OUTLINE OF SCIENCE AND TECHNOLOGY ACTIVITIES IN JAPAN

MAY 1989

NATIONAL INSTITUTE OF SCIENCE AND TECHNOLOGY POLICY
SCIENCE AND TECHNOLOGY AGENCY

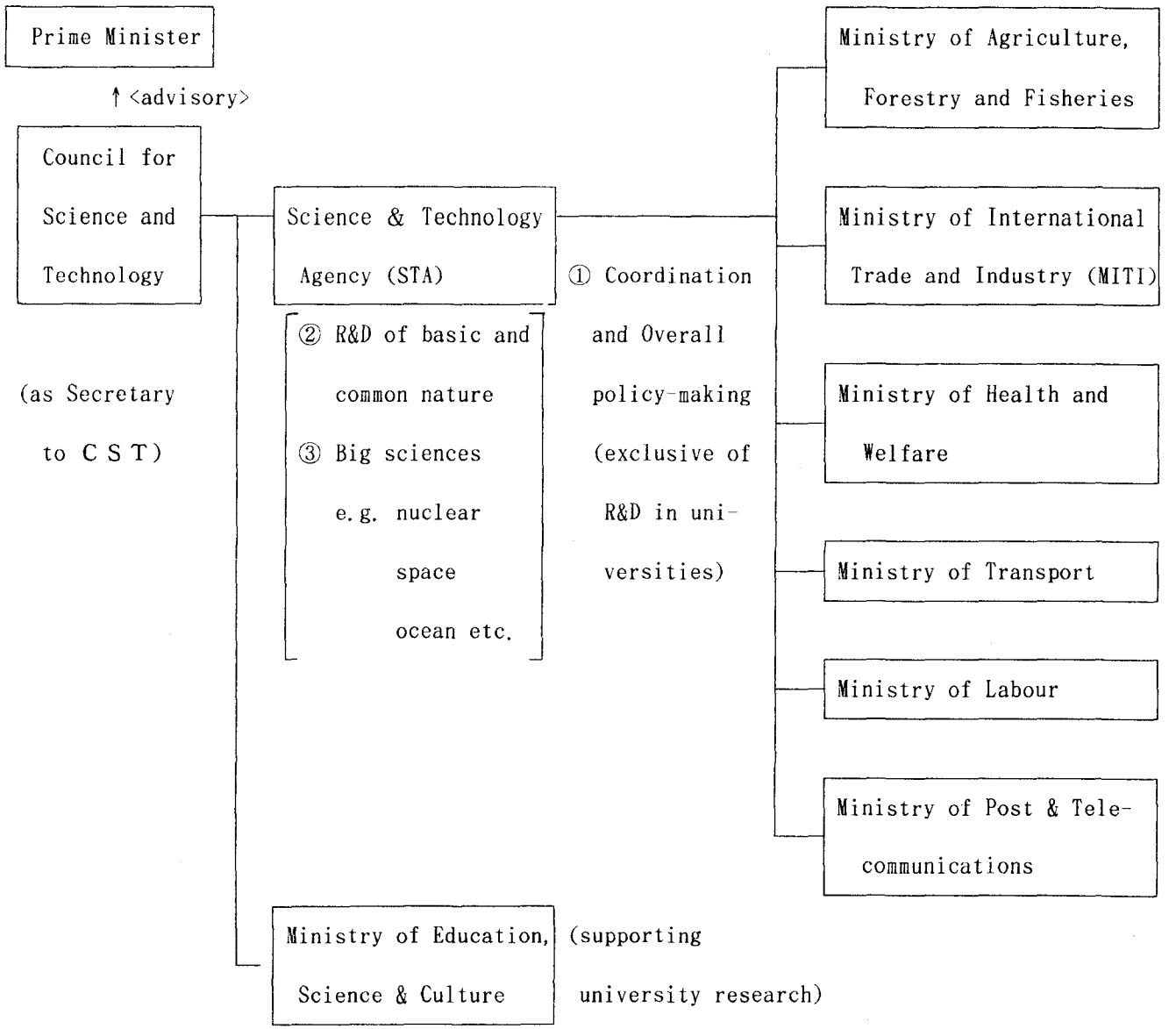
◇This material is compiled to offer for foreigners a comprehensive understanding of the science and technology activities in Japan.

◇Edited by NISTEP 3rd policy-oriented research group

C O N T E N T S

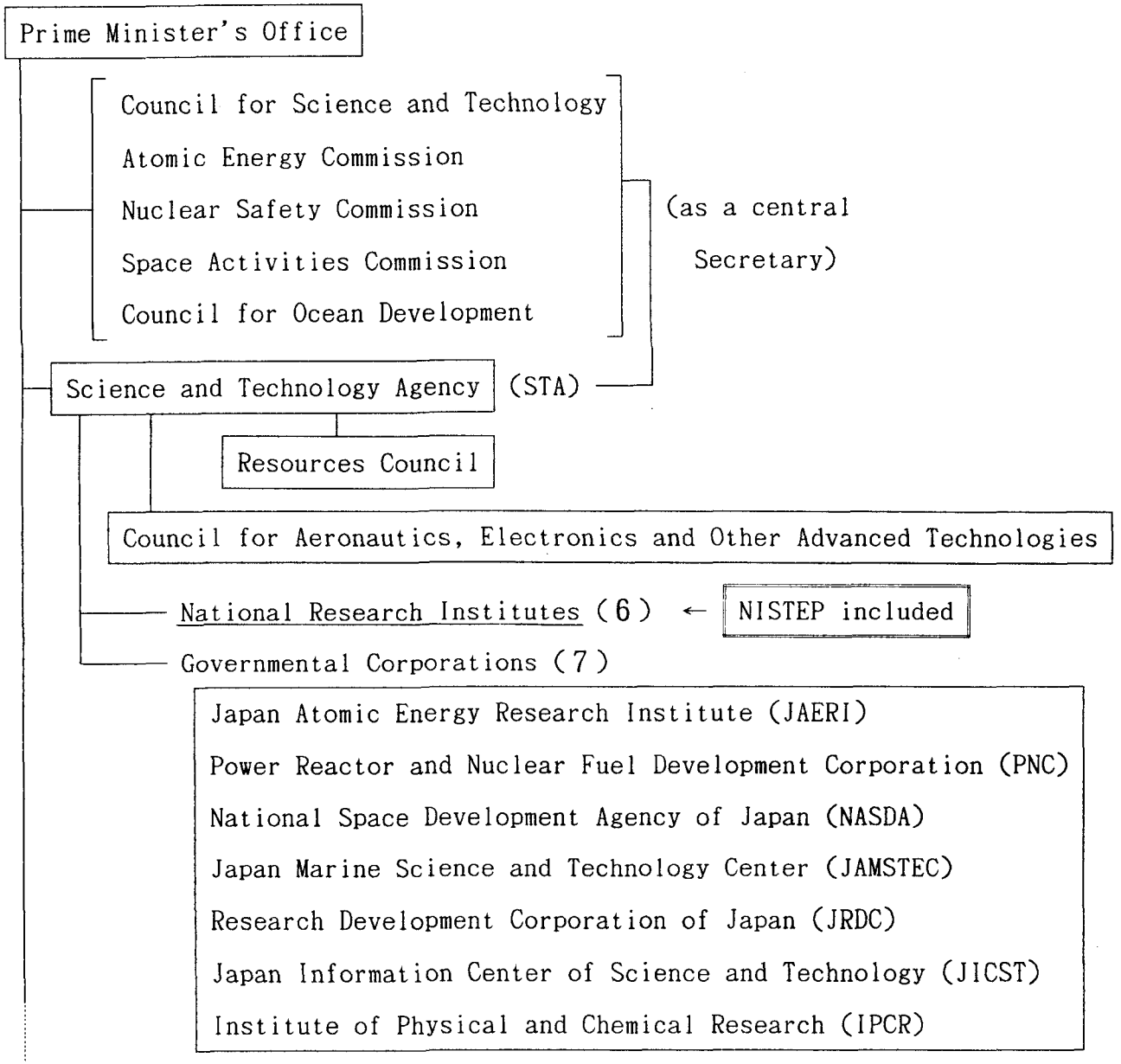
I. ADMINISTRATIVE STRUCTURE OF S&T POLICY

(Functionable Chart of Administrative Organizations)

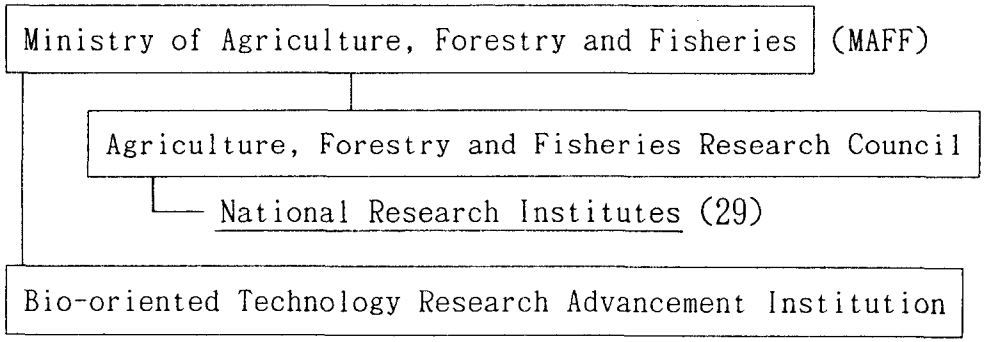


〔 Major administrative organs for science and technology 〕

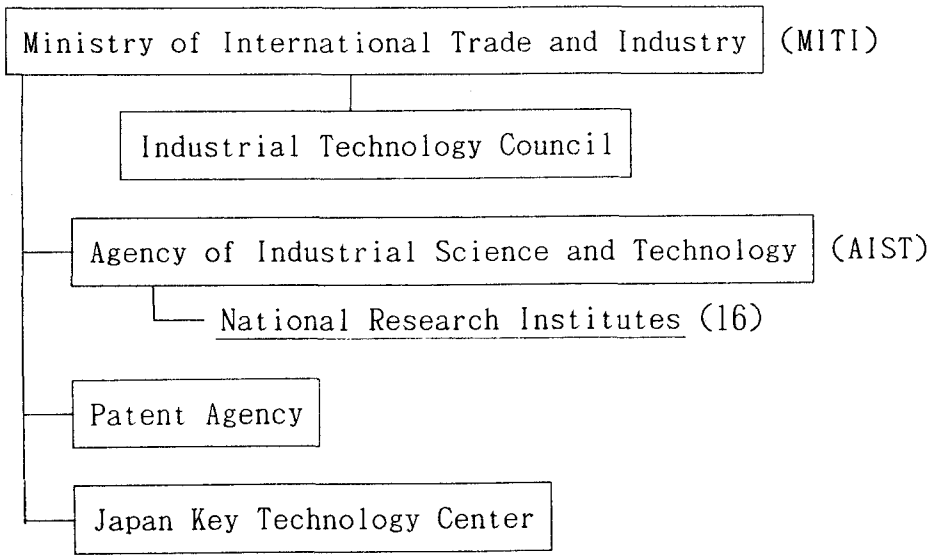
(i) Overall coordination (exclusive of universities) and S&T of large-scale, basic and common nature



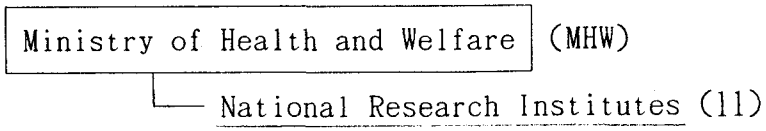
(ii) S&T for agriculture, forestry and fisheries



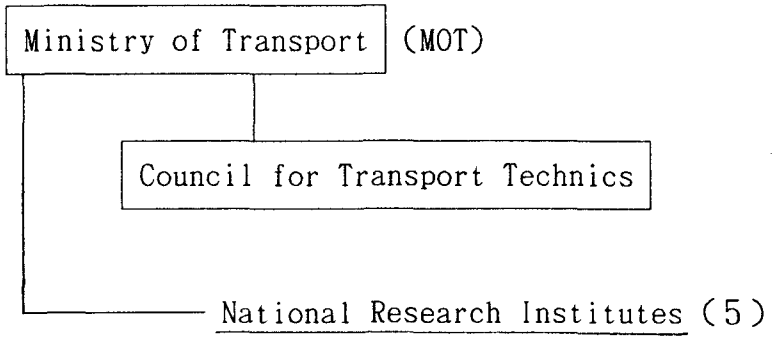
(iii) S&T for industry and mining



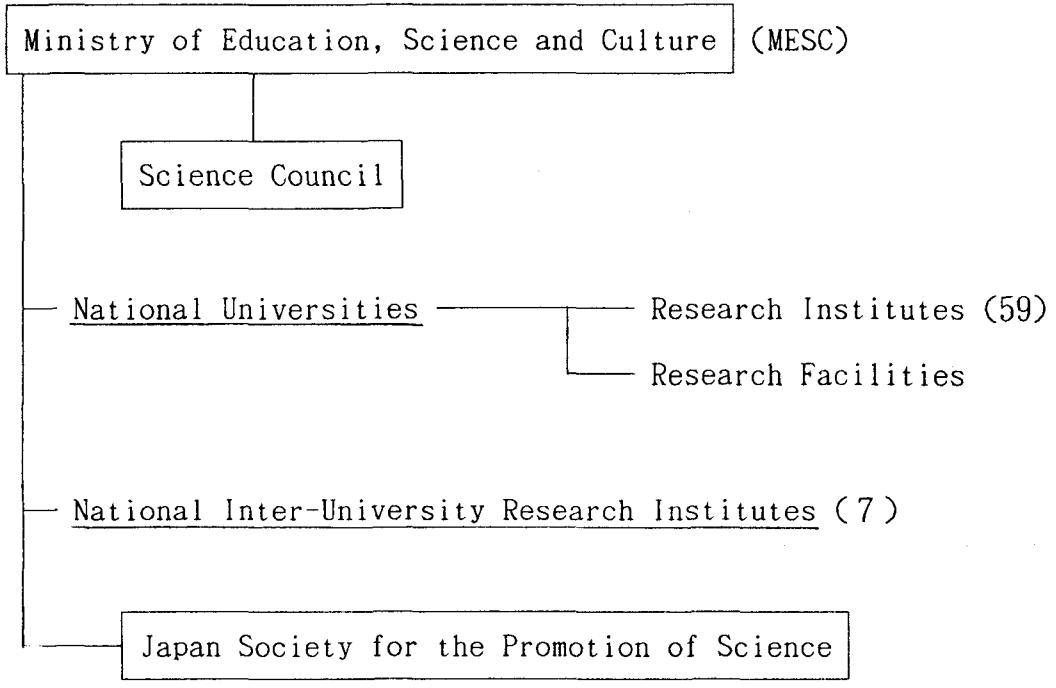
(iv) S&T for health



(v) S&T for transport and weather forecast



(vi) R&D in universities and S&T for Education and Culture



Ⅱ. "General Guideline for Science and Technology Policy"

March 28, 1986
Cabinet Decision

The Japanese Cabinet Council set down the outline of the science and technology promotion policy in the immediate future as "General guideline for science and technology policy", which is based on the cabinet decision titled "The administrative reform embodiment policy in the immediate future" dated September 24, 1985, and based on the recommendation of the Council for Science and Technology on the 11th inquiry from the prime minister titled "Comprehensive fundamental policy for promotion of science and technology to focus current changing situations from the long-term view" dated November 11, 1984, and the 12th inquiry titled "General guideline for science and technology policy" dated December 3, 1985.

General Guideline for Science and Technology Policy

I. Basic Principles

Highly creative science and technology should be the core of the nation's science and technology policy if we are to respond correctly to the various needs, to make our society and national life richer in the coming 21st century as well as to open up new possibilities in the future.

Especially, we should concentrate on encouraging basic research to pave the way for technological progress in the next generation. Steps should be taken to create technological seeds brought up from further studies and reviews of theories, principles and phenomena, which will lead to the promotion of more creative and imaginative science and technology capable of exceeding the bounds of mere modifications and improvements by combining such seeds with the emerging social needs.

In doing so, we should be aware that developments in science and technology are greatly dependent on a wide range of domains related to national life, dignity of man, ethics, etc. While maintaining the basic recognition that science and technology should serve man and society, and deepening our understanding of man itself, we should develop science and technology in harmony with man and society. We should also realize that Japan's contributions to science and technology should be appropriate for its increasingly significant role in the world community of nations. On this recognition, we should seek to internationalize our science and technology personnel, organization and activities and to promote international exchanges and cooperation, while giving sufficient consideration to the importance of cooperation with developing countries and to the latest international trends in high technology areas. Due attention should be paid to this global aspect in our science ahd technology promotion program.

II. Emphasizing Priority Programs

In encouraging creative science and technology, it is important to develop and strengthen favorable systems and conditions for R & D activities. Therefore, we should carry out the following programs in a comprehensive and flexible manner, while continuing to formulate timely and improve basic guidelines for implementing priority programs for this purpose.

1. Developing and Strengthening R & D systems

Universities, which are endowed to make academic research for continued progress in basic research, should further improve and upgrade their research activities to keep up with and exceed the international level while taking into account the social requirements and acting on their initiative based on their missions and objectives.

National research institutes and similar bodies should expand and strengthen their basic, leading research and development programs while properly reviewing their internal systems in accordance with changing social and economic needs.

From the viewpoint of activating national research institutes, the basic principles for their intermediate- and long-range operations should be established on the basis of our Council's finding.

Considering that private enterprises are stepping up basic research as a basis for expanding into new areas of activity, resulting in increased opportunities for industrial-academic-Government cooperation in all stages of R & D ranging from basic research to applications and product development, the Government should endeavor to promote industrial-academic-Government research exchanges by improving pertinent systems, operating them more flexibly, encouraging practical applications of research findings, and taking other appropriate steps. The Government should also improve cooperative research projects, comprenensive research projects, flexible research systems and other systems and encourage contacts among researchers through research

meetings and so forth.

2. Developing and Improving R & D Conditions

1) Increasing R & D investment

Continued investment in research and development should be ensured since the capacity of R & D depends largely on the accumulation of knowledge and skill generated by R & D investment. For this purpose, the Government should provide more R & D funds, use them more effectively, and improve environmental conditions favorable for vitalizing private R & D activities while taking steps to increase the national total of R & D investment.

2) Securing and training R & D personnel

Since people are a key factor in promoting science and technology, it is essential to secure and train young researchers and other R & D personnel at universities, national research institutes and other facilities that constitute the core of the nation's basic research sector while paying attention to the needs for such personnel in these new growth areas of activity.

Special efforts should be made to improve the quality of undergraduate-level training and graduate-level training, research guidance, etc., to secure necessary personnel mainly in the public sector where private initiatives cannot be continued on, and to improve conditions for more successful performance on the part of the researchers.

3) Consolidating the basis for science and technology promotion

Considering the markedly increasing importance of the intellectual basis on which the promotion of science and technology rests, efforts should be made to expedite the production and distribution of science and technology information by facilitating transfers of literature and encouraging the construction and utilization of factual databases, to upgrade facilities for developing, maintaining and making available such equipment, materials, genetic resources, etc., as the private sector cannot be counted on to provide, and to improve environmental conditions to give vitality to the supporting activities, thus helping to consolidate the basis for further promotion of science and technology.

4) Expanding international exchanges and cooperation in science and technology

Under the basic principles outlined in I, we should endeavor to promote mutual understanding between nations and positively expand international exchanges and cooperation activities. For this purpose, the Government should take steps to develop an internationally open research system, by increasing the number of foreign researchers employed and admitted to universities and national research institutes. Also, efforts should be made to improve and upgrade various international cooperative research projects, to expedite exchanges of researchers and information, and to develop necessary conditions to deal with such problems as protection of rights involved in research cooperation.

5) Promoting public understanding and securing cooperation

Now that science and technology have rearched every corner of the economy and society as well as national life, it is important to develop a climate in which the people can not only take advantage of science and technology effectively but also cooperate in promoting science and technology. Therefore, the Government should endeavor to stimulate the interest of the younger generation in science and technology, and to take other steps for the fulfillment of this purpose.

III. Encouraging and Promoting Research and Development in Priority Areas

To promote highly creative sciences and technologies, we should, while taking the various steps mentioned above, emphasize research and development not only in the areas mentioned in 1 below but also basic, leading sciences and technologies in the areas indicated in 2 and 3 by properly evaluating research projects and carrying out R & D activities energetically and effectively.

For this purpose, the Prime Minister should formulate a series of fundamental program for research and development in each priority area.

1. Encouraging Basic, Leading Sciences and Technologies in which New Progress Can Be Expected

Efforts should be made in a much more energetic manner to encourage basic, leading areas of science and technology with emphasis on developing new scientific findings, looking for seeds of revolutionary technological developments and helping them grow while being aware of the importance of basic scientific research and taking care to promote growth in that area.

Special emphasis should be laid on the following objectives:

(1) Investigating the limitations of the existing technology in dealing with matter, energy, information and other basic factors involved in science and technology, looking for and unveiling new principles and phenomena, and exploring new possibilities in science and technology exceeding the bounds of the existing technology;

(2) Investigating life phenomena by taking advantage of latest developments in molecular biology and related areas in recent years, and looking for possible applications of new knowledge resulting therefrom;
and

(3) Acquiring better insight into man, the earth, outer space, the ocean, and other macroscopic entities in the environment around us, and looking for possible applications of new knowledge resulting therefrom.

For this purpose, the following areas of research should be more energetically encouraged:

a) Matter/materials sciences and technologies
b) Information/electronics sciences and technologies
c) Life sciences
d) Soft series of sciences and technologies
e) Space sciences and technologies
f) Ocean sciences and technologies
g) Earth sciences and technologies

2. Encouraging Sciences and Technologies for Activating the Economy

Now that it is important for the nation to revitalize its economy in relation to the rest of the world as well as to maintain and increase economic growth at home, thus further strengthening the basis for our survival, we should endeavor to encourage the following areas of research as sciences and technologies for activating the economy:

a) Development and management of natural resources
b) Development and utilization of energy
c) Upgrading of production technologies and distribution systems
d) Recycling and effective utilization of resources
e) Improvement of service to society and life

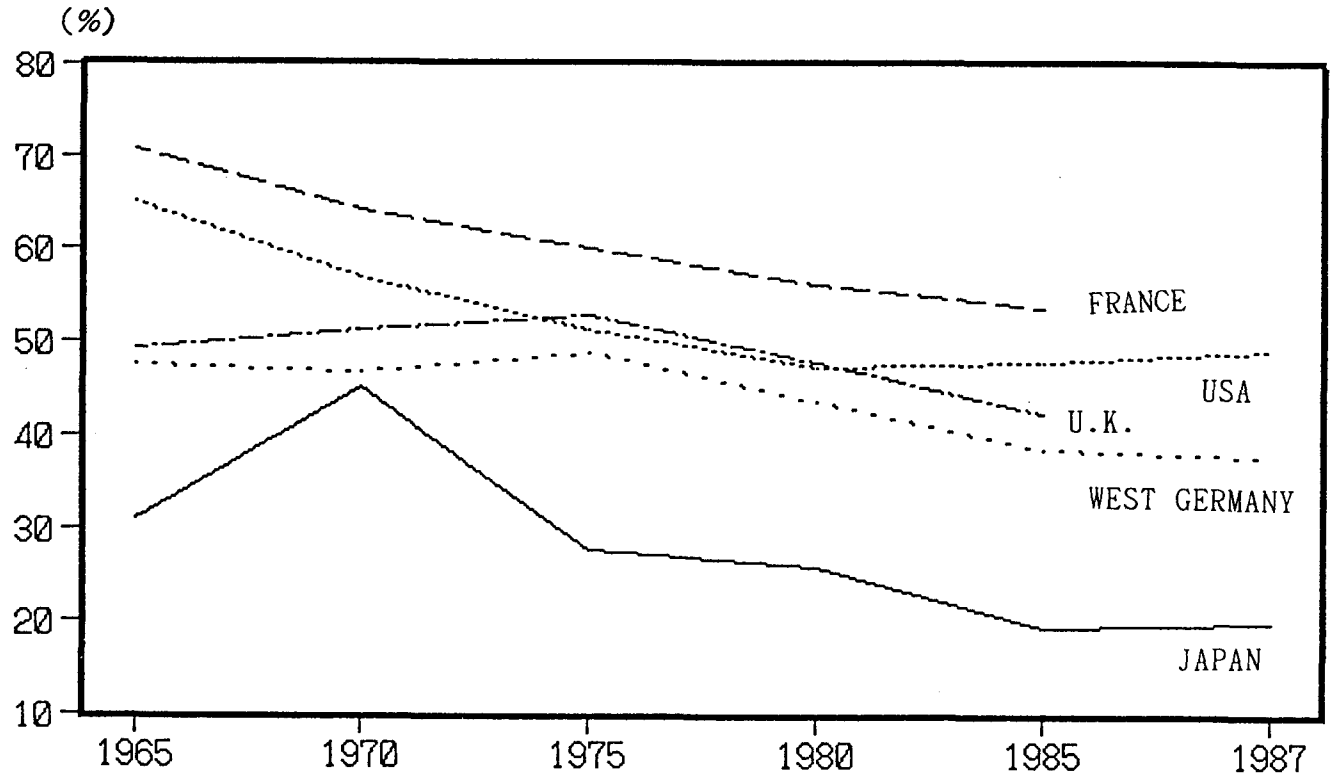
3. Encouraging Sciences and Technologies for Improving the Quality of Society and Life

At a time when the nation is becoming more mature socially and more advanced in average age while it is increasingly required to operate in harmony with the rest of the world community, it is important for us to promote sciences and technologies characterized by still greater respect for man, better adapted to people and society, and contributing to their sound growth. In particular, the following areas of research should be encouraged:

a) Maintaining and improving the mental and physical health of the people
b) Formulation of individual and cultural life
c) Formulation of comfortable and safe society
d) Improving the human environment based on a global viewpoint

Ⅲ. JAPANESE BUDGET FOR SCIENCE&TECHNOLOGY

1. TREND OF SHARE OF GOVERNMENT FINANCED R&D EXPENDITURE IN NATIONAL TOTAL R&D EXPENDITURE %



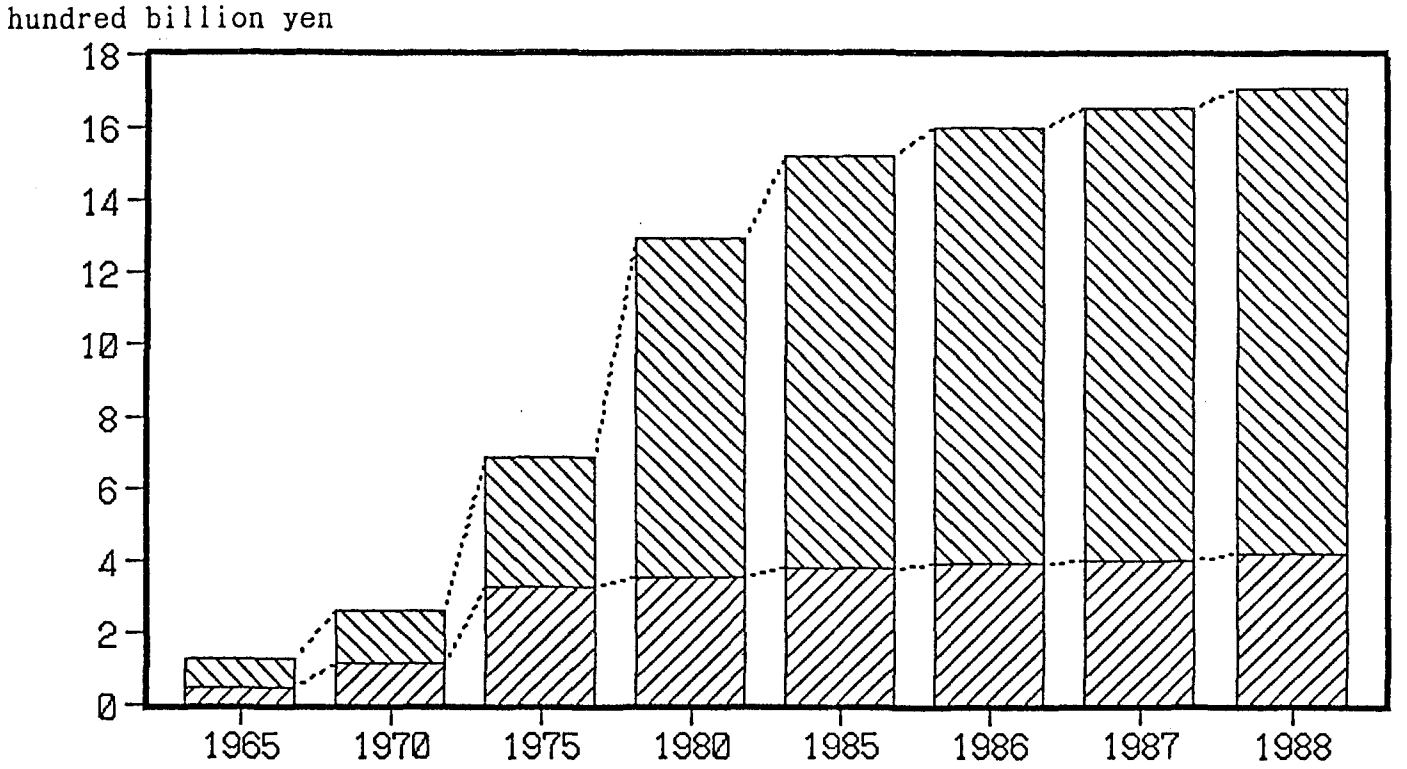
[Source : White Paper on Science and Technology 1988 etc.]

2. COMPARISON OF BUDGET FOR SCIENCE AND TECHNOLOGY (1987)

COUNTRY	BUDGET FOR S&T (BILLION YEN/DOLLAR)	RATIO TO TOTAL BUDGET	RATIO TO GNP
JAPAN	1655.0 (B.YEN) 11.4 (B.DOLLAR)	1.56%	0.47%
U.S.A	7850.3 54.3	5.4%	1.21%
WEST GERMANY	1111.6 7.7	5.1%	0.68%
FRANCE	1864.8 12.9	7.0%	1.49% (1986)
U.K.	1125.6 7.8	3.2%	1.27% (1985)

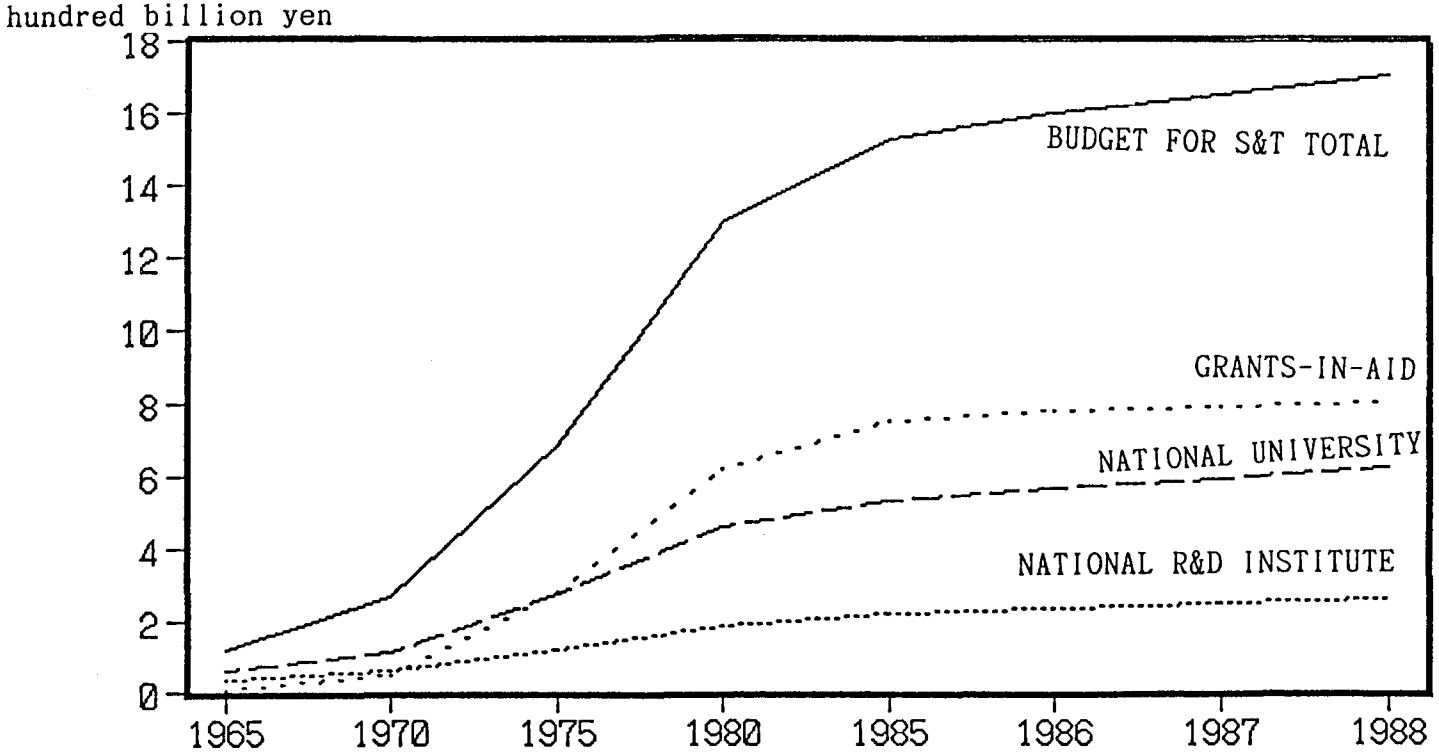
[Source : White Paper on Science and Technology 1988]

3. CHANGE IN BUDGET FOR SCIENCE&TECHNOLOGY



[Source : White Paper on Science and Technology 1988 etc.]

4. CHANGE IN BUDGET FOR SCIENCE&TECHNOLOGY BY ITEMS



[Source : White Paper on Science and Technology 1988 etc.]

5. NATIONAL S&T BUDGET BY AGENCIES

million yen

年度 F.Y. / 省庁別 Agency	'83	'84	'85	'86	'87	'88
国会 Diet	512	517	517	517	525	517
日本学術会議 Science Council of Japan	855	788	889	863	856	903
警察庁 National Police Agency	827	839	847	899	925	972
北海道開発庁 Hokkaido Development Agency	1 008	992	141	142	143	143
防衛庁 Defence Agency	39 452	44 607	58 677	66 133	74 135	82 700
経済企画庁 Economic Planning Agency	714	715	704	704	710	716
科学技術庁 Science & Technology Agency	392 311	401 833	413 337	420 342	425 232	430 955
環境庁 Environment Agency	10 882	10 482	8 524	8 320	7 914	7 752
国土庁 National Land Agency	-	-	298	210	160	105
法務省 M. of Justice	757	775	787	808	806	849
外務省 M. of Foreign Affairs	5 608	5 985	6 266	6 594	6 298	6 417
大蔵省 M. of Finance	854	873	897	938	1 009	978
文部省 M. of Education	709 242	714 760	713 789	745 591	780 174	812 954
厚生省 M. of Health & Welfare	29 313	31 812	33 759	36 121	39 761	44 059
農林水産省 M. of Agriculture, Forestry & Fisheries	58 749	60 193	61 266	66 477	66 748	66 642
通商産業省 M. of International Trade & Industry	177 764	171 487	198 672	217 557	221 409	221 226
運輸省 M. of Transportation	14 913	16 159	13 139	13 271	14 516	14 627
郵政省 M. of Post & Telecommunication	4 331	4 535	14 258	24 667	29 042	30 279
労働省 M. of Labour	1 890	3 821	2 827	2 970	3 635	3 708
建設省 M. of Construction	5 731	5 889	5 185	5 817	5 506	5 459
自治省 M. of. Home Affairs	497	512	515	527	536	543
合計 Total	1 456 210	1 477 573	1 525 294	1 598 969	1 655 040	1 706 504

[Source: Indicator of S&T 1987 STA]

Ⅳ. JAPAN's R&D STRUCTURE

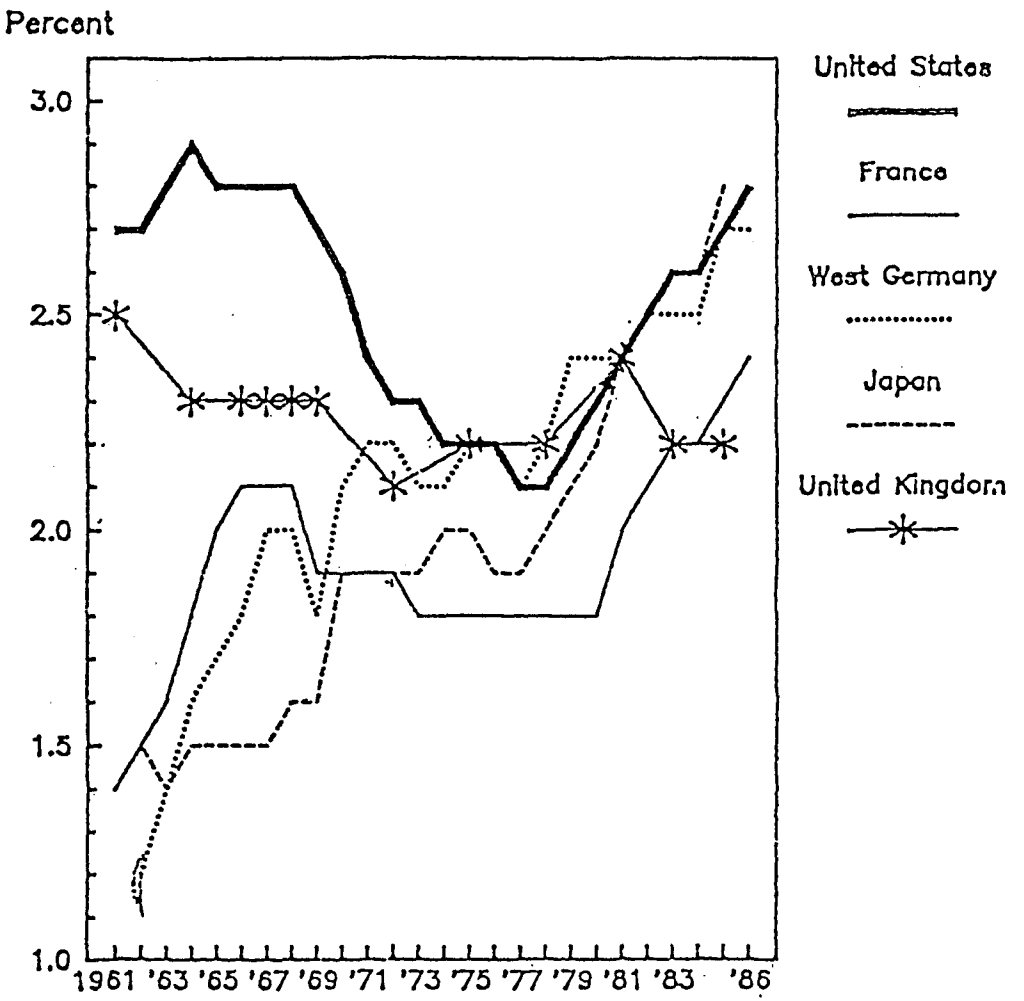
1. Survey of R&D activity (1987 fiscal year)

	JAPAN	USA	EUROPE		
			WEST GERMANY	FRANCE	U.K.
GNP (trillion yen)	351	649	163	1986 122	1985 110
(trillion dollars)	2.43	4.49	1.13	0.72	0.46
POPULATION (ten million persons)	12	24	1986 6	1986 6	1985 6
NATIONAL R&D EXPENDITURE (trillion yen)	9.0	17.8	4.6	1986 2.8	1985 2.4
(billion dollars)	62	123	32	17	10
RATIO OF NATIONAL R&D EXPENDITURE TO GNP	2.6%	2.7%	2.8%	1986 2.3%	1985 2.2%
RATIO OF GOVERNMENT FINANCED R&D EXPENDITURE TO NATIONAL R&D EXPENDITURE (INCLUDING DEFENSIVE R&D)	19.9%	49.0%	37.7%	1986 45.4%	1985 42.2%
(EXCLUDING DEFENSIVE R&D)	19.2%	28.9%	34.4%	32.0%	17.9%
NUMBER OF RESEARCHERS (TEN THOUSAND PERSONS)	42	80	1985 14	1985 10	1985 9
NOBEL PRIZE WINNERS (NATURAL SCIENCE)	5	147	57	23	65
(POST WAR WINNERS [ ])	[5]	[128]	[21]	[7]	[40]

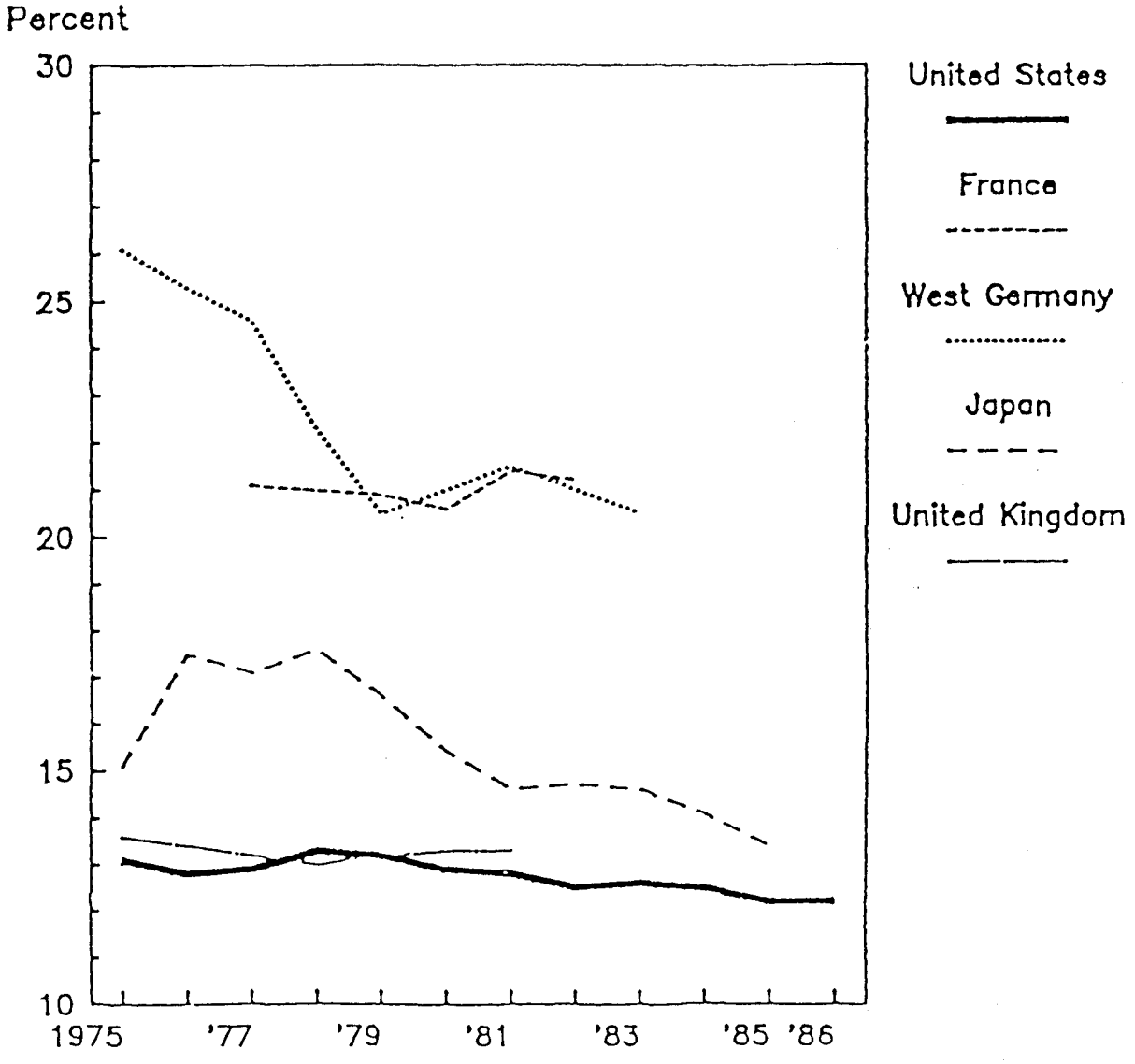
[source: white paper of science and technology 1987]

2 . INTERNATIONAL COMPARISON OF R&D INVESTMENT, BASIC RESEARCH INVESTMENT

National R&D expenditures as a percent of GNP by country

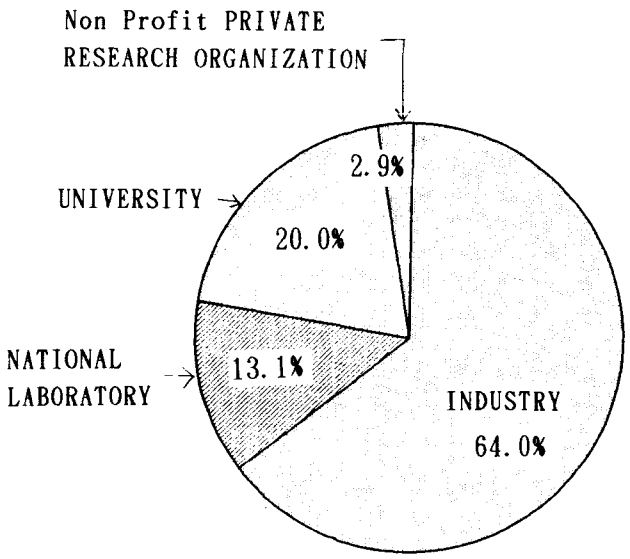


Basic research expenditures as a percent of total R&D expenditures by country

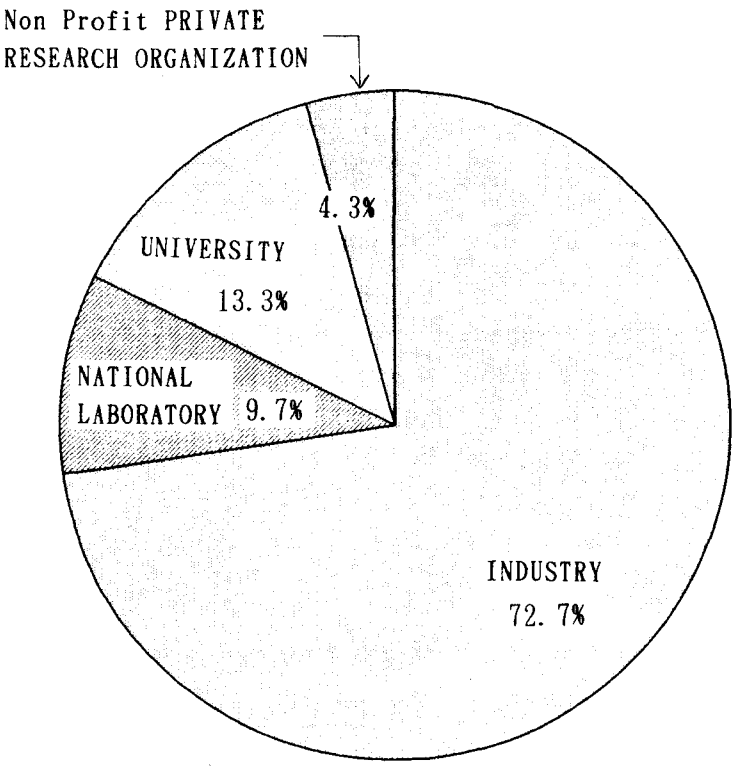


3 R&D EXPENDITURE BY SECTORS

1976 FISCAL YEAR TOTAL 2.9TRILLION YEN

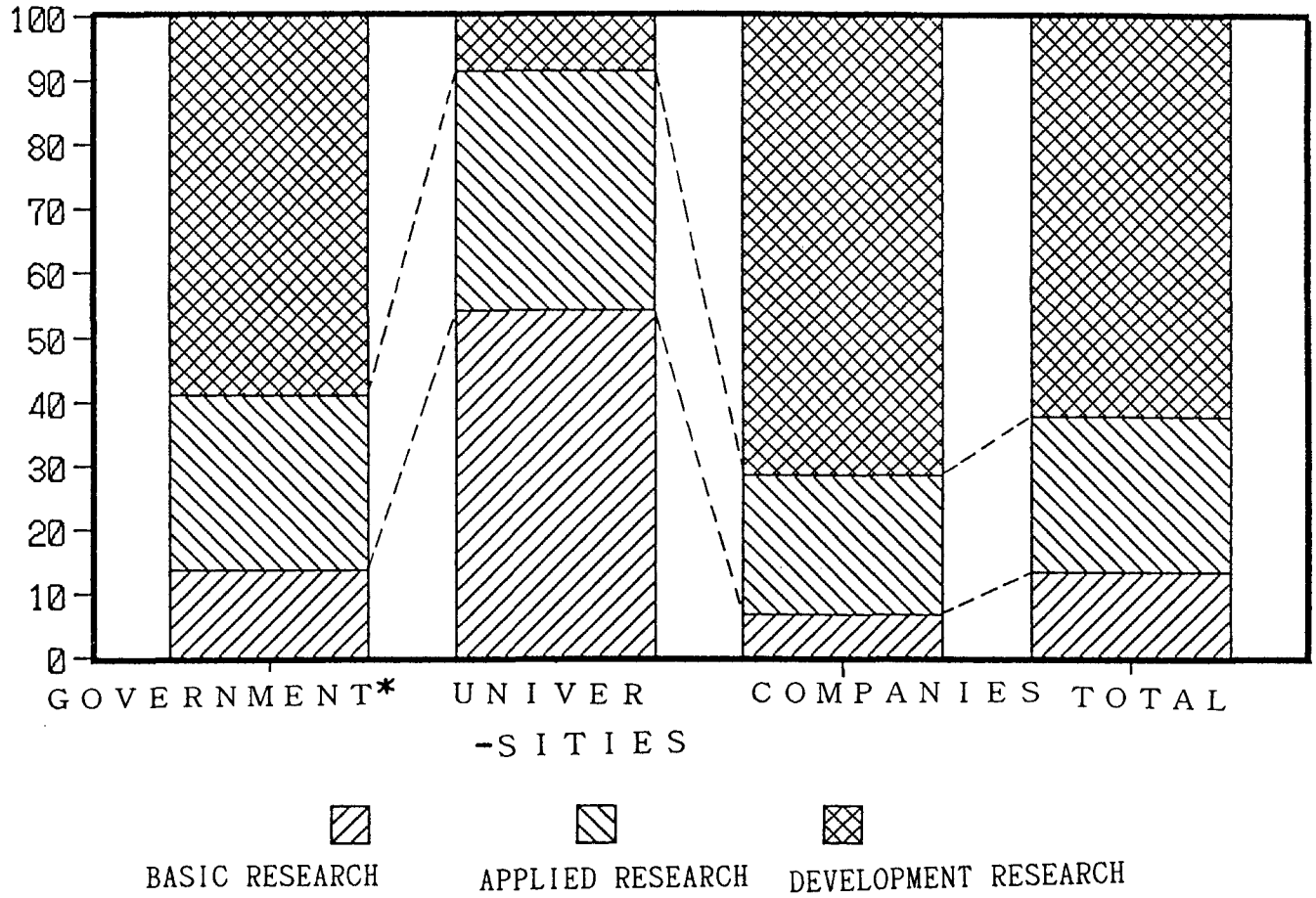


1986 FISCAL YEAR TOTAL 8.4TRILLION YEN



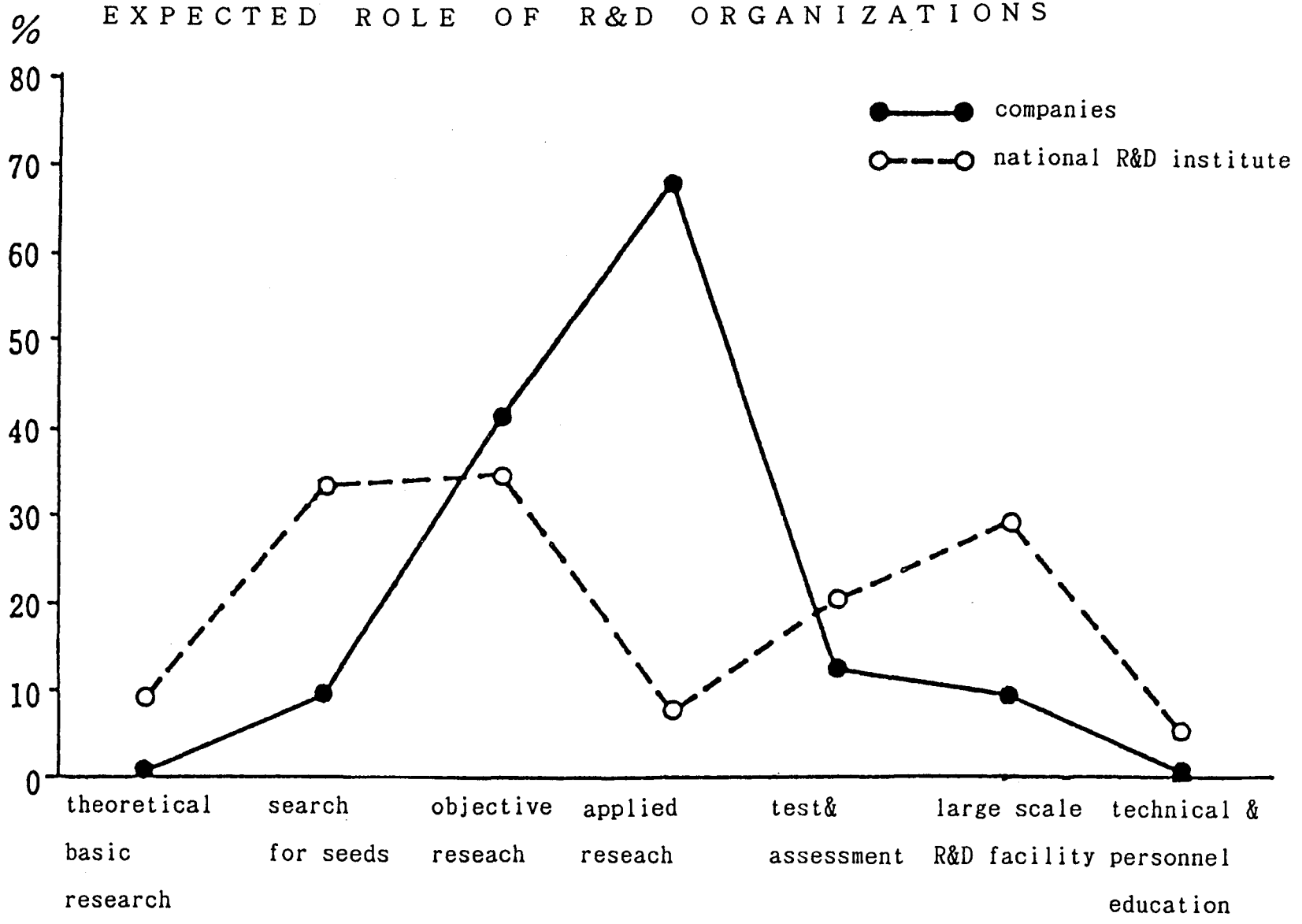
[Source: White Paper on S&T 1988]

4. PROPORTION OF JAPANESE R&D EXPENDITURES BY R&D CATEGORY (1986 FISCAL YEAR)



(* including local government's institutes and special corporations)

[Source : Report on the Survey of R&D 1987, Management and Coordination Agency]



[Source : White Paper on Science and Technology 1988]

5. INTER-SECTORAL AND INTERNATIONAL FLOW OF R&D FUND

COUNTRY	FISCAL YEAR	CROSS-FLOW OF R&D FUND BY SECTORS		FLOW OF FUND FROM OVERSEAS
		GOVERNMENT	INDUSTRY	
JAPAN	1986	11.6%	4.7%	0.1%
U S A	1987	56.5%	1.8%	-
WEST GERMANY	1987	58.2%	1.5%	1.1%
FRANCE	1983	24.4%	0.5%	3.6%
U.K.	1985	38.9%	10.7%	8.2%

[Source : White Paper on Science and Technology 1988]

CROSS-FLOW OF GOVERNMENTAL FUND = FUND FLOW TO INDUSTRY SECTOR + FUND FLOW TO PRIVATE RESEARCH INSTITUTES

CROSS-FLOW OF INDUSTRY FUND = FUND FLOW TO NATIONAL INSTITUTES + FUND FLOW TO PRIVATE RESEARCH INSTITUTES
+ FUND FLOW TO UNIVERSITIES

6. RESERCHERS TREND BY SECTORS

COUNTRY	FISCAL YEAR	NUMBER OF RESEARCHERS (THOUSAND PERSONS)	PROPORTION BY SECTORS		
			GOVERNMENT	UNIVERSITY	PRIVATE
JAPAN	1965	118	15.5%	33.3%	51.2%
	1975	255	9.8%	32.1%	58.1%
	1985	381	7.0%	31.0%	62.1%
	1987	418	6.3%	29.7%	64.0%
U S A	1986	802	7.9%	14.1%	78.0%
WEST GERMANY	1985	144	13.4%	20.5%	66.1%
FRANCE	1985	102	30.2%	25.5%	44.3%
U. K.	1985	90	19.0%	(not available)	81.0%

[Source : White Paper on Science and Technology 1988]

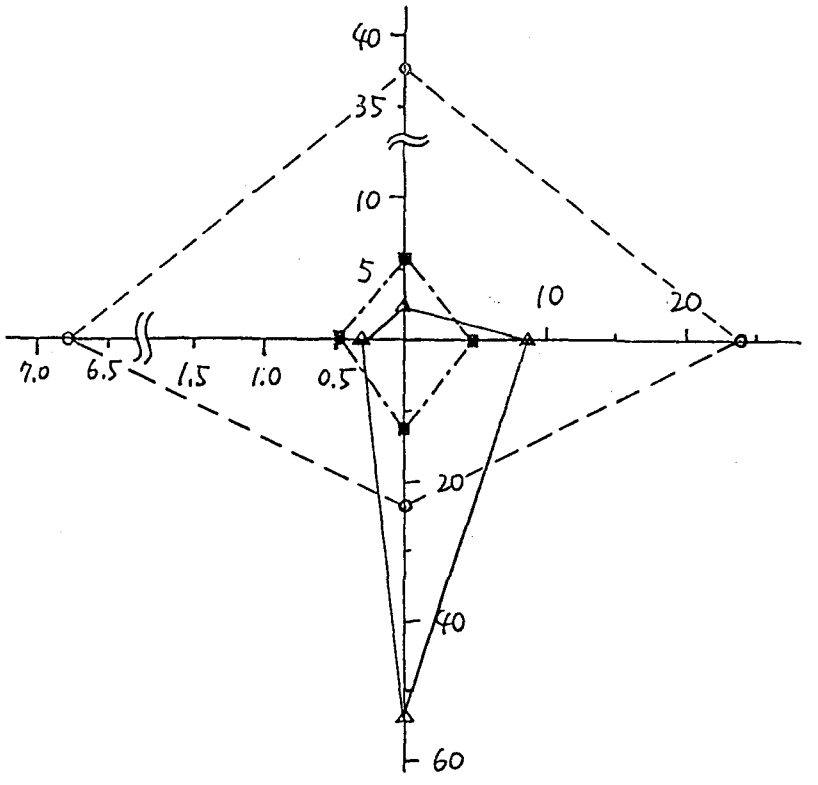
7. COMPARISON OF PROPORTION OF OUTPUT OF R&D ACTIVITY

proportion of papers cited by other authors in article published in scientific journals % [1982]

JAPAN
USA
WEST GERMANY

※ In each item,
100% = (JPN + USA + W.G. + U.K. + FRANCE + USSR)

technical trade balance income/expense [1987]



share of number of scientific papers [1985]

share of number of patent application % [1984]

[Source : White Paper on Science and Technology 1988 etc.]

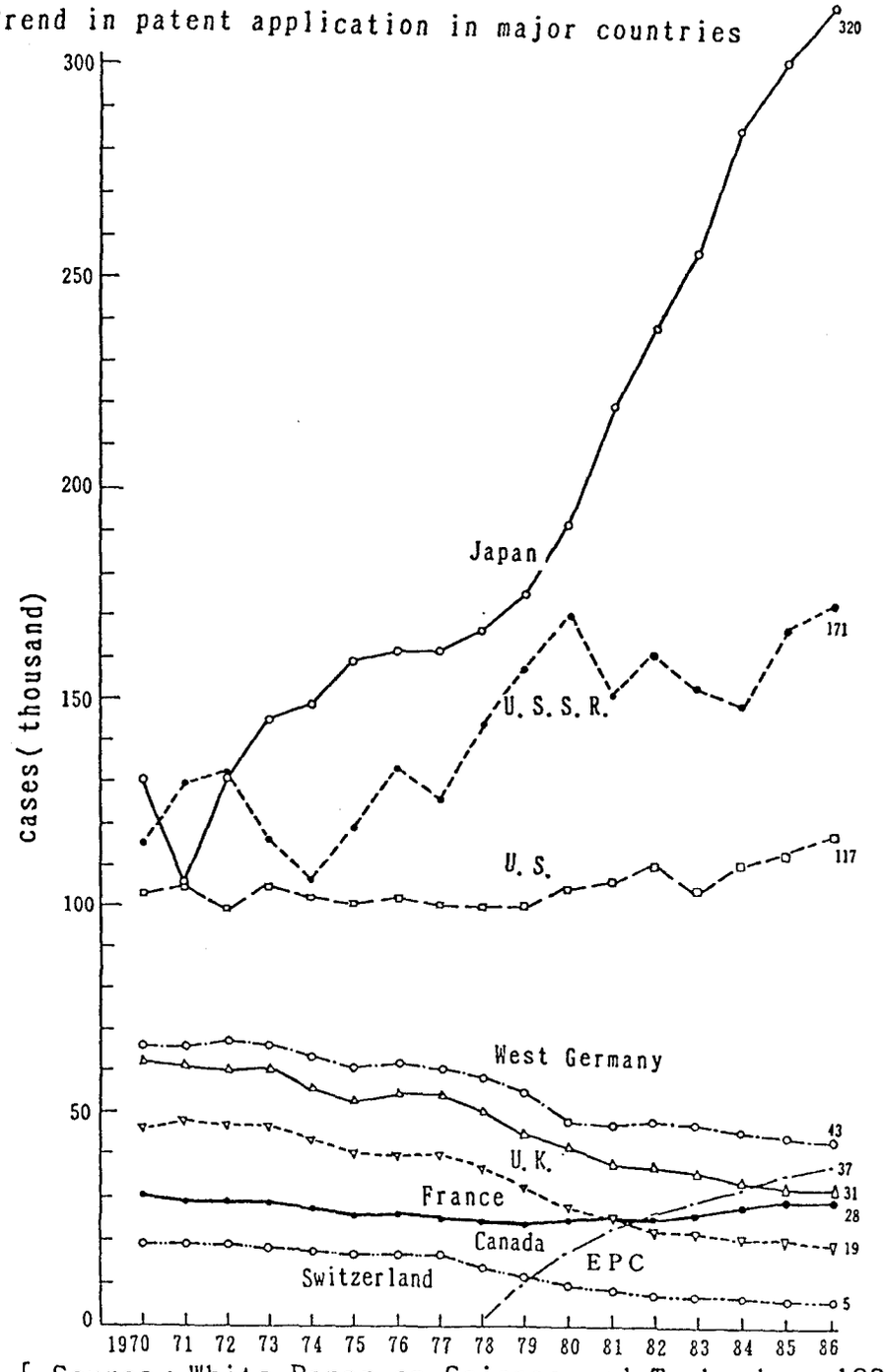
8. QUALITICAL COMPARISON OF SCIENTIFIC RESEARCH

(Qualitative analysis based upon the view of 1000 scientists & engineers)

LIFE SCIENCE FIELD	: USA > EUROPE > JAPAN
MATERIAL SCIENCE FIELD	: USA > EUROPE ≒ JAPAN
INFORMATION／ELECTRONICS SCIENCE FIELD	: USA > JAPAN > EUROPE
OCEAN&EARTH SCIENCE FIELD	: USA > EUROPE > JAPAN

[Source : White Paper on Science and Technology 1988]

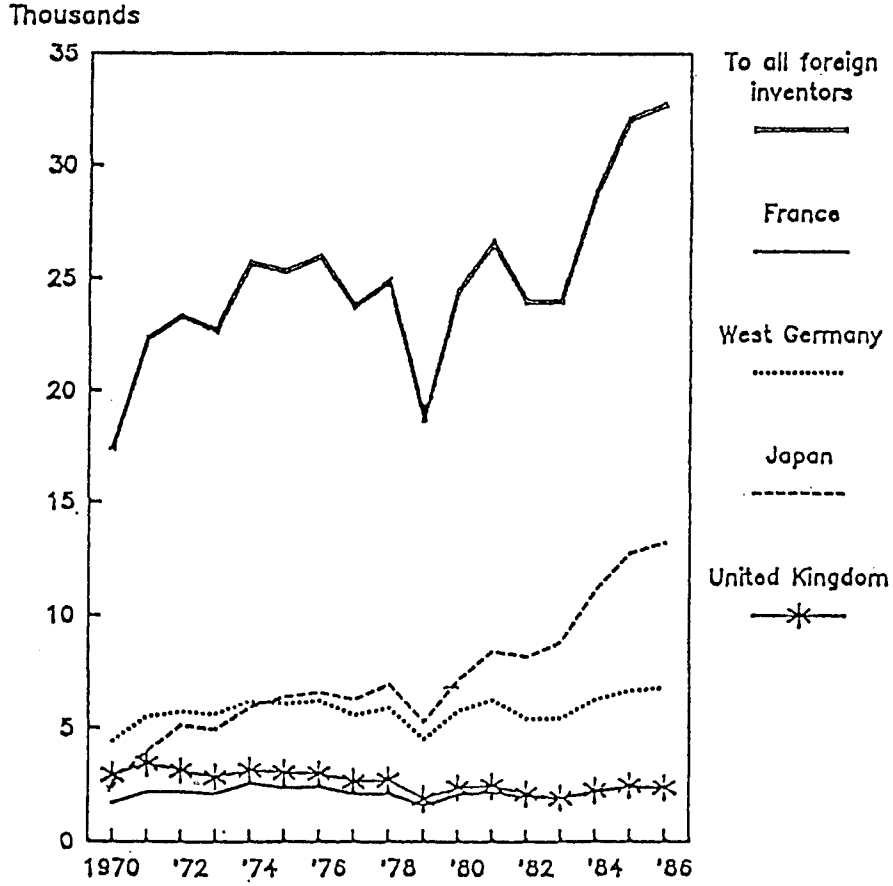
9. Trend in patent application in major countries



[Source : White Paper on Science and Technology 1988]

10 . TREND OF PATENTS IN USA

U.S. patents granted to inventors from selected countries, by date of grant and nationality of inventor



Japanese-invented U.S. patents by SIC category: 1975 and 1985

[Percent]

SIC category	Share of total patents granted	
	1975	1985
Food	8	11
Textiles	10	17
Chemicals and allied products	10	15
Petroleum	3	6
Rubber	10	18
Ceramics[1]	8	20
Primary metals	13	23
Fabricated metals	5	12
General machinery	7	15
Office computing and accounting machines[2]	13	33
Electrical machinery	10	21
Communications equipment and electronic components	13	26
Motor vehicles	7	23
Aircraft and parts	10	30
Professional and scientific instruments	12	23
All fields	9	19

[1]Stone, clay, and glass products.

[2]Includes computers.

SOURCE: Office of Technology Assessment and Forecast, U.S. Patent and Trademark Office, unpublished data

11. TECHNOLOGY TRADE OF JAPAN

	1976	1981	1986	AVERAGE ANNUAL INCREASE RATE RECENT TEN YEARS (1976~1986)
EXPORT Billion Yen	83	175	224	10.4 %
(Million Dollar)	(281)	(794)	(1330)	(16.8 %)
IMPORT Billion Yen	177	260	261	3.9 %
(Million Dollar)	(598)	(1177)	(1547)	(10.0 %)
EXPORT／IMPORT (%)	47 %	67 %	86 %	

[Source: Report on the Survey of R&D 1987, Management and Coordination Agency]

12 TREND IN SCIENTIFIC ARTICLES OF JAPAN

* This survey accounts the number of scientific articles which were written in 7 countries below, by means of searching those articles for reliable several data-base made in foreign countries annually from 1976 to 1985.
* 7 countries are Japan, Canada, France, FRG, UK, USA, USSR.

NAME OF DATA BASE (FIELD)	Increase ratio of number of all the articles in 10 years (1976~1985)	Increase ratio of number of the articles by Japanese researchers in 10 years(1976~1985)	Rank of Japan among 7 countries 1976	Rank of Japan among 7 countries 1985
INSPEC (Physics & Electronics)				
Physics	1.44	1.97	5	3
Electronics	1.40	2.67	4	2
Computer	1.79	2.53	4	3
CHEMICAL ABSTRACTS (Chemistry, Materials & Energy)				
Pharmaceutial Chemistry	1.66	2.66	3	2
Bio-chemistry	1.19	1.66	3	2
Agricultural Chemistry	0.94	1.20	3	2
Organic Chemistry	0.97	1.16	3	3
High Molecular Chemistry	1.12	1.19	3	3
Chemical Engineering	1.17	1.91	3	2
Industrial Chemistry	1.17	1.33	3	3
Metallurgy	0.88	1.20	3	3
Physical Chemistry	1.36	1.72	3	3
Energy	1.47	2.13	3	3
Property of Matter	1.30	1.76	3	3

NAME OF DATA BASE (FIELD)	Increase ratio of number of all the articles in 10 years (1976~1985)	Increase ratio of number of the articles by Japanese researchers (1976~1985)	Rank of Japan among 7 countries 1976	Rank of Japan among 7 countries 1985
COMPENDEX (Engineering)				
Civil Enginerring & Environmental Engineering	1.50	2.80	4	2
Metal & Resource Engineering	1.40	2.81	4	2
Mechanical Engineering	1.45	2.61	5	2
Chemical & Agricultural Engineering	2.00	3.37	5	3
Industrial & Management Engineering	1.96	4.07	5	2
Excepta Medica (Medical Science)				
Genetics	1.93	3.85	7	2
Physiology	1.30	1.48	4	3
Cancer Research (basic)	1.48	2.30	2	2
Cancer Research (clinical)	1.38	2.27	3	2
Heart Surgery	1.72	2.68	6	2

[source: International Comparative Survey on number of Scientific Research Articles, by Ministry of Education 1987]

13.EMPLOYMENT TRENDS OF SCIENCE AND ENGINEEERING GRADUATES

Employment trends of graduates from undergraduate courses by industries

Persons: In parentheses percentages are shown.
s=science **E=Engineering**

Graduating year		1965	1975	1980	1985	1987	1988
Number of graduates	S	4,748	9,504	11,554	12,698	13,389	13,385
	E	30,121	65,422	73,508	71,396	75,843	76,362
Number of employed	S	3,522 (74)	6,408 (67)	7,590 (66)	8,766 (69)	9,261 (69)	9,257 (69)
	E	26,698 (89)	54,234 (83)	62,131 (85)	59,216 (83)	61,883 (82)	61,822 (81)
Manufacturing	S	1,806 (51)	2,346 (37)	2,165 (29)	3,440 (39)	3,610 (39)	3,083 (33)
	E	17,656 (66)	27,848 (51)	31,473 (51)	35,373 (60)	36,197 (58)	32,829 (53)
Non-manufacture-ing	S	324 (9.3)	1,742 (27)	1,925 (25)	2,498 (28)	3,079 (33)	3,440 (37)
	E	1,226 (4.6)	7,960 (15)	10,354 (17)	8,845 (15)	11,074 (18)	12,860 (21)
Finance insurance trading companies etc.	S	194 (5.5)	886 (14)	758 (10)	443 (5.1)	596 (6.4)	718 (7.8)
	E	948 (3.6)	4,851 (8.9)	5,779 (9.3)	2,512 (4.2)	2,855 (4.6)	4,013 (6.5)
Finance and insurance	S	79 (2.2)	349 (5.4)	172 (2.3)	172 (2.0)	250 (2.7)	380 (4.1)
	E	94 (0.4)	641 (1.2)	457 (1.5)	454 (0.8)	586 (0.9)	1,193 (1.9)

Note 1: In the columns of the number of employed the ratio of the number of employed to that of graduates is indicated in parentheses.

Note 2: In other columns the ratio of employed persons by industries to the total number of employed is shown in parentheses.

[Source: "Preliminary Survey of Employment Trends of Science & Engineering Graduates" C. NISHIKATA et al. 1st Policy-Oriented Research Group]

Employment trends of graduates from masters courses by industries

Persons: In parentheses percentages are shown.

s=science E=Engineering

Graduaing year		1965	1975	1980	1985	1987	1988
Number of graduates	S	786	1,382	1,649	1,992	2,213	2,377
	E	1,666	6,060	7,135	8,628	10,413	11,129
Number of employed	S	277 (35)	624 (45)	809 (49)	1,208 (61)	1,306 (59)	1,459 (61)
	E	1,010 (61)	5,018 (83)	6,294 (88)	7,666 (89)	9,195 (88)	9,824 (88)
Manufacturing	S	106 (38)	307 (49)	438 (54)	783 (65)	880 (67)	894 (61)
	E	672 (67)	3,537 (71)	4,400 (70)	5,608 (73)	6,536 (71)	6,249 (64)
Non-manufacturing	S	10 (3.6)	54 (8.7)	77 (10)	104 (8.6)	142 (11)	165 (11)
	E	14 (1.4)	175 (3.5)	318 (5.1)	410 (5.4)	620 (6.7)	786 (8.0)
Finance, insurance, trading companies, etc.	S	1 (0.4)	11 (1.8)	10 (1.2)	13 (1.1)	22 (1.7)	43 (2.9)
	E	5 (0.5)	39 (0.8)	49 (0.8)	73 (1.0)	144 (1.6)	193 (2.0)
Finance and insurance	S	0 (0)	3 (0.5)	3 (0.4)	9 (0.7)	15 (1.1)	37 (2.5)
	E	0 (0)	10 (0.2)	10 (0.2)	16 (0.2)	72 (0.8)	113 (1.2)

Note 1: In the columns of the number of employed the ratio of the number of employed to that of graduates is indicated in parentheses.

Note 2: In other columns the ratio of employed persons by industries to the total number of employed is shown in parentheses.

[Source: "Preliminary Survey of Employment Trends of Science & Engineering Graduates" C. NISHIKATA et al. 1st Policy-Oriented Research Group]

Employment trends of graduates from doctor courses by industries

Persons: In parentheses percentages are shown.
s=science E=Engineering

Graduating year		1965	1975	1980	1985	1987	1988
Number of graduates	S	238	494	589	610	605	589
	E	170	570	657	552	638	721
Number of employed	S	167 (70)	240 (49)	259 (44)	287 (47)	283 (47)	294 (50)
	E	150 (88)	404 (71)	434 (66)	411 (74)	409 (64)	490 (68)
Manufacturing	S	11(6.6)	56 (23)	61 (24)	98 (34)	73 (26)	70 (24)
	E	21 (14)	124 (31)	174 (40)	139 (34)	110 (27)	138 (28)
Non-manufacturing	S	8 (4.8)	24 (10)	26 (10)	19 (6.6)	35 (12)	57 (19)
	E	1 (0.7)	26 (6.4)	16 (3.7)	23 (5.6)	37 (9.0)	57 (12)
Finance, insurance, trading companies, etc.	S	0 (0)	0 (0)	0 (0)	1 (0.3)	2 (0.7)	0 (0)
	E	0 (0)	2 (0.5)	0 (0)	1 (0.2)	2 (0.5)	1 (0.2)
Finance and insurance	S	0 (0)	0 (0)	0 (0)	1 (0.3)	1 (0.4)	0 (0)
	E	0 (0)	1 (0.2)	0 (0)	0 (0)	2 (0.5)	0 (0)

Note 1: In the columns of the number of employed the ratio of the number of employed to that of graduates is indicated in parentheses.

Note 2: In other columns the ratio of employed person by industries to the total number of employed is shown in parentheses.

[Source: "Preliminary Survey of Employment Trends of Science & Engineering Graduates" C. NISHIKATA et al. 1st Policy-Oriented Research Group]

V. RECENT INTERNATIONAL & DOMESTIC ENVIRONMENT OF S & T POLICY

Rising Recognition that the Development of S&T is a Key Factor for the Continuous Progress of World-wide Economy

○ S&T has become a main topic of the Economic Summit

1982 Versaille Summit
S&T was adopted as agenda

1986 Tokyo Summit
Space Station Program

1987 Venice Summit
HFSP(Human Frontier Science Program)

1988 Toronto Summit
HFSP — Global Environment Issues —

○ OECD Communique (1988.5)

"Technological progress is one of the major driving forces in the development of the world economy. Among the aspects which figure prominently on the policy agenda of Member Governments are: the process of generation and diffusion of new technology; their potential contribution to more dynamic economic performance and greater social welfare; the interaction between technology and society; and the implications for environment. Recognizing the growing importance of these questions and their international dimension,....."

Recent Changes around International Relationships in the Field of S&T

1. Changes of U.S. rules in the S&T activities

2. Advancement of international cooperation
   - Basic research, Large-scale R&D
   - Exchange of researchers

3. The intense competition on high technology and a rise of protectionism
   - Access to results of R&D
   - Protection of Intellectual Property Rights
   - Security concerns

○ Articles 1 of the newly Negotiated Japan-U.S. S&T Agreement States :

This Agreement establishes the policy framework for the overall science and technology relationship between the Parties, including collaboration in large-scale projects and major research and development initiatives. To strengthen that relationship, the Parties will conduct their science and technology relationship based on the principles of:

Examples of international cooperation in large-scale projects
ITER program of nuclear fusion area (1987～)
Space Station Program (1987～)

○ Omnibus Trade and Competitiveness Act of 1988
[Amendment of section 337 of the Tariff Act of 1930 —simplification of patent charge of US corporations]
Articles invading patent rights can be prohibited to be imported without the judgement of the damage to domestic industry (Reinforcement of protection of Intellectual Property Rights)

○ the Japan-US S&T Agreement (1988.6)
Article 6 of the Agreement (protection of intellectual property rights etc.), Article 7

(protection of information from security reasons and export control etc.), Annex Ⅳ "protection and distribution of intellectual property rights and other rights of proprietary nature"

○ Differences between the Japan and the US patent systems

○ Protection of the top-secrets —Dual Use Technology

Japan Has Developed S&T by Catch-up Method, but We Have no Model Country for the future

More emphasis upon creative basic research

↓

1. Creation of the "seed" by which we can make a stable and continuous economic growth

2. Change into the centers of excellence that can create, stock and dispatch common intellectual knowledge, so as to contribute to the world-wide progress of S&T

○ Recommendation of the council for S & T on the 11th, Preface

"Japan is expected, as one of technology-advanced countries along with the United States of America and EC countries, to contribute more to the development of the international community. On the other hand, hereafter, Japan will no longer have any model in the world to lead her future. Therefore, it is absolutely necessary for Japan to make efforts, trials and even errors. ....."

○ Council of economics, special committee of economic structure coordination

○ The Japan－US S & T Agreement, Annex Ⅱ

"Provide substantial numbers of competitive government fellowships in science and engineering for foreign nationals at their respective centers of excellence ....."

Rising Direct and Indirect Interactions between S&T and Human Society

Pursuit of qualitative affluence rather than quantitative

↓

1. Expectation to the role of S&T

2. Intrinsic change in the character of S&T

↓

Accurate grasp of social consciousness and demands is indispensable in promoting S&T

Advancement of S&T and Utilization of Resources → Affluent Society → Global Viewpoint on Resource Problems

Society abusing resources must recognize the limitation
—Desertization phenomenon、Green House Effect etc.

↓

Planning S&T policy taking into account effective and efficient utilization of resources from a global viewpoint

Request for Local Development

1. Decentralization of S&T activities

2. From factory siting to research facility siting
—Science City
—Intelligent City

Japan is now a Transient Period into 21st Century

Structural changes are needed including S&T field

In planning S&T policy, we must bear followings in mind.

- Creation of renewed policy innovation
- Timely and appropriate development of S&T policy from international viewpoint

↓

We should promote comprehensive research activities in many issues on both S&T activities and S&T policies.