# Self-evaluation report (draft): General Research Group

## 1. Objectives

The General Research Group has two missions: to develop science and technology for society to solve society's problems related to safety, and to build the necessary knowledge base and general methodology. To fulfill these missions, the General Research Group conducts research with the following three goals.

(1) Clarification of the concepts of science and technology for society, and establish a methodology for designing such technology

While clarifying the concepts of science and technology for society, we put together science and technology for society's development processes that various research groups implement, and, as a "universal constant" derived from individual cases, build a methodology for designing the science and technology for society.

(2) Planning and implementation of supplementary researches

We integrate research results produced by various research groups and build a knowledge system related to safety. At the same time, we plan and implement supplementary researches that will become necessary for establishing a universal methodology related to the design of science and technology for society.

(3) Program design, management, and operation, and systematization of knowledge/information

We design and coordinate programs, promote inter-group crossovers and information exchanges, provide a forum for releasing research results, and conduct hearings and make budget adjustments. At the same time, we systematize the knowledge formulated by various research groups.

## 2. Members

| Name | Affiliations |
|---|---|
| Hiroshi Komiyama | Vice President, the University of Tokyo |
| Hideyuki Horii | Professor, Graduate School of Engineering, the University of Tokyo |
| Yoshinori Iizuka | Professor, Graduate School of Engineering, the University of Tokyo |
| Teruo Koyama | Professor, Human and Social Information Research Division, the National Institute of Informatics |
| Issei Fujishiro | Professor, Faculty of Science, Ochanomizu University |

| | |
|---|---|
| Toshiko Kikkawa | Associate Professor, Faculty of Business and Commerce, Keio University |
| Kazuhisa Takemura | Professor, School of Letters, Arts and Sciences, Waseda University |
| Satoshi Fujii | Associate Professor, Graduate School of Engineering, Tokyo Institute of Technology |
| Tatsuhiro Kamisato | Exclusive researcher |
| Taketoshi Toyoda | Cooperative researcher |
| Eri Miyamoto | Technical staff |

## 3. Target achievements

### 3-1. Methodology of designing science and technology for society

The General Research Group aims at constructing a general methodology for designing science and technology for society that comprises universal knowledge and information formed from the results of individual studies conducted by various research groups. Science and technology for society will be designed by analyzing various social issues, drafting science and technology for society, predicting changes in society as a result of this science and technology for society, and repeating the process of evaluating the anticipated changes in society.

### 3-2. Method for visualizing structured knowledge and information

Huge amounts of knowledge and information are involved in complex social issues, such as the problems, countermeasures, and facts/data/legal regulations. It is not easy to understand inter-knowledge relationships and the overall image of knowledge. Thus, as a method for supporting the understanding of the overall image of the problems and issues, a 3D graphics technology will be adopted to develop an information visualization tool that can operate/manipulate the information that has been structured by means of a Web browser. We will use a Directed Acyclic Graph (DAG) that is made by expanding this structure, apply it to a visualization method called the corn tree, and develop a visualization system for structured knowledge.

We will also develop a system that shows, two-dimensionally, knowledge that has a stratified structure.

### 3-3. Method for structuring problems

We will develop a method for clarifying the structure of factors that make up complex problems. Factors will be extracted from newspaper articles and other items.

We will add keywords to these factors and group them together under a major heading, using the KJ technique. After analyzing the mutual relationships between the factors that had been listed, we will apply the structuring technique to show the structure of the factors in the form of a directed graph.

### 3-4. Clarification of the concepts of safety and security

We will make cross-sectional comparisons between various sectors/fields to build knowledge systems related to safety.

### 3-5. Supplementary researches

We will plan and implement supplementary researches that would become necessary to establish a universal methodology on the design of science and technology for society.

## 4. Status and self-evaluation

### 4-1. Methodology of designing science and technology for society

We have developed a technique for visualizing structured knowledge and a method for structuring the problems. We have also developed a prototype of an influence analysis method, and applied them to the science and technology for society that is being developed by various research groups. Influence evaluation was conducted in the following three sectors:

(1) Promotion of repairs/remodeling of inappropriate (disaster-prone) houses that have already been built (Seismic Disaster Prevention Group)
(2) Real-Time Clinical Navigator System (Medical Safety Research Group)
(3) Traceability of Foods (General Research Group)

Through these researches, we confirmed that it is possible to construct a methodology for designing science and technology for society. Up to this point, we have concentrated on developing a tool for helping grasp a problem's overall picture, as well as a method for analyzing the influence of science and technology for society. From here on, our tasks will be to improve them and enhance their precision/accuracy. We will also develop a method of supporting the establishment of science and technology for society, and a method of evaluation based on the multifactorial values of the science and technology for society. The aims are to rotate the science and technology for society's design loop, and to apply these methods to science and technology for society that other research groups are developing.

**4-2. Method for visualizing structured knowledge**

Development of a method for visualizing structured knowledge has more or less been completed. We were able to make a list of about 1,000 items related to seismic disaster prevention, including problems, countermeasures, facts/data/legal regulations and other issues, and installed them in a visualization tool that had been developed. We were able to grasp the overall picture of problems related to seismic disaster prevention, and to learn that eliminating disaster-prone houses is a high-priority problem from the perspective of protecting human lives.

From here on, we will conduct knowledge structuring in areas other than seismic disaster prevention, and install in the visualization tool that had been developed, the knowledge database that will be obtained.

**4-3. Method for structuring problems**

We completed developing this method. We applied it to the nuclear reactor's cover-up scandal and confirmed its effectiveness/usefulness.

**4-4. Clarification of the concepts of safety and security**

We investigated the context in which the concepts of safety and security are used in everyday situations, primarily based on newspaper articles. We then studied how experts perceive each of these concepts by referring to the safety standards that are implemented in various sectors. We classified safety and security into active type and ignorant type, then showed how "active-type safety"—something that science and technology for society should aim at—may be achieved.

Numerous studies have been made in recent years on people's awareness and attitudes toward various social risks including nuclear power generation and disasters. They repeatedly point out the importance of "trust" to risk experts. With this as background, we proposed a hypothesis related to people's trust in risk experts, and investigated this hypothesis by using a panel data implemented before and after the scandal that broke out in September 2002 at an electric company's nuclear power plant involving a cover-up of cracks in nuclear reactor shrouds. The data targeted households living in the region served by said electric company. The analysis supported our hypotheses that people's trust in risk experts dropped in the wake of the cover-up scandal, and, as a result, their tendency to demand stronger governmental control of nuclear power stations rose, although their trust did not drop if the people felt that the company acted with sincerity after the incident.

**4-5. Analysis of factors that led to the nuclear power plant's cover-up scandal**

To identify the social factors that led to the cover-up scandal at a nuclear power plant, we conducted an interview survey. We first applied the technique of structuring the problem, then, using newspaper articles, etc., we represented the structure of the factors in a diagram. We then used the findings to conduct an interview. The findings of the interviews are currently being used to analyze the social causes by focusing on the following points: why maintenance criteria were not in place for such a long time; why the ambiguous reporting standards and discretionary administration were allowed to continue; why the local community exerted such great influence; and why the general public fail to understand them. We also collaborated with MIT to conduct a comparative analysis between Japan and the U.S. Results of this joint research will be compiled and published by the end of this fiscal year.

**4-6. Methodology for malpractice prevention and medical process management**

A study is currently under way to apply the knowledge of engineering-type quality management to the medical field so as to contribute to promoting medical safety, and to guaranteeing and enhancing medical quality. Along with proposing a methodology for preventing medical malpractices and managing medical processes, we are working to express our views and comments on medical treatment as a form of science and technology for society.

As far as medical safety is concerned, we are basically collaborating with hospitals to conduct in-depth analysis and examination of actual patient cases that occur in clinical situations. By regarding medical malpractices not as a personal error but by understanding the mechanism by which such human errors were induced, we hope to gain fundamental knowledge on the structuring of factors that induce errors and of error occurrence prevention. As an example of such usage, we aim to develop an error prevention support system.

Regarding the management of medical processes, we will study the essence of a clinical path and propose a path catering to individual patient's conditions that is based on the understanding of the treatment process as a whole. We also hope to propose a methodology for ensuring and confirming the quality of medical treatment and nursing care through various processes.

**4-7. Study of a system to ensure safety of foods**

Ever since the outbreak of BSE in Japan, food has become the center of attention as an important social issue. Our Group has studied and proposed an ideal analytical

method that would help solve these problems in a favorable light.

We began by establishing a model of a social structure that is liable to develop in the initial stages of the outbreak of incidents related to food, and, based on this model, we showed that it is difficult to determine the size of the actual risks by simply referring to media coverage, social repercussions, or administrative measures implemented in response to them. Through studies such as these, we have shown that analyzing the issues beforehand from scientific, technical, systemic and social aspects is important as a social information infrastructure to conduct risk management in the broad sense.

With a growing number of people beginning to lose faith in food safety in recent years, the issue of food traceability is attracting strong interest. We therefore analyzed its influence. We interviewed representatives of companies who trace the origin of food items and identified their activities and intentions. At the same time, we took note of the effects of false labeling prevention and risk management as well as what influence these costs have on the ultimate price of food, and applied the influence analysis technique used in science and technology for society, and predicted the influence such traceability will have on society.

**4-8. Evaluation and future tasks**

As we described in the section on target achievements, the mission of the General Research Group is to sum up the entire Mission Program I. Therefore, evaluations and tasks of this Group overlap those of the entire Mission Program I. Because of this, our Group’s evaluations and tasks will be described by including them in the evaluations and tasks of the entire Mission Program I.