

The 5th Technology Forecast Survey

- Future Technology in Japan -

(NISTEP Report No. 25)

2nd Policy-Oriented Research Group

The Science and Technology Agency has conducted technology forecast surveys using the Delphi method approximately every five years since 1971 in order to provide direction for technology development from a long-term perspective. This report is the result of the fifth survey which was released on November 26, and is the first survey completed under charge of our institute (NISTEP) which will conduct surveys for forecasts for the next thirty years.

1. Outline of the Survey

(1) Fields covered and number of topics asked

Field	No. of Topics	Field	No. of Topics
1. Materials and Processing	108	10. Agriculture, forestry and fisheries	74
2. Information and electronics	106	11. Production	72
3. Life Sciences	98	12. Urbanization and construction	65
4. Outer space	46	13. Communications	65
5. Particles	40	14. Traffic	62
6. Marine Science and Earth Science	82	15. Health and medicine	109
7. Mineral and water resources	39	16. Lifestyle	82
8. Energy	51		
9. environment	50	Total	1,149

(2) Survey Method: Delphi method (survey conducted twice; the results of the first questionnaire are fed back to respondents when completing the second questionnaire so that each respondent can reassess the questionnaire while observing the trend of the overall opinions).

(3) Survey Parameters: 1) Degree of importance 2) Forecasted realization time 3) Necessity for international joint development 4) Comparison of current R&D level between Japan and other countries, 5) Constraints on realization

(4) Overview of the Survey

1) Overview of the survey

Survey	No. of people surveyed	No. of respondents	Return rate
1st Survey (July 1991)	3334	2781	83%
2nd Survey (December 1991)	2781	2385	86%

2) Breakdown of respondents

Company personnel 879 (37%) University staff 864 (36%)
Public research institute staff 349 (15%) Special corporation, others 293 (12%)

2. Outline of Results of the Survey

This report is comprised of the results of surveys from each field and cross-sectional analysis. Here we provide a section of that cross-sectional analysis.

(1) Degree of importance

Issues relating to the attainment of a "healthy and stable life", such as environmental preservation, overcoming disease and preventing disasters were ranked highly in importance across all fields (35 of 43 topics, or more than 80%, of topics that were rated at a "high" level of importance).

(2) Forecasted realization time

Distribution of the forecasted realization time is as follows. Approximately 80% of all topics are expected to be realized between 2001 and 2010.

Of topics forecast to be realized early, there is a high ratio in the fields of "urbanization and construction" and "marine science and earth science", with expectations for the early development of the emplacement and enhancement of social infrastructure, and meteorological forecasts and forecasting technology.

In contrast, topics which are forecast to be realized late include a high ratio from the fields of "life sciences" and "outer space". Many relate to basic research and large scale technological development, such as the elucidation of brain functions, treatment for Alzheimer dementia, and landing manned space-craft on Mars, all of which require long-term effort.

(3) Constraints on realization

The majority of respondents cited the following constraints: in order, technological constraints (83% of all topics), cost constraints including market competitiveness problems (32% of all topics), and capital constraints including securing research and development funds (16% of all topics).

(4) Examples of topics of interest and their forecast realization times

(The following topics appear in summarized form.)

2001

- Practical application of an economical separating method to recover valuables from urban waste.
- Conducting kidney, heart, liver and other organ transplants at a level equal to Europe and the United States.

2002

- Practical applications for a super LSI chip with a memory of 1 gigabyte or more.
- Practical application of improvements in crops through gene manipulation (harvest volume, disease resistance, cold resistance, etc.).

2003

- Dissemination of a technological system for automatic separation of urban and other waste into combustibles, metals, glass etc.
- Development of aircraft positioning and time control system for high precision flying and improved safety.
- Enhanced system for the early detection of cancer in society to bring average 5-year

- cancer survival rate above 70%.
- Practical application of a system to enable home health checks and appropriate diagnosis.
- Meetings through the advancement of television phones.
- Spread of telecommuting for general office work apart from negotiations.
- Practical application of multi-purpose nursing robots which conduct relieving and bathing duties in line with subject needs.

2004

- Accurate clarification of the mechanism for the production and destruction of carbon dioxide in the atmosphere.
- Practical role of micro-machines in bio-sciences and micro-processing, application in assembly, semi-conductor manufacturing and other types of tasks.
- Dissemination of electric cars through the development of batteries with a charging capacity that will enable commuting.

2005

- Development of portable, or implanted, artificial kidneys as an alternative to dialysis.

2006

- Reliable predictions 2-3 days in advance of volcanic eruptions.
- Establishment of treatment for AIDS

2007

- Dissemination of photovoltaic batteries for home electricity supplies.
- Practical application of a super electro-magnetic elevation train with a maximum speed of 500 km/hour.
- Practical application of super-effective treatment for arteriosclerosis.

2008

- Dissemination of industrial use electrical machinery using super conductive material with a critical temperature higher than that of liquid nitrogen (77 K).
- Development of an aircraft-carried particle accelerators to repair the ozone hole.
- Development of a real time, automatic interpreting phone between English and Japanese.
- Practical application of three-dimensional broadcasts to homes without the need for special glasses.
- Dissemination of district disaster prediction systems for earthquakes and landslides.

2009

- Practical application of technology to convert solar energy into biochemical energy (conversion, storage, etc.).

2010

- Development of intelligent material incorporating sensor programming effector functions.
- Elucidation of human memory, recognition and learning mechanisms, and models of same for computer application.
- Sequences for all DNA bases in human chromosomes.
- Development of technology to provide several days advance warning of earthquakes of magnitude 7 or more.
- Elucidation of genesis for all forms of cancer.

2011

- Development of effective preventative measures for Alzheimer dementia.

2013

- Elucidation of the aging mechanism.

2015

- Realization of a permanently manned space observation base, like the Showa Base in Antarctica, on the surface of the moon.

2017

- Development of a super-conductor that has a room temperature transfer point

(5)Assessment and analysis of the results of the first survey carried out in 1971

We attempted to assess whether topics forecast at the time of the first survey have come to realization or not. The forecast topics of the first survey totaled 644 divided into five sections. Of these, 530 topics were selected to be surveyed (topics forecast to be realized prior to 1991, and topics that were forecast to be, and were in fact, realized from 1992 on). There is considerable disparity between sections, 64% of the topics had been realized or partially realized.