NISTEP REPORT No.17

"SCIENCE, TECHNOLOGY, SOCIETY AND COMMUNICATION"

(SUMMARY)

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SCIENCE AND TECHNOLOGY AGENCY

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Japanese version

Contents

Forwords

This is the summary of "NISTEP REPORT No.17 -- Science, Technology, Society and Communication". The contents of the report show the results of studies which were discussed and researched by the study group of "Science, Technology, Society and Communication" conducted by 2nd policy-oriented research group, NISTEP. The member list of the group is attached with this report (Reference 1).

Members of the study group had 11 meetings during two and half years and discussed communication problems on science and technology, e.g., "How to understand communication activities on science and technology ?", "What communication model can be established ?", "How to measure actual communication activities ?" or "How to define the public's understanding or acceptance on science and technology ?", etc.

<SUMMARY>

We compiled this report based on the two year and four month discussion of the Study Group of "Science, Technology, Society and Communication (the STSC Study Group)".

Chapter 1. Background of the Study

The relationship between science and society has become stronger and more complicated. It's not easy to give an exact and brief description of these dynamics, but as background to the report we have classified the relationship into six subjects as follows:

1. Science and Technology in Daily Life

Science and technology permeates a greater part of daily life. We cannot provide for our livelihood, nor survive any longer without science and technology.

2. Evaluation of Japan's Science and Technology

According to a public opinion poll, as a whole, the Japanese evaluate the level of science and technology in Japan quite highly.

3. Evaluation of the Development of Science and Technology

Responses differ about the evaluation of science and technology with respect to the time of the evaluation and the occupation. The evaluations are all related to the background of each respondent when science or technology was first introduced to daily life, and importance of science and technology to the respondent. Therefore it's almost impossible to classify all of the evaluations in the same way.

4. Attitudes and Perceptions of Advanced Science and Technology

People's attitudes and perceptions of advanced science and technology depend on the extent of their anxiety about safety and reliability. Measuring attitudes and perceptions is also effected by differences between what they really think of new science and technology and what they say what they think.

5. Interest and Information Sources on Science and Technology

The degree to which people are interested in news of science and technology is constantly changing. Recently men in their twenties have different degrees of interest from men in other age groups and from women.

The changes in the degree of interest in science and technology might indicate that their sense of value and life planning are becoming different from those of other age groups.

6. Strengthening Interfaces between Society and Science and Technology

Where science and technology should stand in societies today is between the new stage of matured-industrialized societies and the old stage of modern-industrialized societies. Science and technology thus now needs to be understood in the higher stage.

This conclusion arose through the study on "communication", which is one of the social functions that provides for an intercourse between science/technology and society.

Chapter 2. Communication and Science and Technology

1. Quantity and Quality of Communication

Communication is the most basic social process, and is a topic which arises at various points in various fields. In this chapter, we analyzed the roles of communication in science and technology in modern societies, thinking of the nature of communication.

1) Diversification of Personal Information (Quantity Increasing and Quality Diversification)

One of the features of a highly advanced industrialized society is the high level of freedom of individual activities. So we need to make communication in science and technology more productive as we promote it. It is thus necessary to increase the sources of science and technology information and to improve the quality.

2) Communication and Understanding (Debates and Dialogues)

To communicate is to exchange information in an effort to understand each other more clearly, but in reality communication is not that simple.

Human beings have both of a rational and an irrational personality so when we receive new information our reactions can vary depending on the occasion and situation.

As a result, we need various channels so that the information consists to a common understanding of new science and technology information.

2. Communication Infrastructures (Networks of Communication)

Communication infrastructures should be equipped so that individuals and groups with their own personalities can communicate with one another freely and facilitate their social activities as they adjust their biases.

Social infrastructures which have " two- way" communication functions should be equipped so that they help the growth of an individual's ideas and creativity. Today we only have "one-way" communications about science and technology.

Chapter 3. Science and technology Triad: Changing Social Structure

1. Science and Technology Triad and Social Consensus

1) Communication Model of Science and Technology

We developed a model of simplifying the relationships in communications about science and technology in societies and have named it the "Science and technological Triad" as a hypothesis of this research. (Refer to the reference 2)

2) The Changing Socio-Economic Framework

Roughly speaking, product and consumption have occurred on the premise that markets and the resources for producers ("the earth" or "the nature") are essentially unlimited.

But the progress in science and technology has made it clear that the ultimate "resource" , that is to say, " the earth" is limited. People must come to realize that there is a limit which prescribed what the "market" is and what "life" is, with this realization changing the structures of our thoughts of all we owe the world.

3) "Organizational" Challenge

Changes of people's acknowledgements influence enterprises strongly. Many of enterprises are seeking new "Better Corporate Citizenship" and "Corporative culture" as they set their sights on the "Environment". Not only enterprises but also public "Organizations" such as international organizations, governmental organizations, and local governmental organizations, stress that the importance of the "Environment". It is important to know specifically what those organizations think of "Scientists and Engineers" and of the "Public".

The challenge of organizations is to try to create good situations which enable "Scientists and Engineers" to give "up-to-date science and technology information" directly to the "Public" without isolating "Scientists and Engineers" from the "Public" through the "environmental" productions and activities of "*Philanthropy*" and "*Mecenat*".

4) Challenge of "Scientists and Engineers"

There has been a tacit premise that it would be significant and useful for people and societies undoubtfully to promote R&D. In that meaning, we couldn't realize the nessecity of artificial "common place" for "Scientists and Engineers" and the

"Public". But "markets" and " employment" are now becoming regulated with a better appreciation of the idea of " the limits of nature". This makes it clearer what "life" should be.

The maturity of the modern industrialized society, which the development of science and technology has brought about is now ready to help "Scientists and Engineers " and the "Public" communicate with each other. It's a challenge of " Scientists and Engineers" to consider how and where they could manage communication with the "Public".

5) "Public" Challenge

The " Public" must join in developing a consensus regarding science and technology because arriving at a consensus of science and technology is one of the most important matters societies must deal with when serious social concerns are entangled with science and technology.

To achieve this, participants should receive " up-to-date science and technology information". In present situations, it is "Scientists and Engineers" who have " up-to-date science and technology information", and it is "organizations" that use it most effectively. It is a challenge for the "public" to gain access to "up-to-date science and technology information" as a participant in the making of consensus.

2. Consensus Formation of Science and Technology

1) Needs of Consensus Formation

A consensus is necessary for people who are concerned with the science and technology to actively promote the introduction of science and technology into societies. Good communication of the "Science and Technology Triad" can lead to a consensus.

Speaking more specifically, " communication" between the "Public" and "Scientists and Engineers" is the weakest of all and needs to be much stronger. In other words, the new methodologies of technology assessment(TA) are required because old methodologies did not provide the "Public" with a consensus of "acceptable science and technology".

2) Social Support for Science and Technology Triad

Both of visible and invisible social back-ups are needed to create a social consensus regarding science and technology as well as the positiveness and stability within the communication of "Science and Technology Triad".

Compared to the media called " Products/Services" which stands between the "Public" and "Organizations" and the other media called "Employment" which stands between the "Public" and " Scientists and Engineers", the relationship between the "Public" and " Scientists and Engineers" is quite weak, and it needs the social system to support it actively.

Chapter 4. Social Consciousness and Communication Activities Related to Science and Technology

1. Minimum Conditions and Information to Raise Communication Levels

Minimum conditions and information to raise communication levels are as follows.

1) Minimum Conditions

(1) The first minimum condition is that the minimum information should be in common among all the people concerned with.

(2) The second minimum condition is that the "Public" could gain access to "science and technology" and create consensus and sympathy through "Communication" with "Scientists and Engineers" if they have the facilities and the systems and the catalysts to help.

2) Minimum Information

A minimum of information should be the essence of "up-to-date field information regarding science and technology". The " Public" needs to know this level of understanding in order to play a role as members of society as they try to understand " science and technology". They can then let " Scientists and Engineers" and " Organizations" know what they think of "science and technology".

2. Needs and Formation of Social Infrastructures to Raise Communication Levels

What is really required in the relationships between science and technology and societies in the future is science and technology information from the "Public". The "Public" is required to have the ability to evaluate "science and technology". We offer concepts of " Science and Technology Communication Center(STCC)" and "Science Communication Center (SCC)," the place for developing this ability.(Refer to the reference 3) We offer an example of a facility which has both functions of a " museum" and a " science and technology center" as one means of the realizing of the concept.

3. Social Support for Communication Activities Related to Science and Technology

Various kinds of social support are needed for the social communication activities of "science and technology" mentioned above and for the maintenance of social infrastructures. They are the following.

1) The promotion of two-way communication in national and local governmental organizations.
2) The provision of methods of communication related to science and technology and personnel(science journalists) by the enterprises and organizations from newspapers, broadcasting, and publishing.
3) Enterprises' contribution to society with their property.
4) More socialization and openness of the basis of the educational and research activities at universities.

In enterprises in particular, "*Philanthropy*" and "*Mecenat*" activities in science and technology field are effective enough.

Chapter 5. Conclusion and Prospects

This research is the beginning of on " the Harmonization of Science and Technology, Man and Society". The most important objective is to know how far this theme of the research could extend and to know the specific problems of the theme. These are as follows.

1. Research of the awareness and attitudes of the people who are related to science and technology.
2. Communication of people who are related to science and technology and the form of that communication.
3. Views of the "Science and Technology Triad" as a communication model of science and technology.
4. Concepts of " Science and Technology Communication Center(STCC)" and the "Science Communication Center (SCC)" for the community and regional level respectively as supporters for " Scientists and Engineers" and the "Public".
5. Roles of the governmental and the local governmental organizations, mass-media, enterprises, and universities.

We will continue the research of the people's awareness and the communication issues, dynamic analysis of the "Science and technology Triad", and creation of the specific concepts of the "Science and Technology Communication Center" and the "Science Communication Center".

(Reference 1)

Member List of the Study Group
"Science, Technology, Society and Communication"
(STSC Study Group)

1. Specialists

Mrs. Yukiko Ookuma	Columnist, Asahi Newspaper
Dr. Atsushi Kadowaki	Associate Professor, The University of Tsukuba
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Dr. Yasumasa Tanaka	Professor, Gakushuin University
Dr. Fujio Niwa	Associate Professor, The University of Tsukuba
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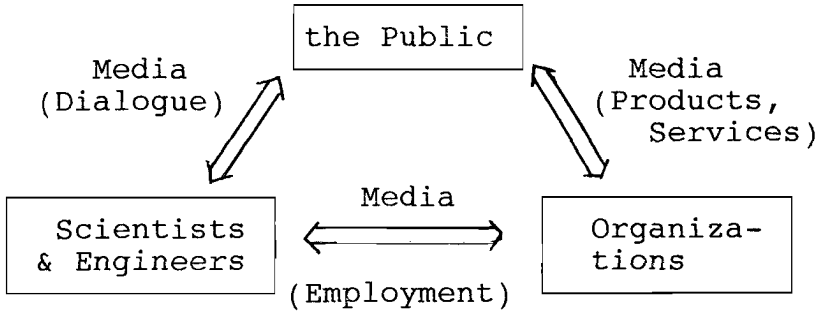
(Reference 2)

The Communication Model among
"Public", "Scientists and Engineers" and "Organization"
(S&T Triad)

The Study Group developed a hypothesis based on the "S&T Triad" as shown below. This communication model represents the social relation of communication on science and technology.

Figure. S&T Triad



The concepts of "Public", "Scientists and Engineers" and "Organization" are groups of persons designed conceptionally. In the actual world, scientists and engineers are members of the "Public" when they are away from their laboratory, and also they are members of an "Organization". And, all members of "Organizations" are actually included in the "Public" when they return to their home.

In this study, we choose the above three groups as the consisting of persons concerned with science and technology communication and presupposed the triad relation called "Science and Technology Triad".

Main media of communication relationships among these persons concerned are shown in the Figure by each arrow. Actually, among the relationships of those media, the "dialogue" between the " public" and "scientists and engineers" is the weekest relationship compared with the other two relationships because "dialogue" has not been supported by social system.

Unfortunately, up to now, most of the "public" does not directly access information sources (such as those from governmental institutions, universities, private research laboratories or academic societies). In addition, despite the well recognized importance of diffusing scientific and technological information to the "Public", little work has actually been initiated.

Therefore, the "public" has had a tendency to depend on the mass media which diffuse information on business and which is easy to access. If the "public" had more access a variety of

information sources, a more non-biased understanding of merits and risks of science and technology could be.

In order to reduce those biases as much as possible, it is necessary to devise a different route (communication route) where "scientists and engineers" could communicate directly with the "public" the exchange "up to date and actual information" on science and technology.

(Reference 3)

Science and Technology Communication Center (STCC) Science Communication Center (SCC)

1. To promote intellectual activities and to provide needed incentives.

2. To provide for adults and children to access the essencial experiences of scientific activities. In order for the public to become familiar with science and technology, it is neces sary to provide opportunities to come in contact with scientific and technological achievement.

3. Society requires a system which breeds the creativity as well as educates the systematic past scientific achievements. We have to construct a dual learning system which has two way courses, one is a course for static knowledge stock and the other is a course for active inquiry.

4. It is necessary for the public to provide a "place" which is able to communicate with others, especially with scientists and engineers. In the post-industrial society, social development will be guaranteed by full-communication (consistent flow of informations) with producers and consumers.

5. To breed abilities which discover and recognize invisible values or mechanisms. Namely, every person will be required more abilities to understand natural or social phenomena and movements such as relativity, co-operation, contradiction and circulation, etc.

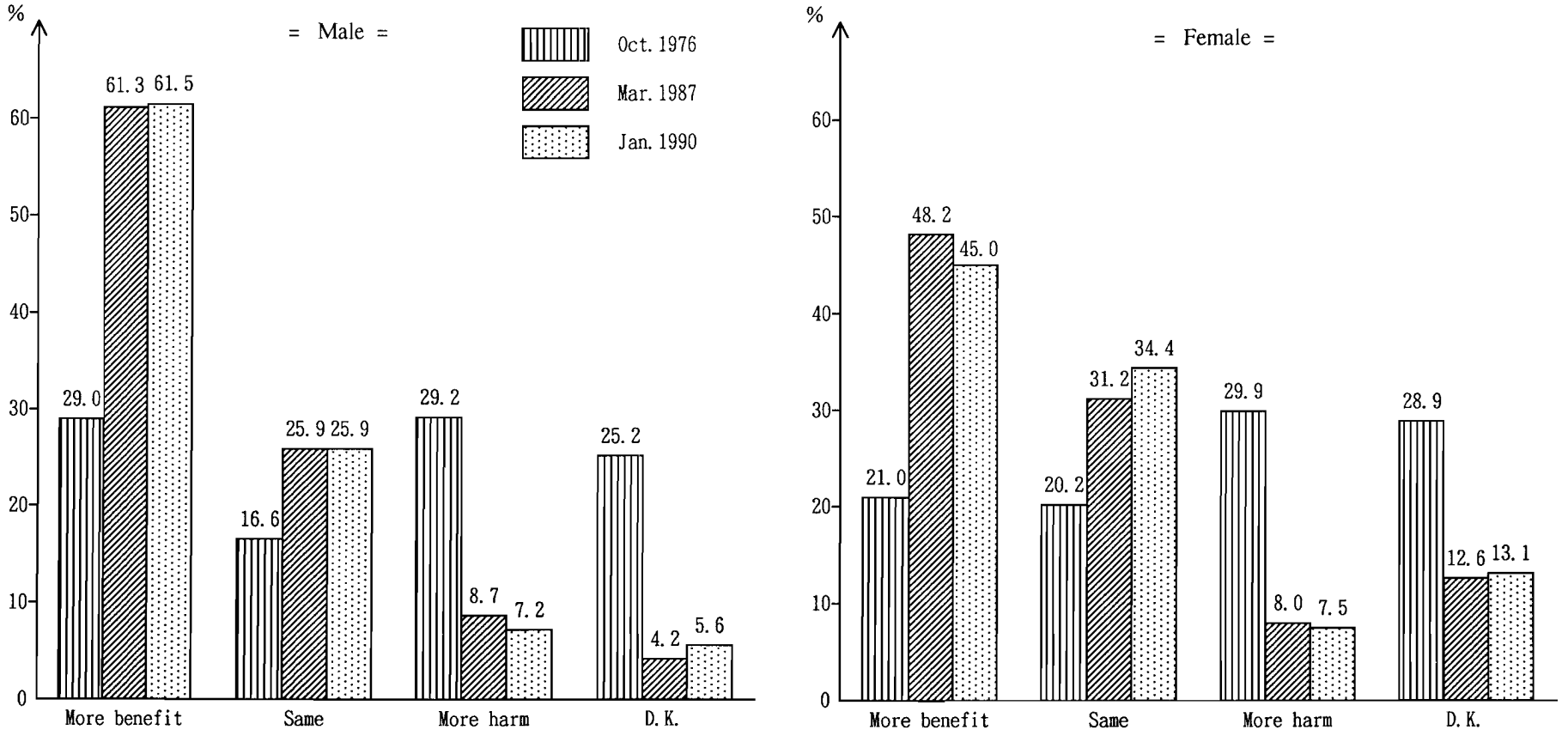
6. Future development and public acceptance of science and technology depend on public's scope of total recognition on science and technology, e.g. "goodness or badness of science and technology", "convenience or inconvenience of science and technology" or "what presumptions are presupposed ?", "what limitations those technologies have ?", etc.

7. It is necessary for us to proceed the realization of contents expressed in the above six items. We recomend a image of "Science and Technology Communication Center (STCC)" as a social infrustracture in which "Public" and "scientists and engineers" are able to participate scientific activities and events with together.
   Those centers also function a role of learning system (life-long education system) which support the school education in a view point of dual learning system.

<REFERENCE>

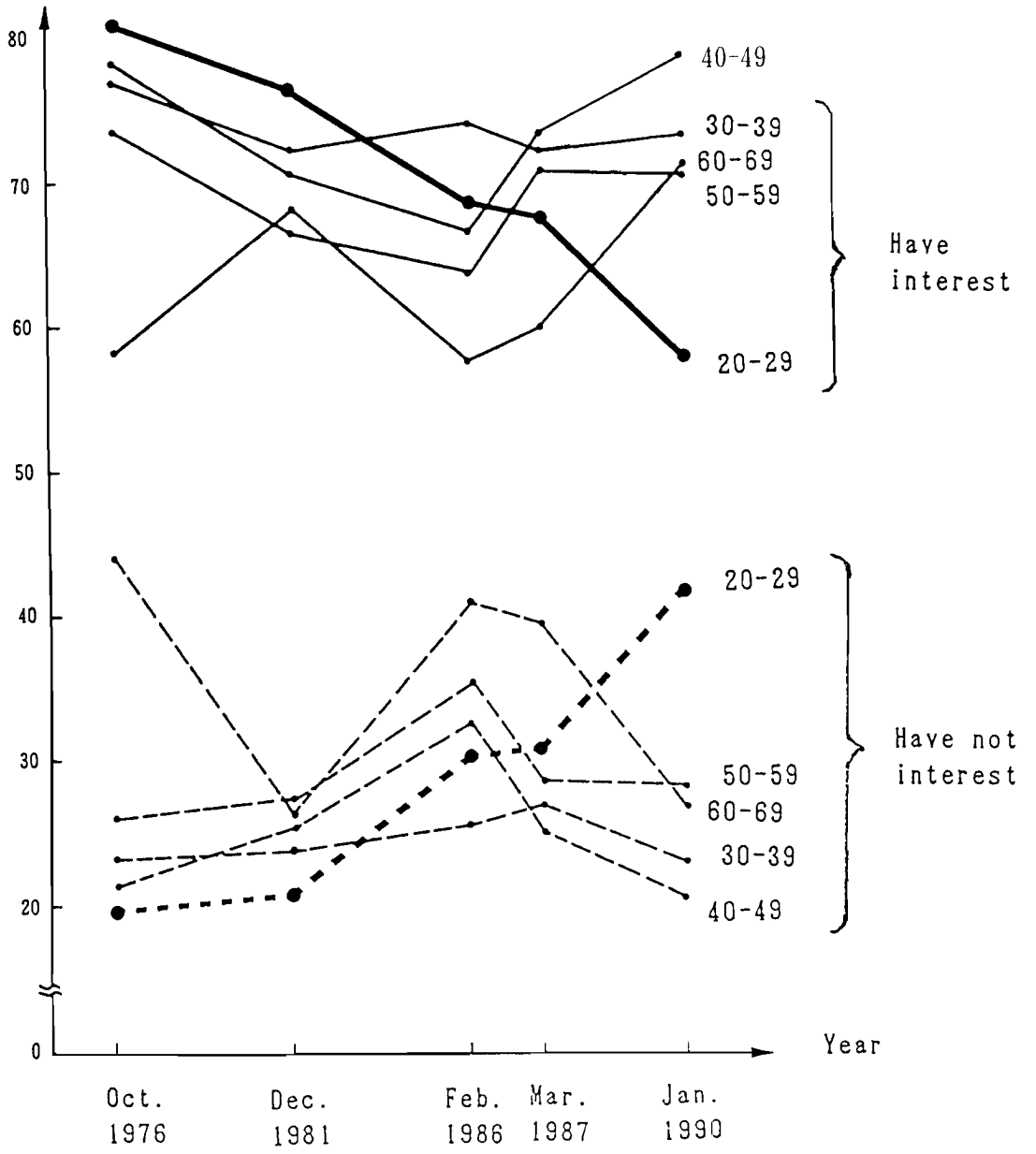
Charts and Tables

Chart 1 "Is development of science and technology bringing us more benefit than harm ?"



(Source) "Opinion Survey on Science / Technology and Society" (Oct. 1987 and Jan.1990, Sampling size is 3,000 in each), "Opinion Survey on Social Consciousness" (Oct. 1976, Sampling size is 10,000)

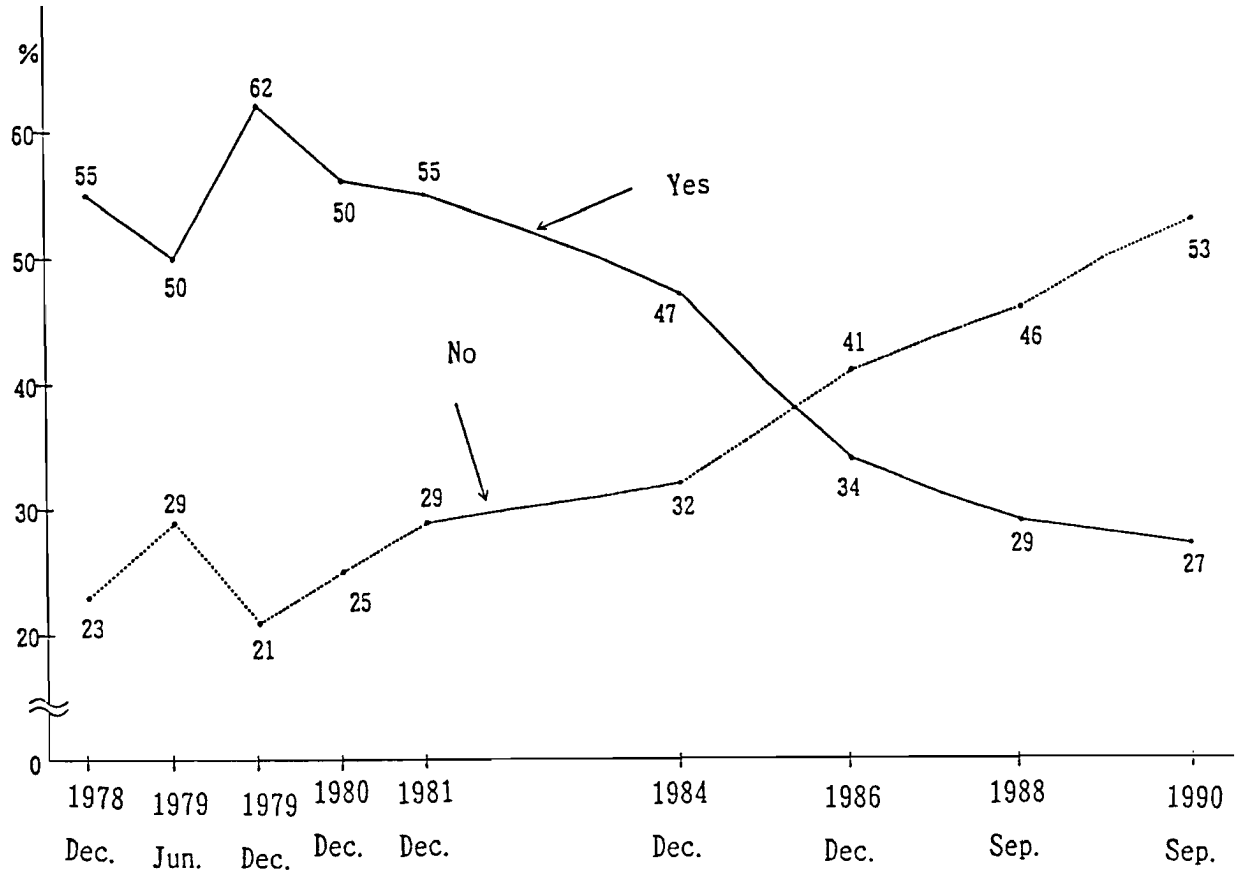
Chart 2 The contrast in the ratios of respondents who have interest or have not interest in news and topics on S&T (in case of male by age group)



(Remark) Sampling sizes are 5,000 of Oct. 1976 survey and 3,000 of other surveys respectively.

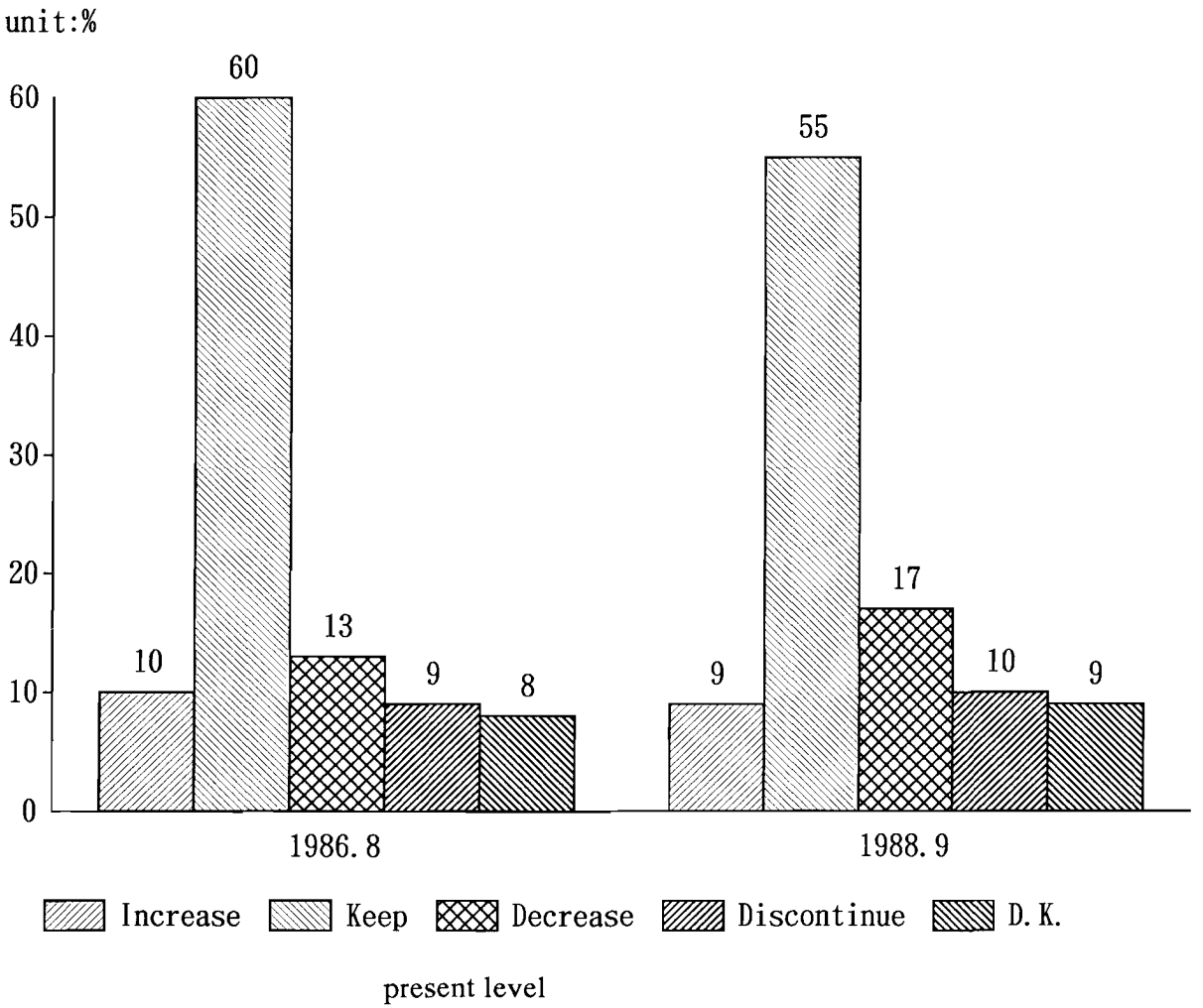
(Source) "Opinion Survey on Science/Technology and Society" and others, Prime Minister's Office

Chart 3 Should nuclear power generation be promoted in future as the energy source ?
(In the view point of new development of generation.)



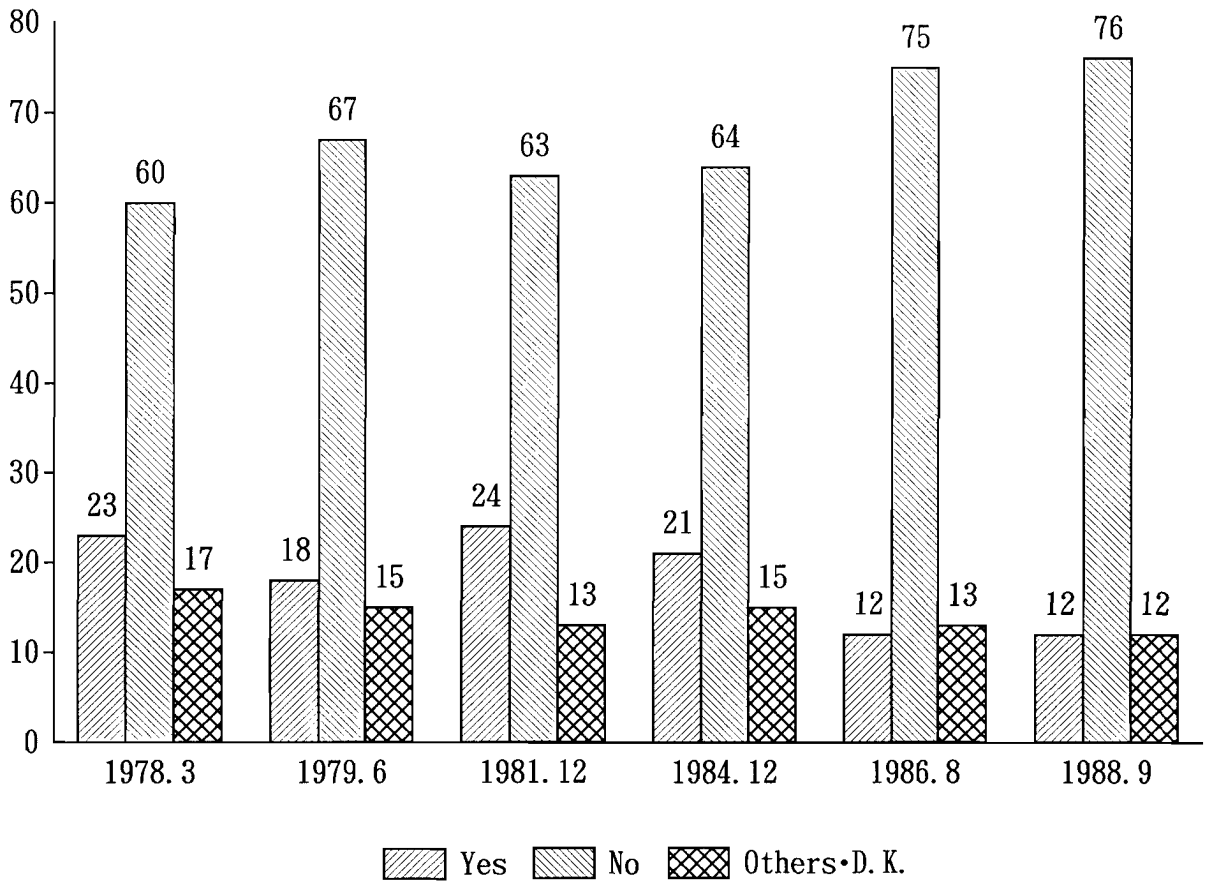
(Source) Asahi Newspaper Opinion Survey

Chart 4 How should be done about future nuclear power generation in Japan ? (In the view point of current dependence on generation.)



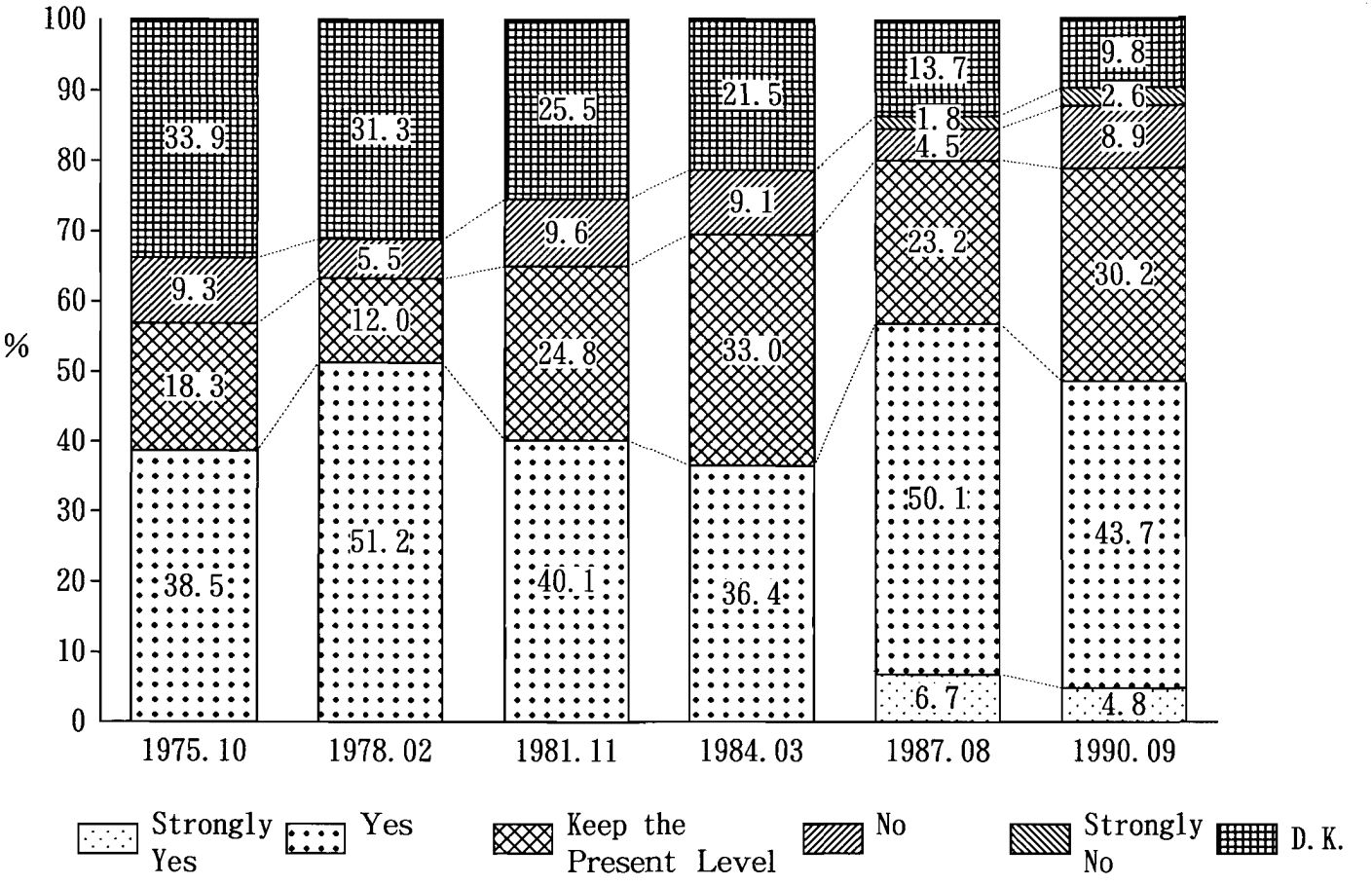
(Source) Asahi Newspaper Opinion Survey

Chart 5 Do you agree or not, if someone propose to construct a nuclear power plant near your town ?



(Source) Asahi Newspaper Opinion Survey

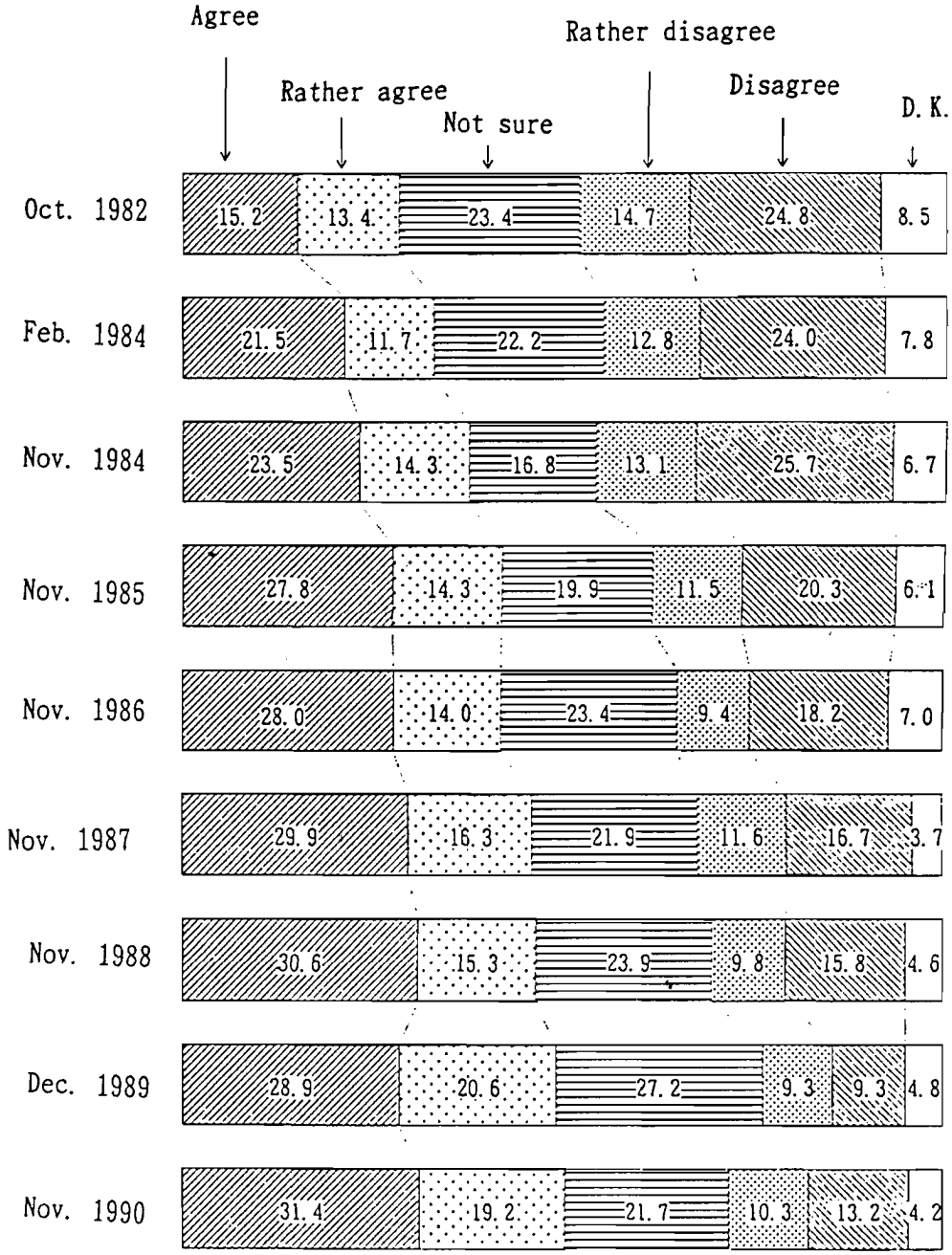
Chart 6 Yes or No about the Future Promotion of Nuclear Power Generation in Japan (Total)



(Source) Opinion Survey on Energy and Nuclear Power, Prime Minister's Office

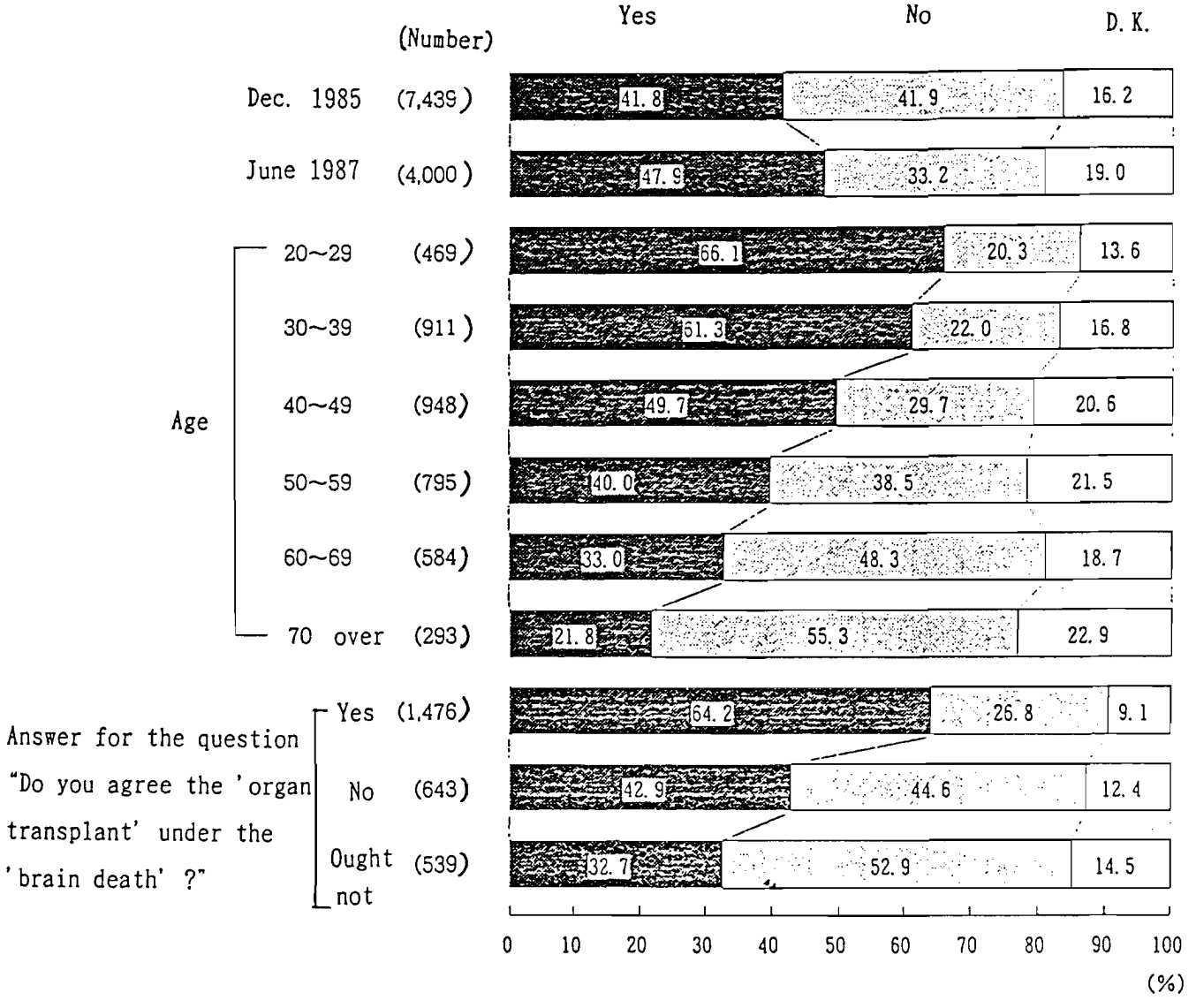
(Remark) Selection items, "Strongly Yes" and "Strongly No" added since 1987 survey.

Chart 7 Trends in responses of the question "Do you agree to take 'brain death' as the 'death' ?"



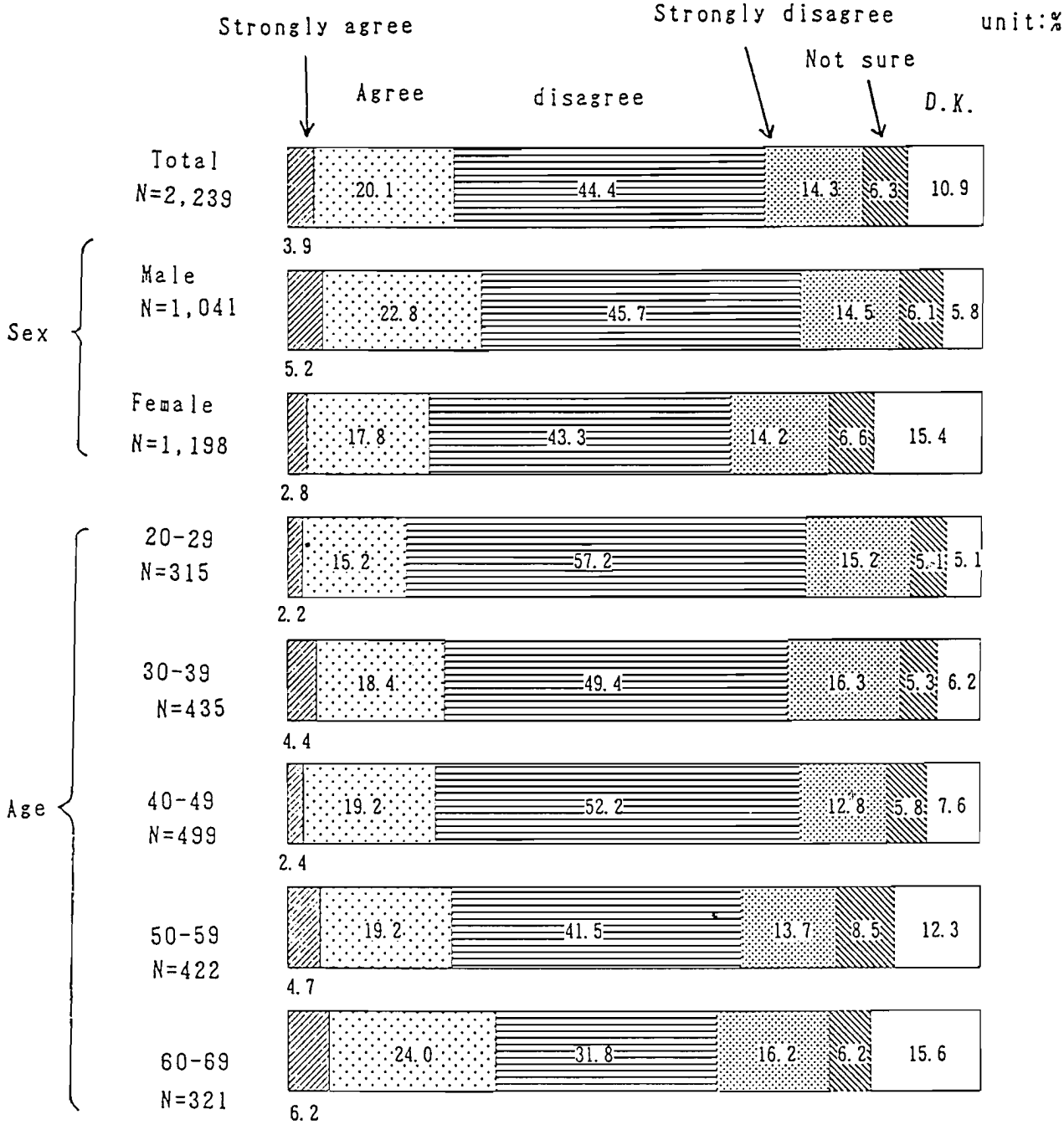
(Source) The Yomiuri Newspaper National Opinion Surveys

Chart 8 Do you accept organ transplant if it is necessary ?



(Source) Opinion Survey on Health and Medical Services,
Prime Minister's Office

Chart 9 The progress of science and technology will solve most of the economic and social problems with which we are faced

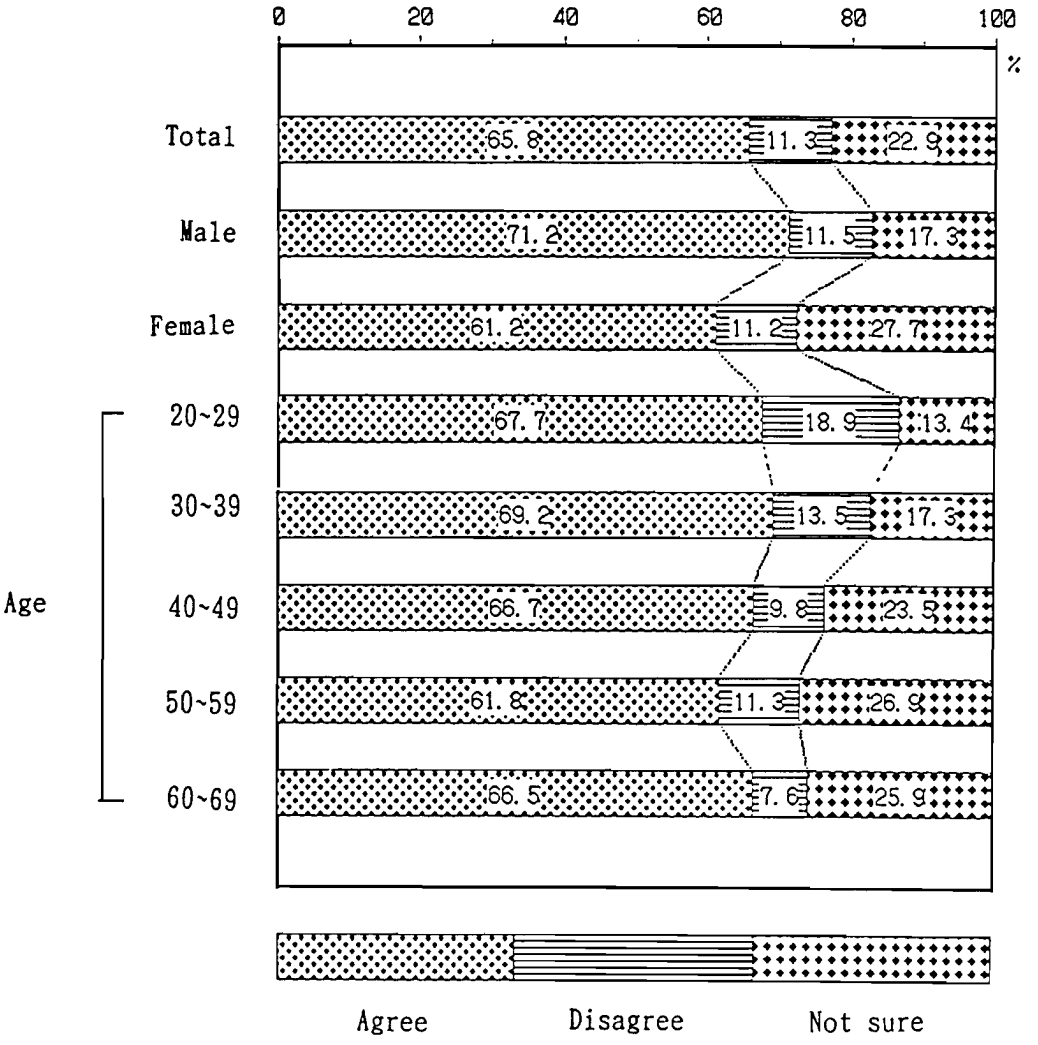


(Remark) The numbers of the Total, Male and Female include respondents over 70 years old.
Sampling size is 3,000.

(Source) "Opinion Survey on Science/Technology and Society" (Jan. 1990), Prime Minister's Office

Chart 10

Do you agree the statement "Science and technology will be so advanced to protect environmental conditions ?"



(Source) "Opinion Survey on Science/Technology and Society", National Institute of Science and Technology Policy, Jan. 1991

Table 1

Response to the Statement "We have sufficient information sources on science and technologies."

	Number (person)	I think so. (%)			I don't think so. (%)			D.K. (%)
			strongly	fairly		fairly	strongly	
Total	2,239	26.5	3.9	22.6	53.9	43.6	10.3	19.6
Male	1,041	31.1	5.1	26.0	54.8	44.2	10.6	14.1
Female	1,198	22.5	2.8	19.7	53.1	43.1	10.0	24.4
Have interest	1,252	30.3	5.2	25.1	59.7	49.0	10.6	10.1
Have not interest	934	22.5	2.2	20.2	47.8	37.6	10.2	29.8

(Source) "Opinion Survey on Science, Technology and Society", Public Relations Division, Prime Minister's Office, Jan. 1990

Table 2

The Number of Museums by Field

(Number of museums)

	Total	Multi-field	Science	History	Arts	Out-door	Zoo	Botanical garden	Zoo and botanical garden	Aquarium
Total	737	100	83	224	223	8	35	20	8	36
National Gov.	28	2	9	4	2	2	-	6	-	3
Local Gov.	354	74	40	115	86	2	21	4	4	8
Private	355	24	34	105	135	4	14	10	4	25

(Remark) The above museums are designated by the Ministry of Education, Science and Culture based on "The Museum Law". There are many small museums in Japan out of designation by the Ministry of Education, Science and Culture.

(Source) "The Survey of Out of School Education, 1987", Ministry of Education, Science and Culture.

Table 3

The Number of Staffs per Museum

(Person)

	Total	Multi-field	Science	History	Arts	Out-door	Zoo	Botanical garden	Zoo and botanical garden	Aquarium
Total	14.3	11.4	14.8	9.4	11.0	15.1	43.2	19.0	69.4	28.0
Full time staffs (total)	11.3	8.0	11.8	6.8	8.4	13.0	41.1	12.2	65.8	23.1
Director	0.5	0.5	0.5	0.5	0.4	0.4	0.9	0.6	1.0	0.6
Specia-lists	2.1	2.8	2.1	1.9	2.3	1.3	0.9	0.3	0.4	1.8
Assit. Specia-lists	0.6	0.4	1.4	0.2	0.3	0.4	1.5	0.9	1.9	1.6
Others	8.2	4.2	7.8	4.2	5.3	11.0	37.8	10.5	62.5	19.0
Part-time	3.0	3.4	2.9	2.6	2.7	2.2	2.1	6.8	3.7	4.9

(Source) "The Survey of Out of School Education, 1987", Ministry of Education, Science and Culture.

Table 4

The Number of Extension Programmes per Museum

(During 1986)

	Total	Multi-field	Science	History	Arts	Out-door	Zoo	Botanical garden	Zoo and botanical garden	Aquarium
Total	18.3 (145.8)	14.5	30.1	9.6	21.2	16.9	13.9	4.1	12.4	51.8
Lectures	2.7 (98.1)	2.3	3.1	2.4	3.3	1.9	2.5	0.5	7.0	0.8
Study meetings	2.9 (65.5)	4.2	6.7	2.1	1.5	13.1	2.9	3.3	0.5	1.5
Film presentation	12.8 (173.8)	7.9	20.3	5.1	16.3	1.9	8.5	0.3	4.9	49.5

(Remark) Number in ( ) shows participants per one programme.

(Source) "The Survey of Out of School Education, 1987", Ministry of Education, Science and Culture.