemented in 2011.

- **Adoption of 17 challenges (Examples of adopted technologies)**

- Use technology of bioethanol from sea algae
- Effective use technology of fishery processing waste
- New technology for cultivation on land

- Purification technology of contaminated seabed
- New fishery processing technology that uses electro-magnetic waves

Source: Created by MEXT

Due to the earthquake and tsunami of the 2011 off the Pacific coast of Tohoku Earthquake, lots of piling up of rubbles and the losses of algae sites arose in the coastal areas of Tohoku region and the marine ecology including fishery places drastically changed. In an effort to reconstruct and revive of the fishery places offshore Tohoku region and the industries and settlements of the coaster areas, by utilizing the 3rd supplementary budget for FY 2011 (2 billion Yen), MEXT has been building bases composed of universities and colleges and research organs nationwide and implementing the technical development that will lead to the investigation studies on the marine ecology and the creation of new industries.

In the investigation and studies in the field of marine ecology, MEXT gathered researchers nationwide, led by Tohoku University, the University of Tokyo and the JAMSTEC, aiming to elucidate the fluctuation mechanism of the ecology and the supply of scientific knowledge that contributes to the reconstruction of fishery places by continuous investigation of the physical and chemical environments of marine ecology and biological kinetics from coastal areas to offshore areas, Furthermore, in order to create new industries in the afflicted regions, effectively utilizing the resources in the sea of Tohoku, MEXT has been promoting innovative technical development that will lead to the creation of new industries, such as the use technology of bioethanol taken from marine alga and the effective use technology of the wastes of fishery processing.