Highlights of the Comprehensive Review of Japan's Science and Technology Basic Plans

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Comprehensive Review of
Japan's Science and Technology Basic Plans
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Outline of Presentation

Knowledge Creation

- Input
  - S&T Budget: Total Budget, Basic Research Budget, Competitive Research Funds, and Budgets for Priority Areas
  - Facilities and Intellectual Infrastructure
  - S&T Human Resources
    - Post-doctorate Researchers and Researcher Mobility
- Output
  - Research Papers
  - Patents

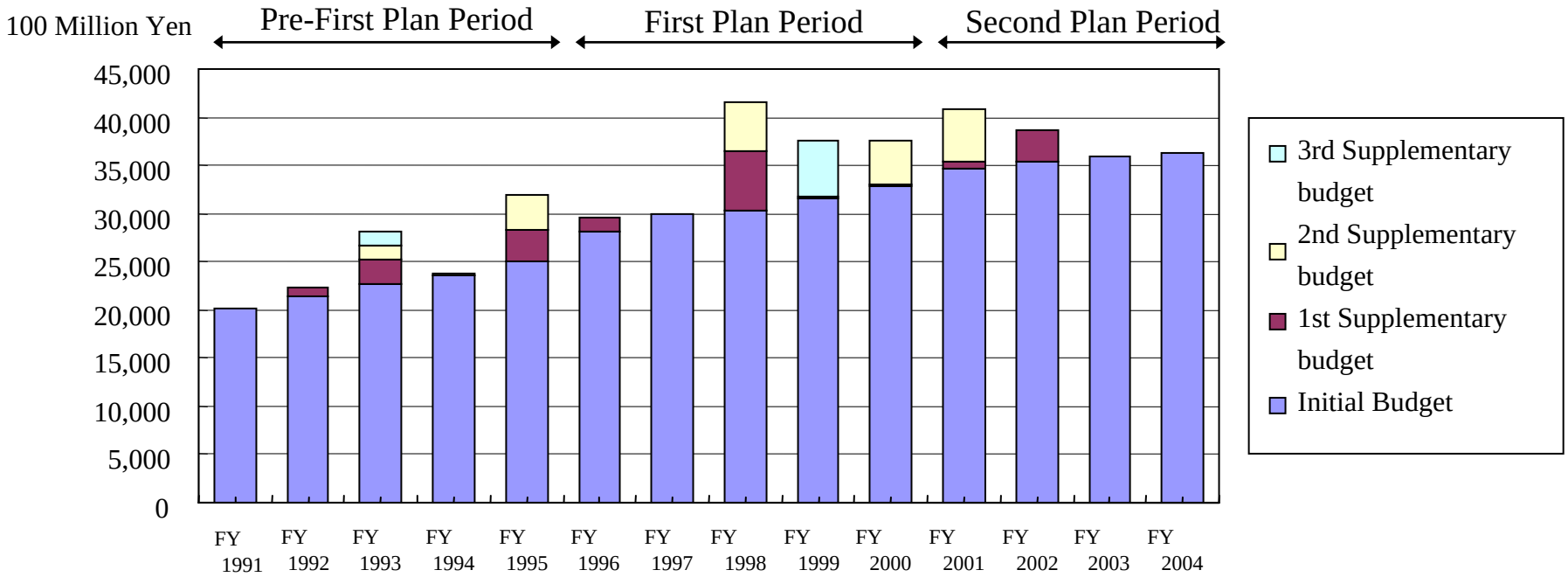
Knowledge Utilization

- University-Industry Collaboration
- Regional Innovation
- S&T Impacts on Economy, Society and People's Life

Trends in S&T Budget

Pre-First-Plan Period (FY1991-FY1995) 12.6 trillion yen (2.5 trillion yen/yr.)
First-Plan Period (FY1996-FY2000) 17.6 trillion yen (3.5 trillion yen/yr.)
Second-Plan Period (FY2001-FY2004) 15.1 trillion yen (3.8 trillion yen/yr.)

Trends in Initial and Supplementary S&T Budgets



Source: MEXT S&T Policy Bureau, "Budget for Science and Technology in FY 2003," May 2003 and its annual issues

Growth of S&T Budget

	Growth rate of initial budget (%)		
	Pre-First Plan Period (FY1991–FY1995)	First Plan Period (FY1996–FY2000)	Second Plan Period (FY2001–FY2003)
S&T Budget	5.4%	5.6%	3.1%
	1.8 pts.	2.9 pts.	3.4 pts.
Government budget (general expenditure)	3.6%	2.7%	-0.3%
GDP nominal value (real value)	2.1% (1.4%)	0.5% (1.4%)	-1.5% (0.0%)

*: The change in the GDP deflator between 1991-2001 was 5.8 points.

Source: MEXT S&T Policy Bureau, "Budget for Science and Technology in FY 2003," May 2003 and its annual issues, Japan Statistical Yearbook 2004

Share of Supplementary Budget

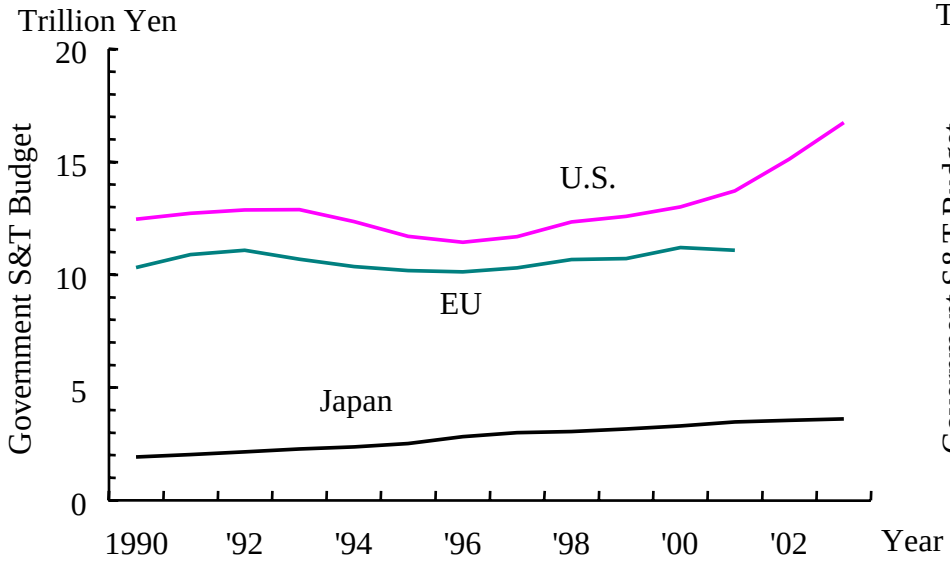
	Pre-First Plan Period (FY1991–FY1995)	First Plan Period (FY1996–FY2000)	Second Plan Period (FY2001–FY2003)
Share of supplementary budget in S&T budget	10.7%	13.4%	8.1%
Share of supplementary budget in general account expenditure (additional funding)*	11.7%	13.2%	7.5%

*: Obtained by dividing the additional funding of supplementary budget in general account expenditure by the value of (initial budget in general account expenditure + supplementary budget in general account expenditure)

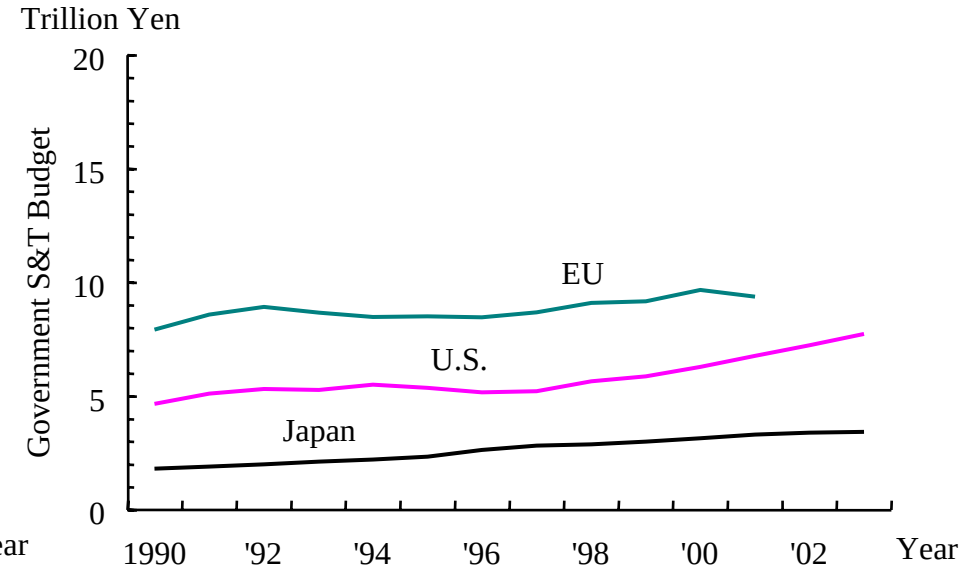
Source: S&T Policy Bureau, "Budget for Science and Technology in FY 2003," May 2003 and its annual issues, Ministry of Finance database "Information on Budgets and Settlements," and its annual issues

Comparison of S&T Budgets among Japan, U.S. and EU

All S&T budgets



Non-defense S&T budgets



International Comparison (Japan = 100)

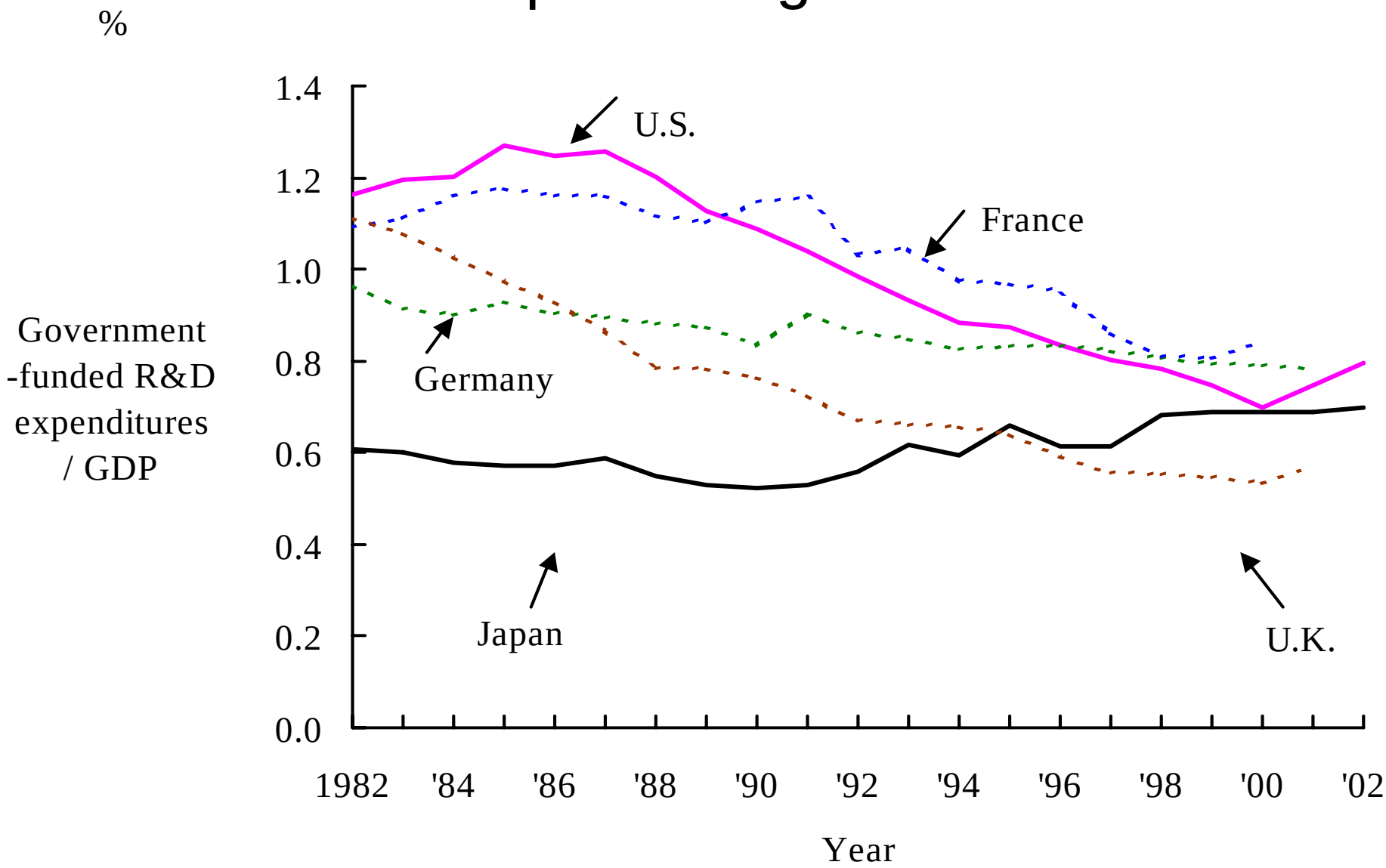
		1995	2000	2003
All S&T Budget	Japan	100	100	100
	U.S.	468	396	465
	EU	407	341	-

*1: All calculations were based on the initial budget.

*2: EU consists of 15 member countries as of March, 2004. The budgets for U.S. and EU were converted into Japanese yen using Purchasing Power Parity (PPP).

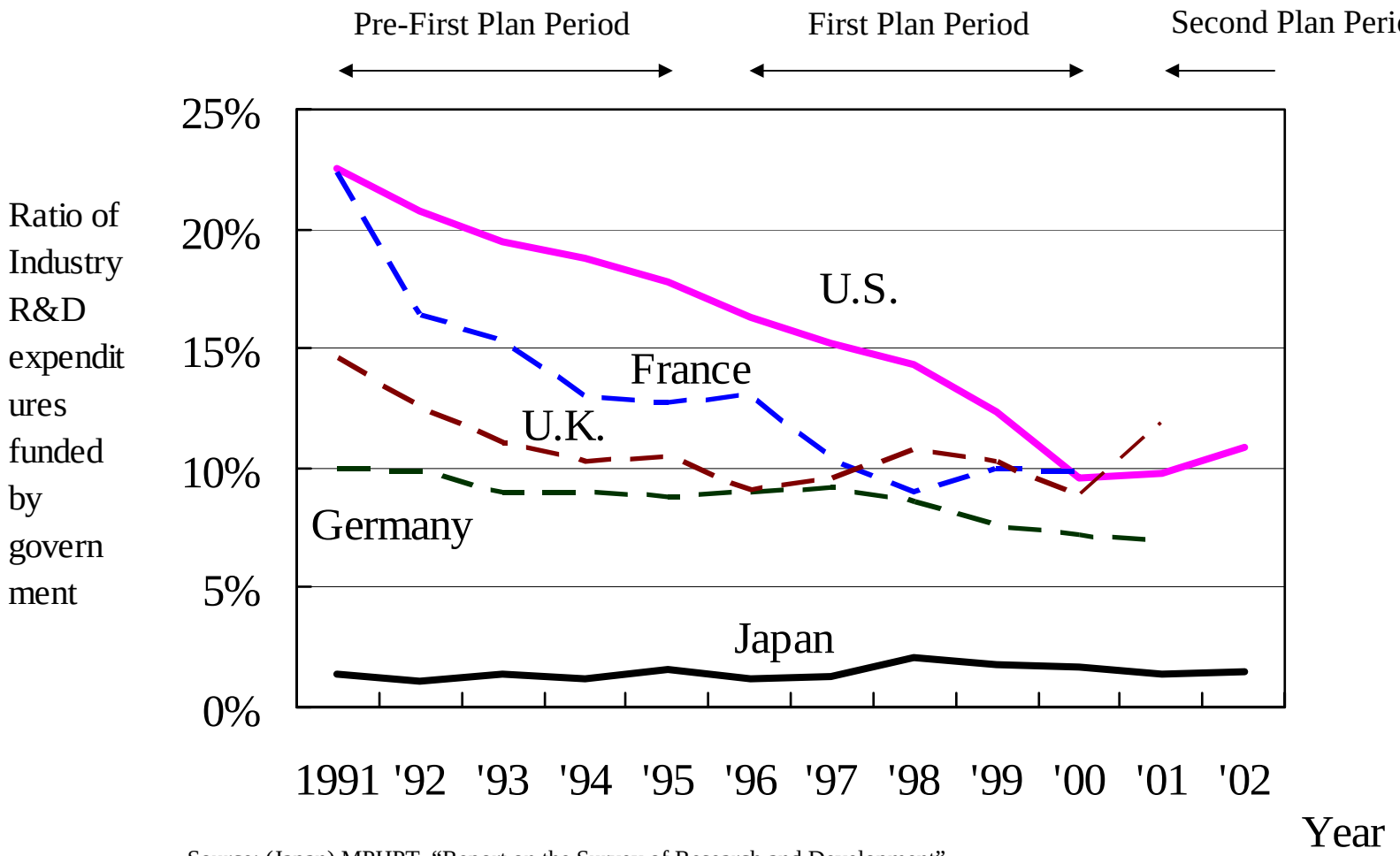
Source: Calculated using the data from OECD“ Main Science and Technology Indicators 2003-2”

Government Expenditure on R&D as a percentage of GDP



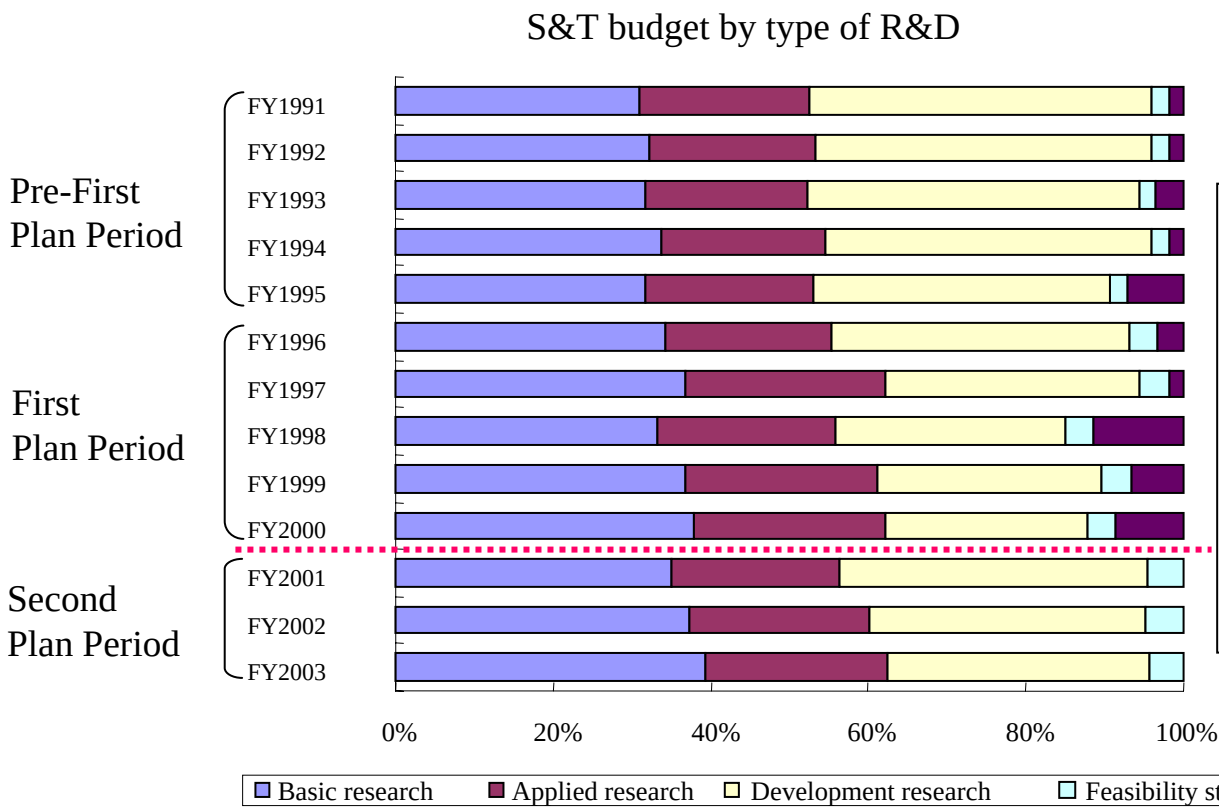
[References]

Industry R&D funded by Government



Source: (Japan) MPHPT, “Report on the Survey of Research and Development”
(U.S.) NSF, ”National Patterns of R&D Resources 2002 Data Update”
(Germany, France & U.K.) OECD, “Basic Science and Technology Statistics 2002/2”
For the UK data in 2001, ONS, “Gross domestic expenditure on Research and Development 2001”

S&T Budget by Type of R&D

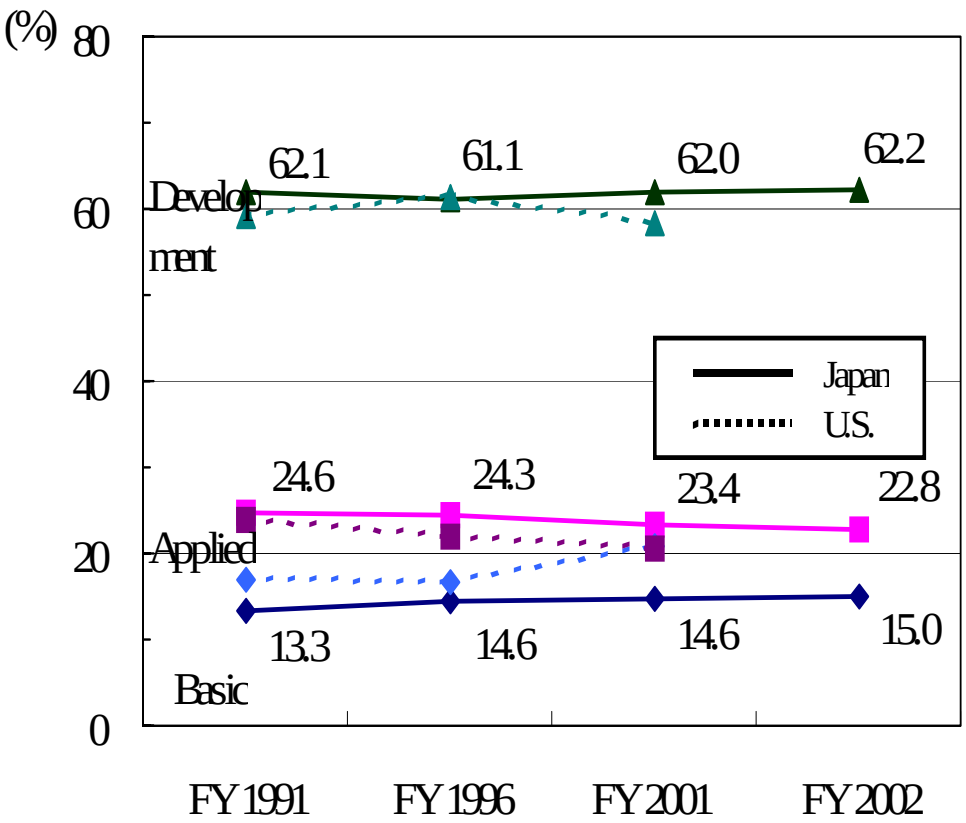


	Basic research ratio	R&D expenditures
Pre-First Plan Period	33.8%	6.1 Trillion Yen
First Plan Period	37.1%	8.8 Trillion Yen
Second Plan Period	38.2%	5.8 Trillion Yen

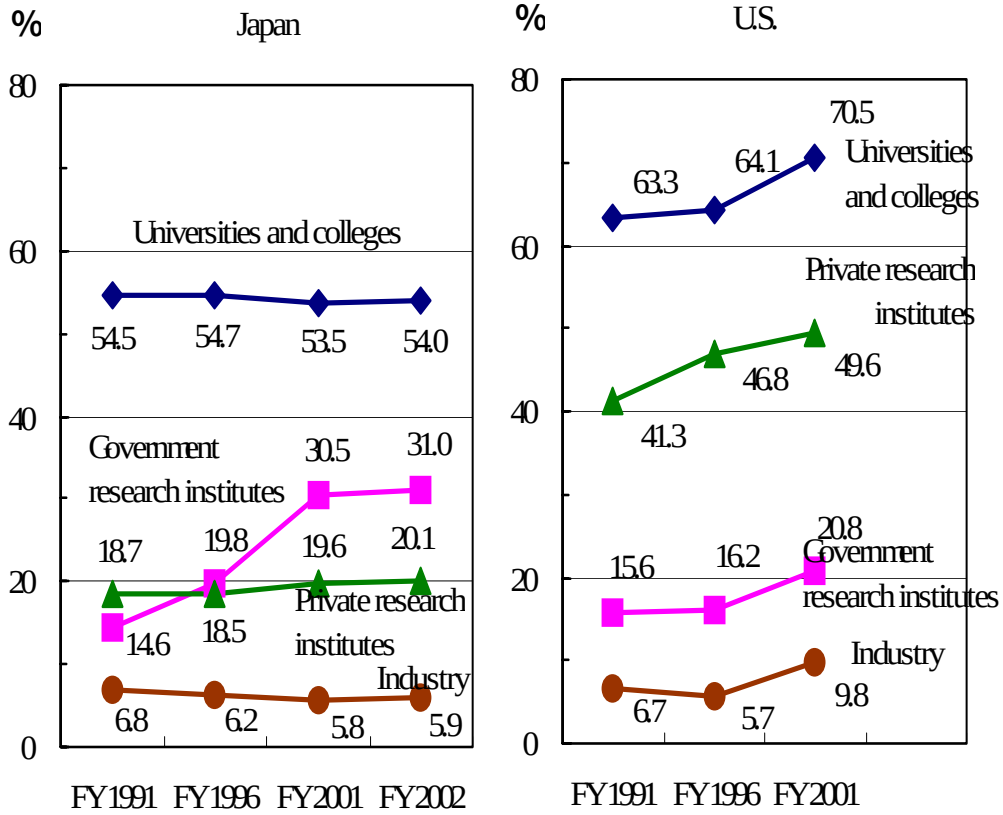
*1:Calculation methods differ for the years before and after FY2001.
*2:Of the S&T budget, R&D expenditures were classified into basic research, applied research, development research, feasibility study and testing, and unclassifiable.
*3: R&D expenditures for national and Special Public Institutions' research institutes were calculated based on the type of R&D ratios in the "Report on the Survey of Research and Development" by Ministry of Public Management, Home Affairs, Posts and Telecommunications (MPHPT). R&D expenditures after FY2001 were categorized by type of R&D, using MEXT's S&T budget database.
*4:R&D expenditures of national, public, and private universities in the S&T budget were multiplied by type of R&D ratios by sector in MPHPT, "Report on the Survey of Research and Development" .
*5: R&D expenditures for Departments of Ministries and Agencies, operating bodies of Special Public Institutions, Special Public Institutions, and others were categorized for each project based on the type of R&D classifications used in the MEXT's S&T budget database.
*6: Budgets for competitive research funds were excluded from the R&D expenditures of Special Public Institutions operating bodies and MEXT departments. Each project was categorized by research type based on its contents.
*7: Ratios in FY2003 are based on the initial budget only.
Source: MEXT S&T Policy Bureau, "Budget for Science and Technology in FY 2003," May 2003, and its annual issues, MPHPT, "Report on the Survey of Research and Development," and competitive research funds data.

[References] Basic Research Ratios in Japan and U.S.

Basic research ratios

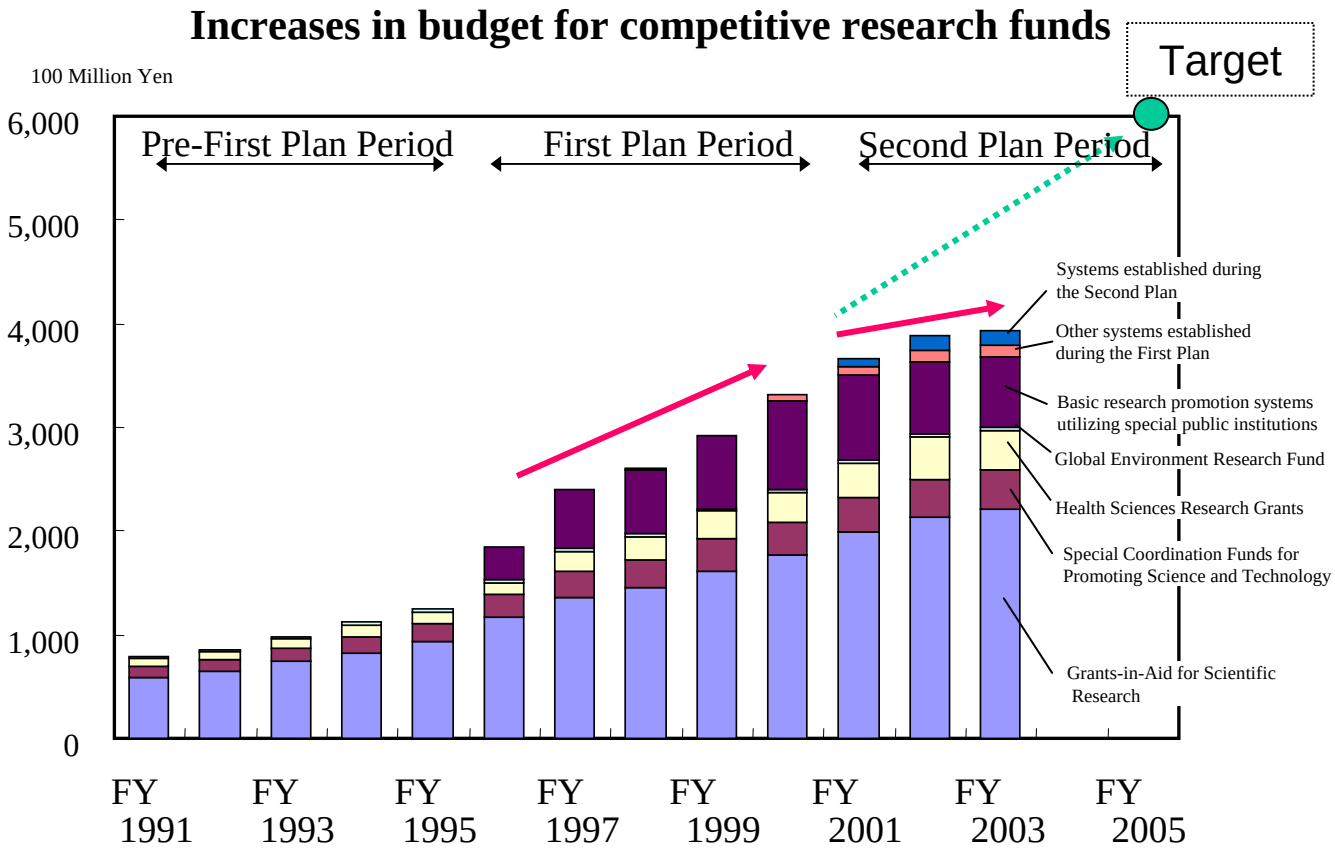


Basic research ratios by sector



Source: MPHPT, “Report on the Survey of Research and Development”
MEXT S&T Policy Bureau, “Indicators of Science and Technology” (2002)
NISTEP, “Science and Technology Indicators” (2004)

Trends in Competitive Research Funds



Source: MEXT S&T Policy Bureau, "Budget for S&T in FY 2003," May 2003 and its annual issues, and budget for S&T data

i. Systems established before the First Plan
- -Grant-in-Aid for Scientific Research
- -Special Coordination Funds for Promoting Science and Technology
- -Health Sciences Research Grants
- -Global Environment Research Fund

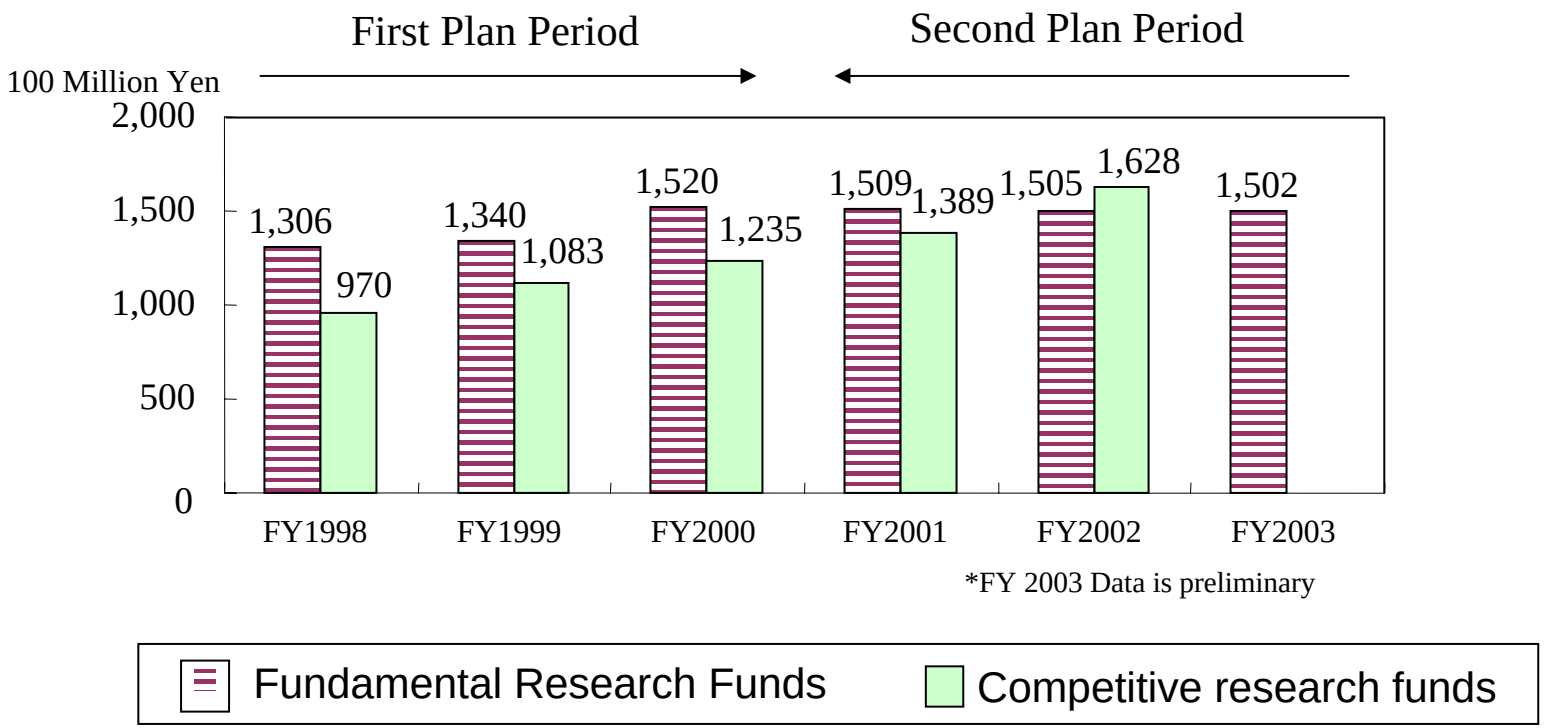
ii. Systems established during the First Plan

[Basic research promotion systems utilizing special public institutions]
- *Core Research for Evolutional Science and Technology
- *Basic Research Promotion System in Information Communication
- *Research for the Future Program Subsidy
- *Program for Promotion of Fundamental Studies in Health Sciences
- *Program for Promotion of Basic Research Activities for Innovative Biosciences
- *Proposal-based Creative R&D Promotion Program and Industrial Technology Research Grant Program (since FY 1999)
- *Program for Promoting Fundamental Transport Technology Research

[Others]
- -Industrial Technology Research Grant Program
- -R&D Program for New Bio-industry Initiatives
- -Research Project for Utilizing Advanced Technologies in Agriculture, Forestry and Fisheries
- -Grant-in-Aid for the Development of Innovative Technology (Open Competition for the Development of Innovative Technology since FY2002)
- -Proposal-based Frequency Resources Development Technology Research
- -R&D Promotion Scheme Utilizing Japan Gigabit Network
- -Proposal-based Basic Research 21 for Breakthroughs in Info-Communications
- -Strategic Information and Communications R&D Promotion System
- -Advanced Technology Development for Pioneering New Communication and Broadcasting Fields (Telecom Incubation)

iii. Systems established during the Second Plan
- -R&D Program for New Bio-industry Initiatives
- -Research Grant for Fire and Disaster Management
- -Creation Support System for University-Initiated Start-Ups
- -R&D Subsidy for Construction Technology
- -Technical Development Program for Making Agribusiness in the Form of Utilizing the Concentrated Know-How from Private Sector
- -Research Promotion System for Private-based Technology
- -R&D of Quantum Information Communications Technology
- -Environmental Technology Development Fund
- -Research and Technology Development on Waste Management Research Grant

Competitive Research Funds and Fundamental Research Funds at National Universities

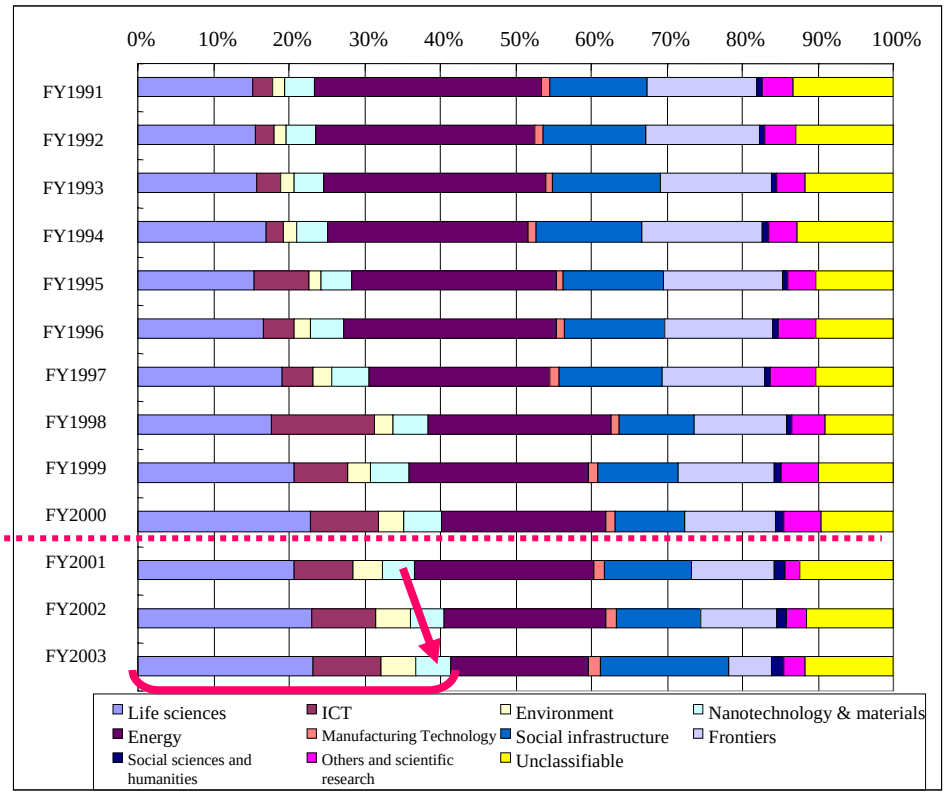


*: "Appropriation for basic cost of education and research" in this figure only contains the portion registered in the S&T budget under the National School Special Account.

"Competitive research funds" represent the funds allocated to national universities under various project names.

Source: Calculated by Mitsubishi Research Institute, Inc, based on data and information provided by MEXT and other government bodies

R&D Budget Ratios by Priority Areas (Life Science, ICT, Environment Science, and Nanotech & Material S&T)



Pre-First Plan Period

First Plan Period

Second Plan Period

Ratios of the four areas

R&D Budget

Pre-First Plan Period 6.1 Trillion Yen
(FY1991–FY1995)
29.1%

First Plan Period 8.8 Trillion Yen
(FY1996–FY2000)
37.6%

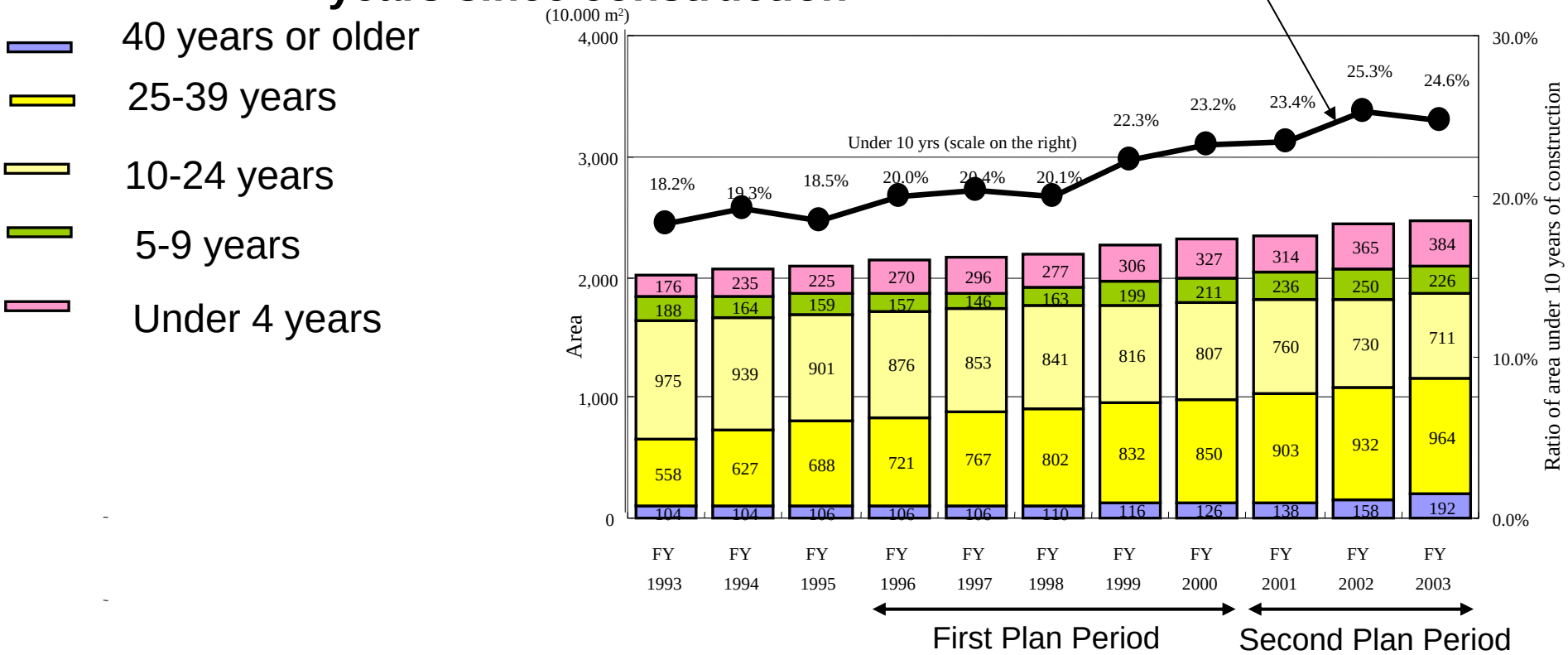
Second Plan Period 5.8 Trillion Yen
(FY2001-FY2003)
41.9%

*1: Data collection standards differ between before and after FY 2001.
*2: Data include initial and supplementary budgets, other than FY 2003 in which only the initial budget was included.
Source:Calculated by NISTEP and Mitsubishi Research Institute, Inc, using the MEXT “Budget for Science and Technology in FY 2003” and its annual issues, “Nationwide List of Research Institutes in Japan,” and data and information provided by the MEXT and other government bodies

Facilities

Ratios of floor space newer than 10 years old

Floor space of national universities by the number of years since construction



Source: MEXT, “Japanese Government Policies in Education, Culture, Sports, Science and Technology” and its annual issues
Research cooperators council on future development of facilities at national universities, “Knowledge base – the management and operation outlines on the improvement of facilities at national universities,” July 2003

Intellectual Infrastructure

[Research materials]

	year			Goals
	2001	2002	2003	2020
Microorganisms (num. of stains)	Approx. 200,000	Approx. 250,000	Approx. 290,000	Approx. 600,000
Animal cells (num of strains)	Approx. 4,000	Approx. 8,000	Approx. 20,000	Approx. 30,000
Animals (Mice, num of strains)	Approx.1,700 (Mouse embryos approx. 60,000)	Approx.2,200 (Mouse embryos approx. 65,000)	Approx.2,600 (Mouse embryos approx. 265,000)	Approx.4,000 (Mouse embryos approx. 240,000)
Plant genetic resources -Core genetic resource - Arabidopsisthaliana	Approx. 220,000 Approx. 46,000	Approx. 340,000 Approx. 72,000	Approx. 340,000 Approx. 74,000	Approx. 600,000 Approx. 90,000

[Measurement tandards]

	year			Goals
	2001	2002	2003	2020
Measurement standards	82 species	136 species	152 species	Approx. 250 species
Reference materials	76 species	119 species	150 species	Approx. 250 species

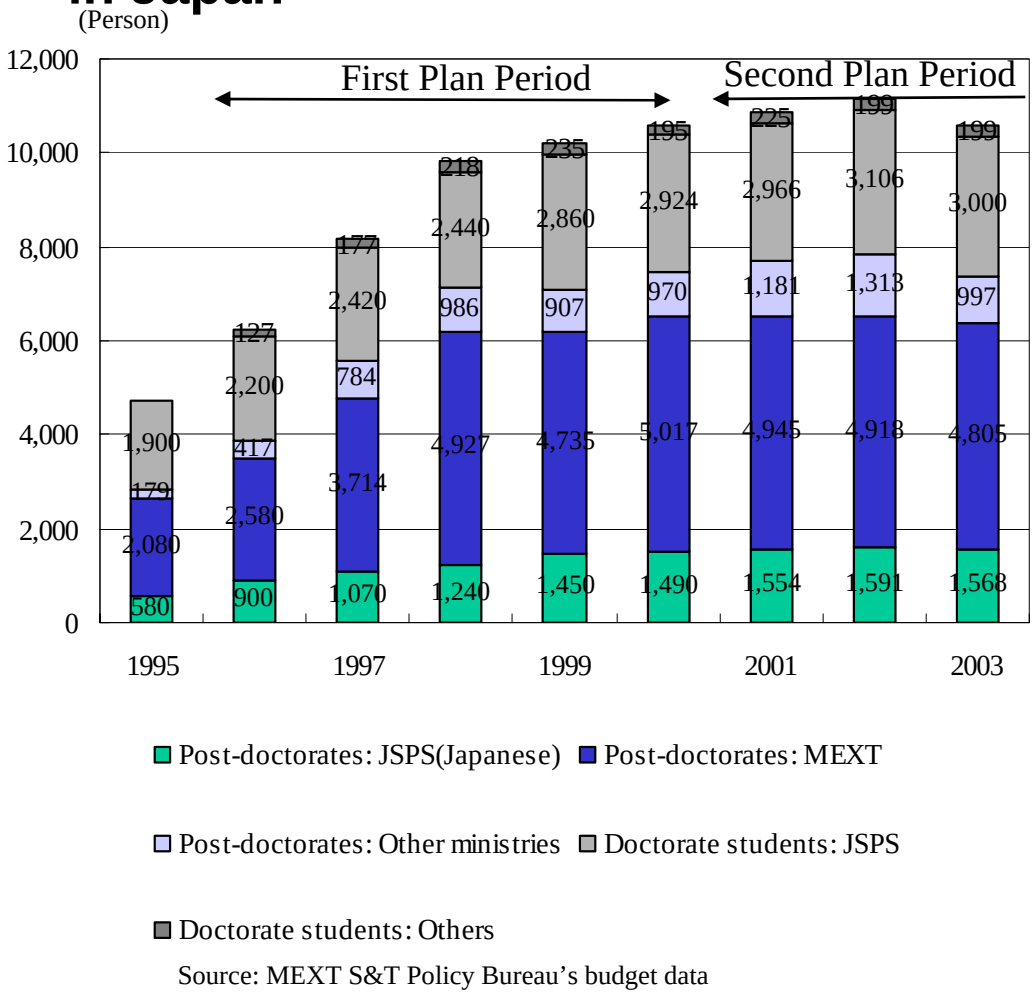
[Databases]

(1) Corresponding database for creatures and organisms					
	DNA sequence database (the number of annual entries of base sequences at the DNA Data Bank of Japan).	600Mbps	940Mbps (2001.10 - 2002.9)	1020Mbps (2002.10 - 2003.9)	6,000Mbps
(2) Corresponding databases for materials and substances					
	Material properties database	Approx. 600,000	Approx. 800,000	Approx. 980,000	Approx. 1,800,000
	Chemical safety database	Approx. 2,000	Approx. 2,900	Approx. 3,000	Approx. 4,500

*: The data from the intellectual infrastructure plan was used for the year of 2001. Questionnaire data was used for 2003.
Source: Handout distributed at the 5th meeting (February 20, 2004) of the Intellectual Infrastructure Committee, Technology and Research Foundations Section, Council for S&T, MEXT

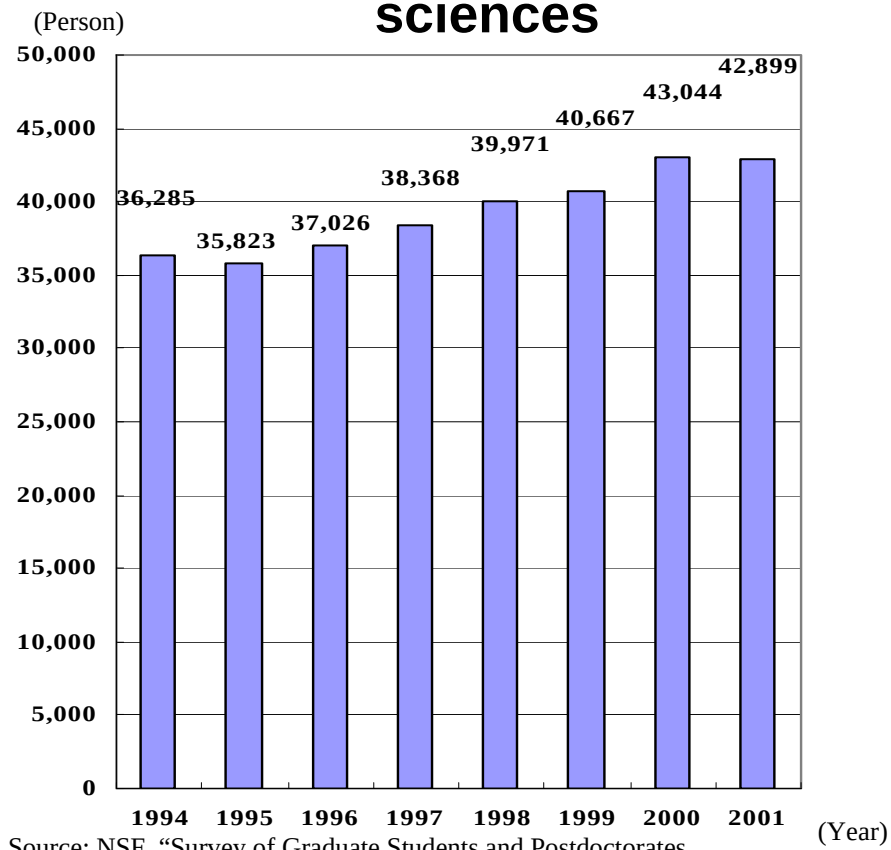
Supports for Post-Doctorates

Number of supported post-doctorates in Japan



Source: MEXT S&T Policy Bureau's budget data

U.S. post-doctorates in natural sciences

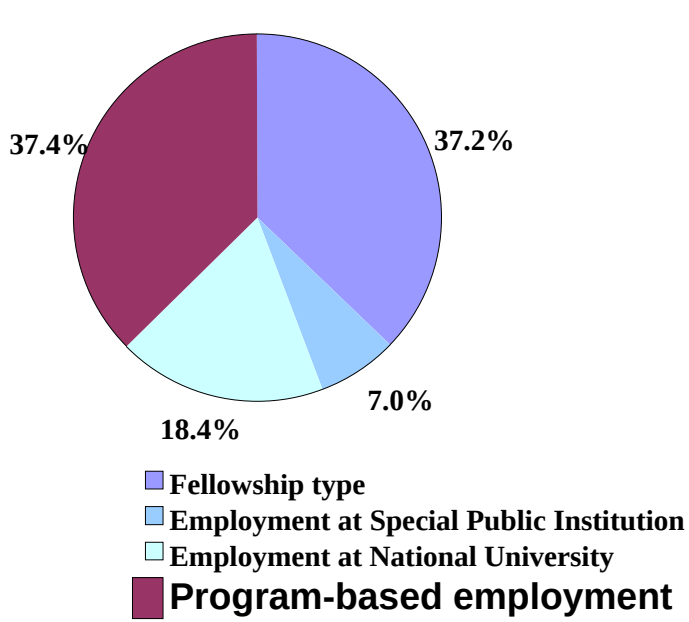


Source: NSF, "Survey of Graduate Students and Postdoctorates in Science and Engineering"

*: As for 2003, the number of post-doctorates in social science and humanities employed between 2001 and 2003 was deducted from the total number of the number of post-doctorates in FY2003.

Types of Supports for Post-doctorates

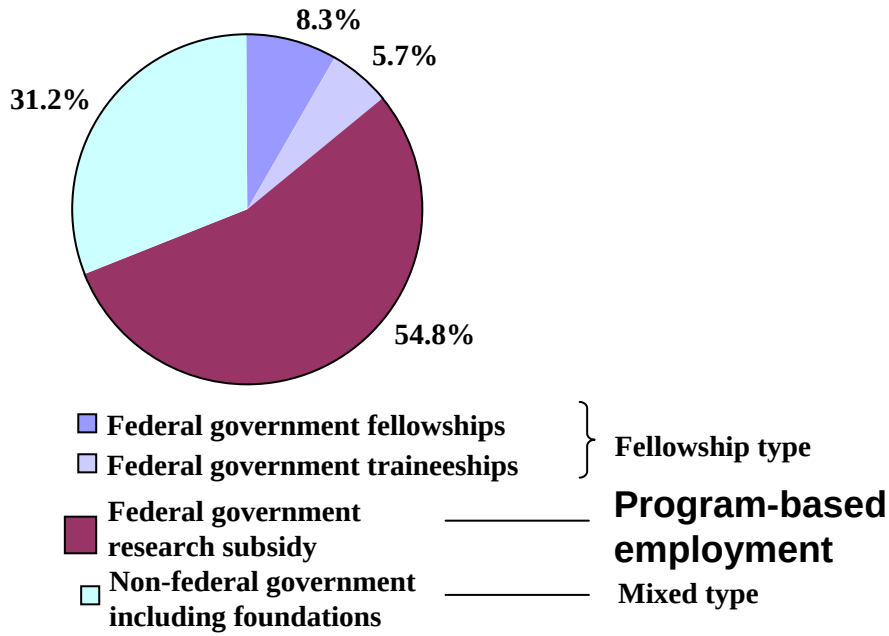
Japan (2003) *



Source: MEXT S&T Policy Bureau, "Budget for Science and Technology in FY 2003"

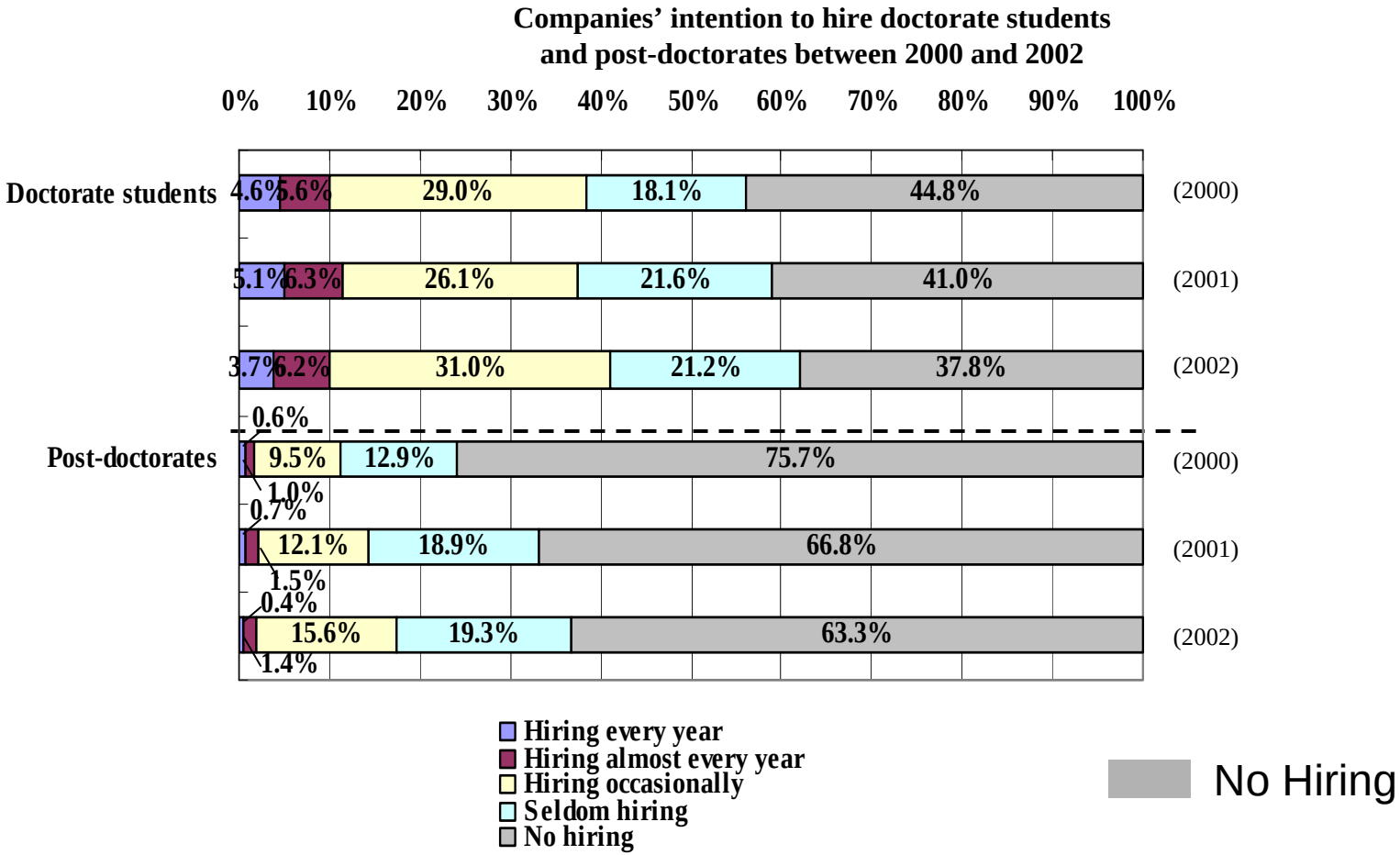
* : The coverage is 10,000 Post-Doctorates Program, other than Course Doctor Support Program, Program for Sending Researchers Overseas, and Foreign Researchers Invitation Program

U.S. (2001)



Source: NSF "Survey of Graduate Students and Postdoctorates in Science and Engineering"

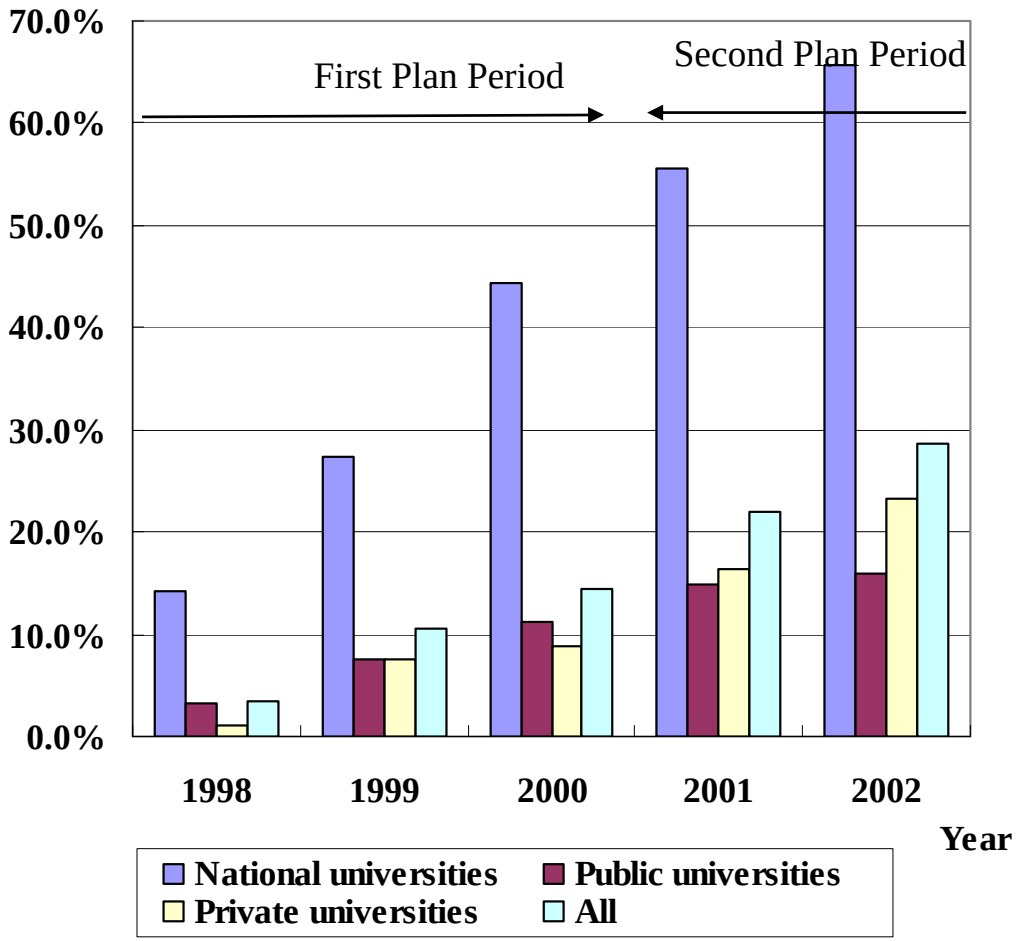
Hiring Post-Doctorates and Doctorate Students by Private Companies in Japan



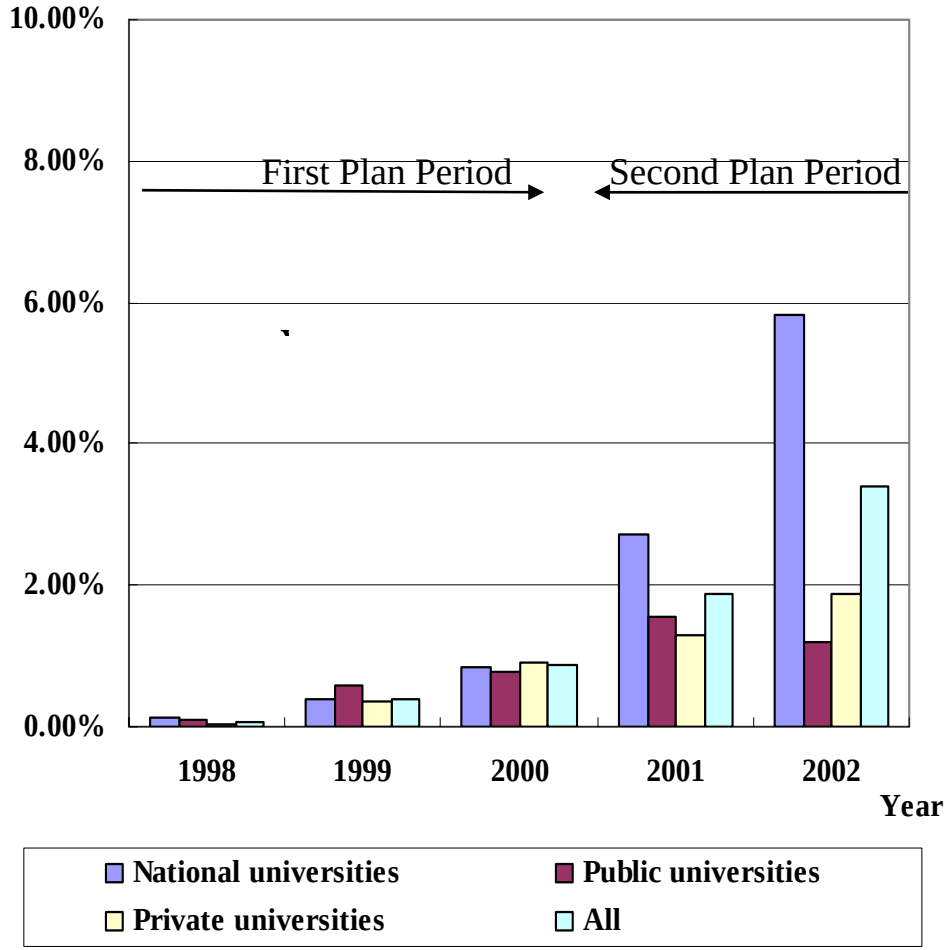
Source: MEXT, "Survey Report on Research Activities of Private Companies"

Introduction of Fixed-term Employment System

Ratios of fixed-term employment system introduction



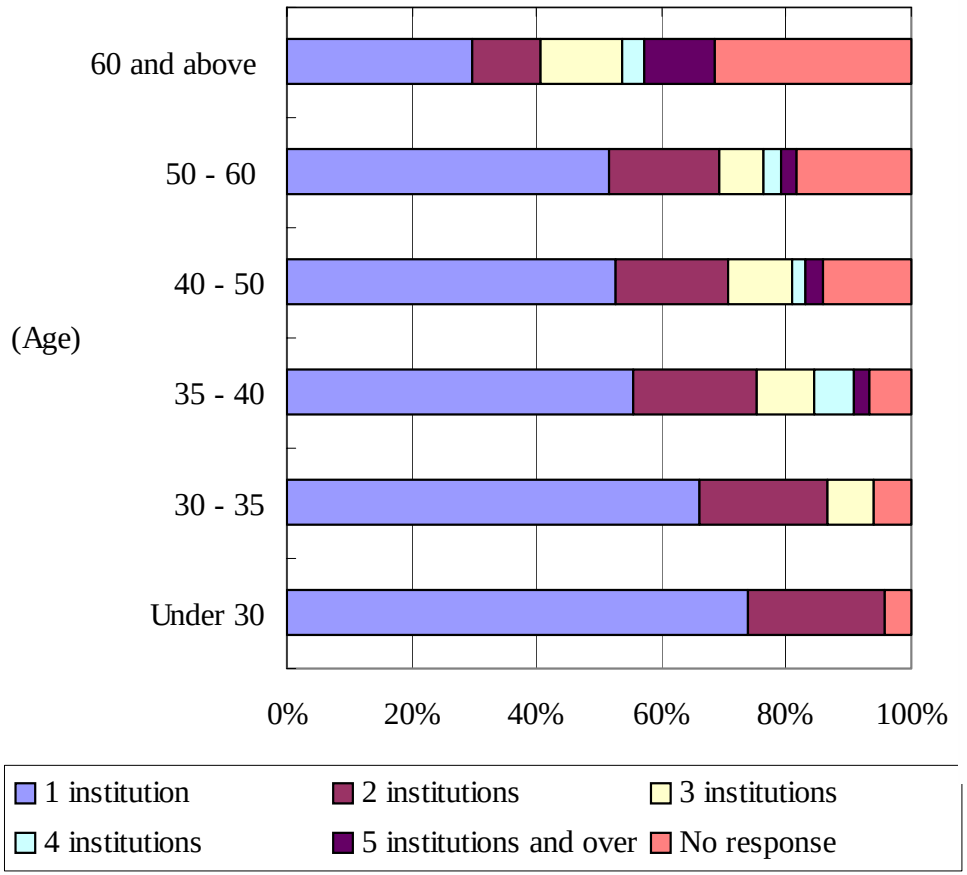
Ratios of fixed-term researchers



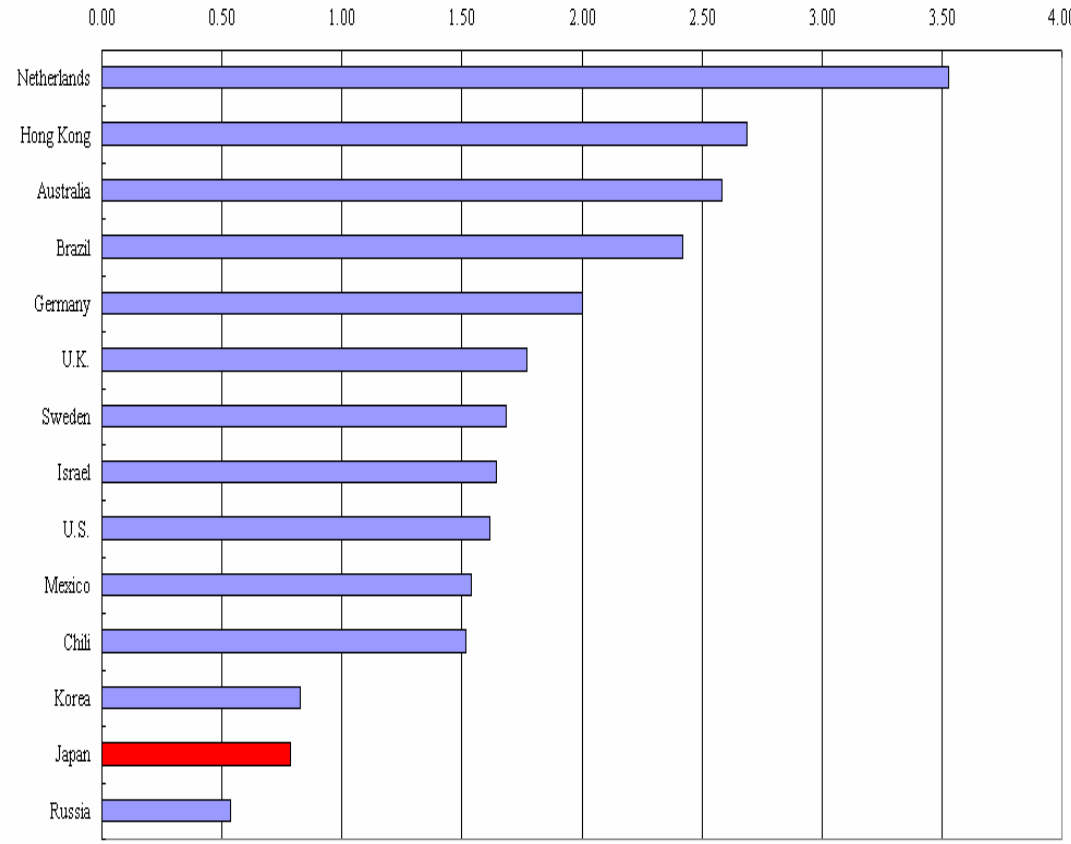
Source: The materials from the Subdivision on Universities of the Central Council for Education

Researchers' Mobility

Number of institutes experienced by a researcher in Japan

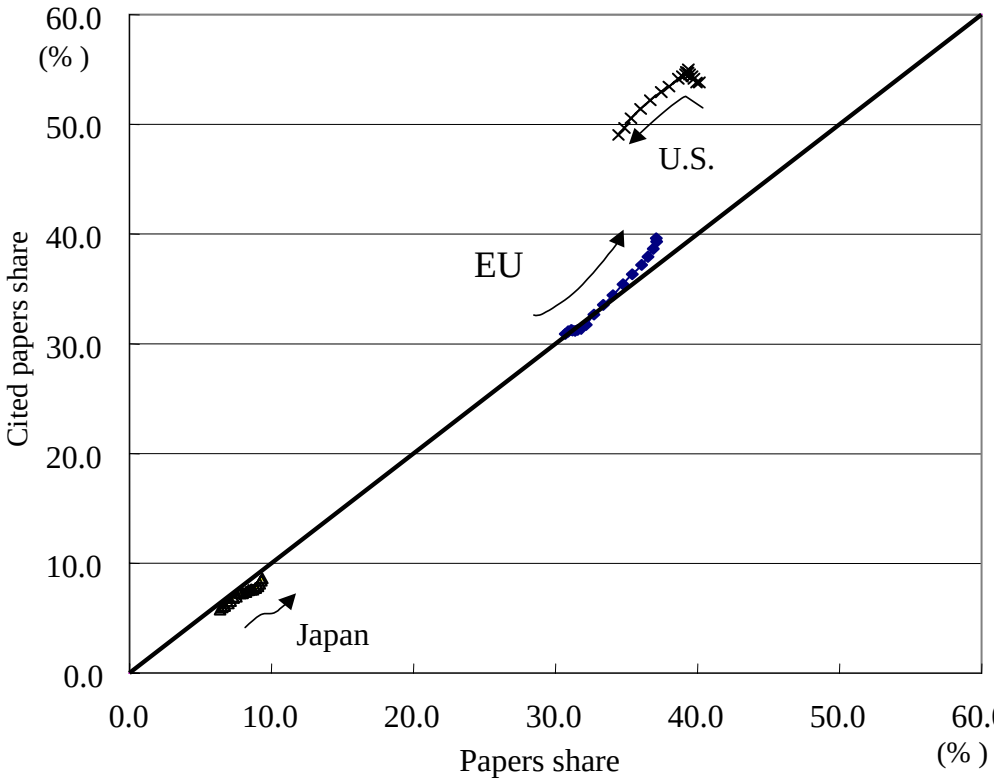


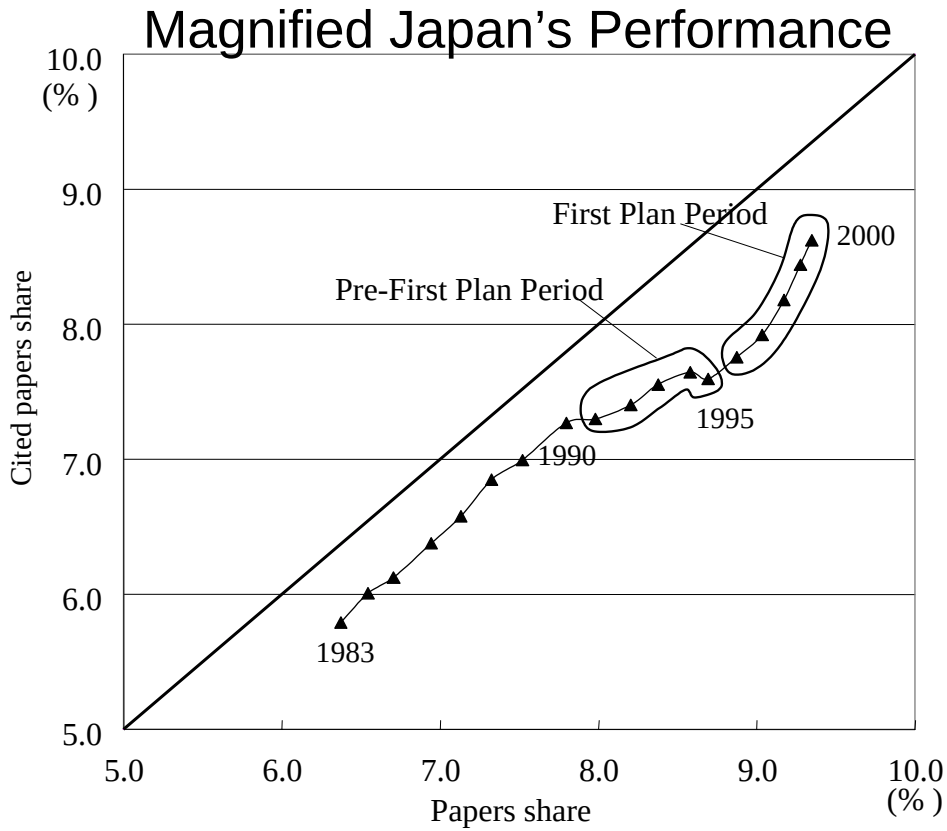
Number of moves expected on university professors (times)



*: Estimated values based on professor's age and the number of his/her move by that age. 30-year of service duration was applied to the estimation process.
Source: Carnegie Foundation, "The International Academic Profession", survey conducted in 1993.

Shares of Research Papers and their Citations among Japan, U.S. and EU



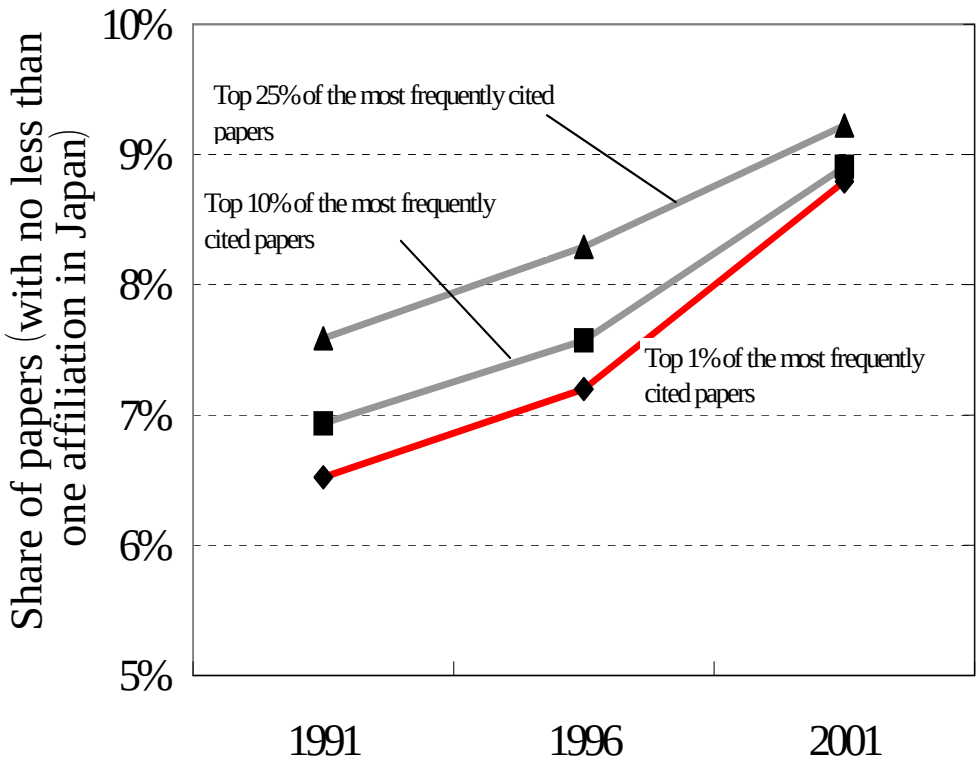


*:A share in each year shows the total number of papers, published and being cited in the same five-year period. Data collected between 1981 and 1985 are marked as "1983" in Magnified data for Japan, above.

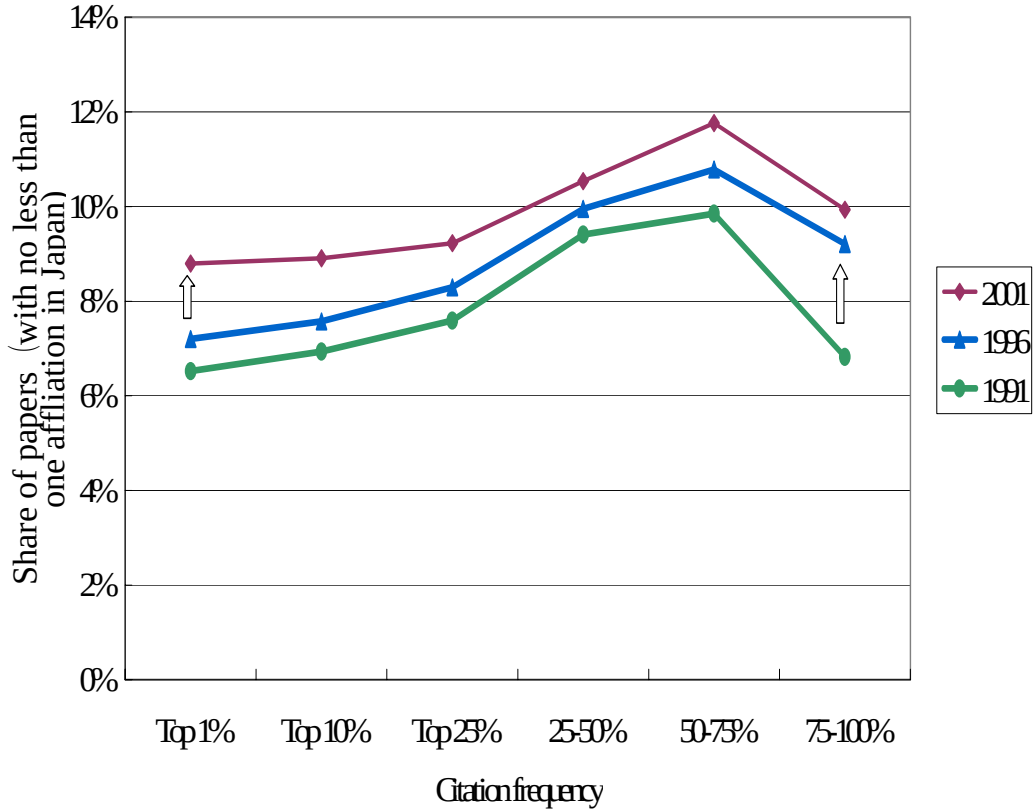
Data: ISI, "National Science Indicators 1981-2002"

Citations of Japanese Research Papers

Trends in Japanese shares in highly cited research papers



Japanese research paper distribution by citation frequency

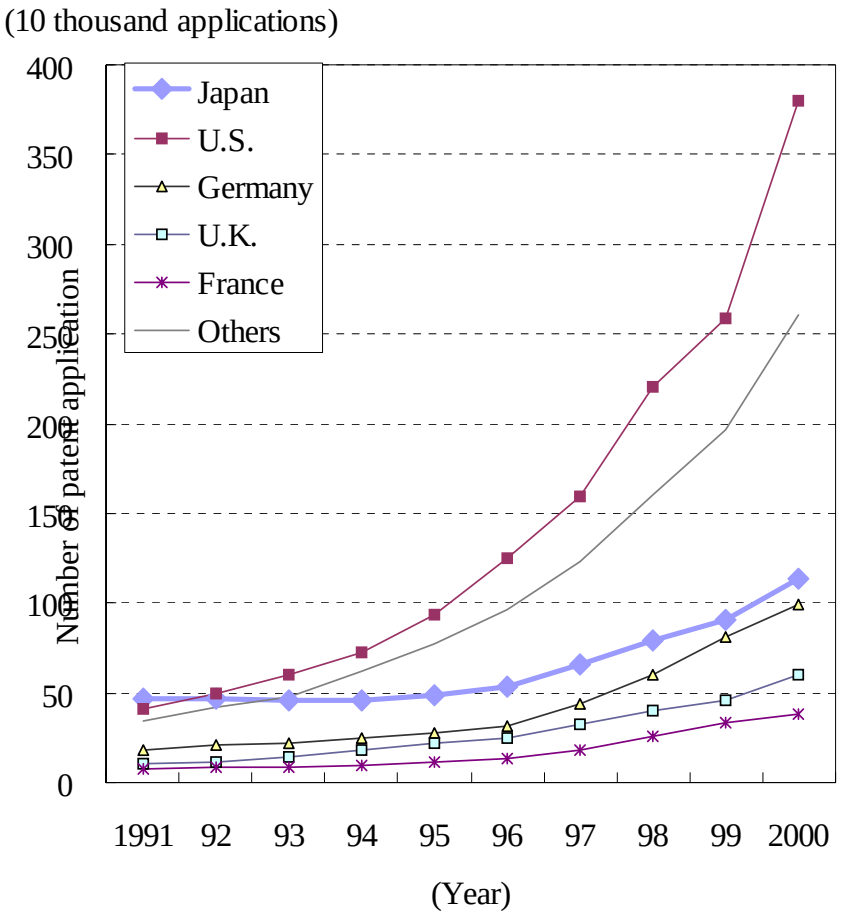


*: The data of "Citation frequency rank" is the data of papers in the SCI categorized into top 1%, 10%,…, based on citation frequency. Japan's paper shares are the share of Japanese papers categorized in the citation ranks.

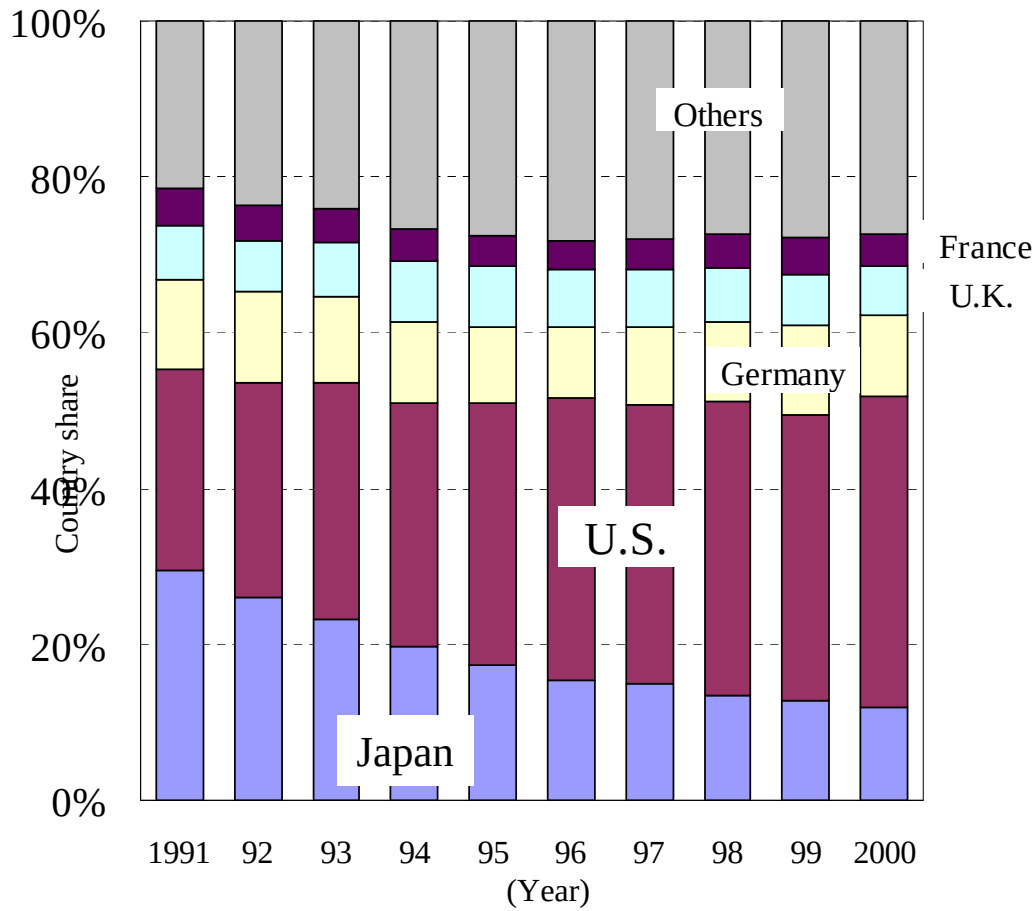
Data: Collected by NISTEP based on the CD-ROM version of SCI

Trends in Patent Applications in the World

Number of patent applications



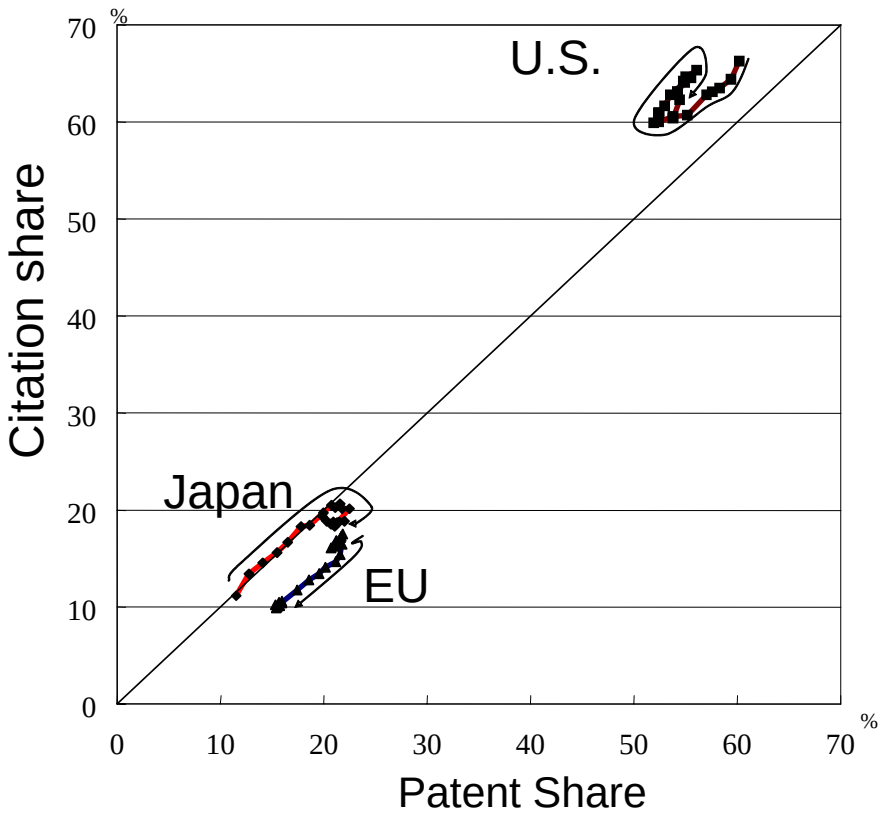
Patent application shares



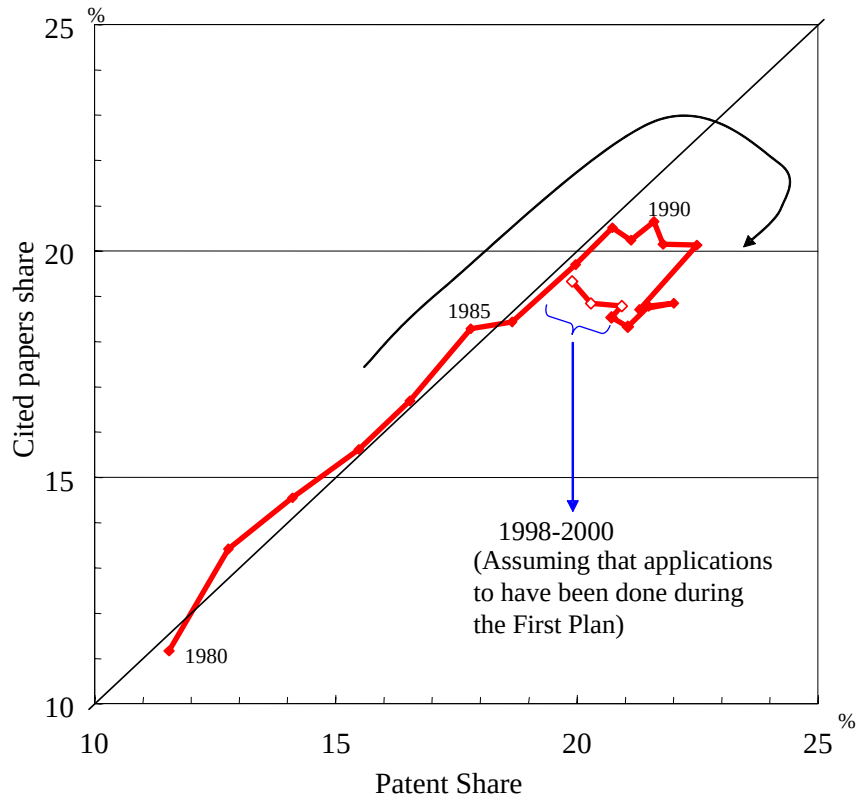
Data: WIPO

Note: The decline in Japan's patents applications share is mainly because the ratio of the patent applications to the Japan's Patent Office has decreased from 23.3% in 1991 to 5.1% in 2000.

Shares of U.S. Patents and their Citations among Japan, U.S. and EU (1980-2000)



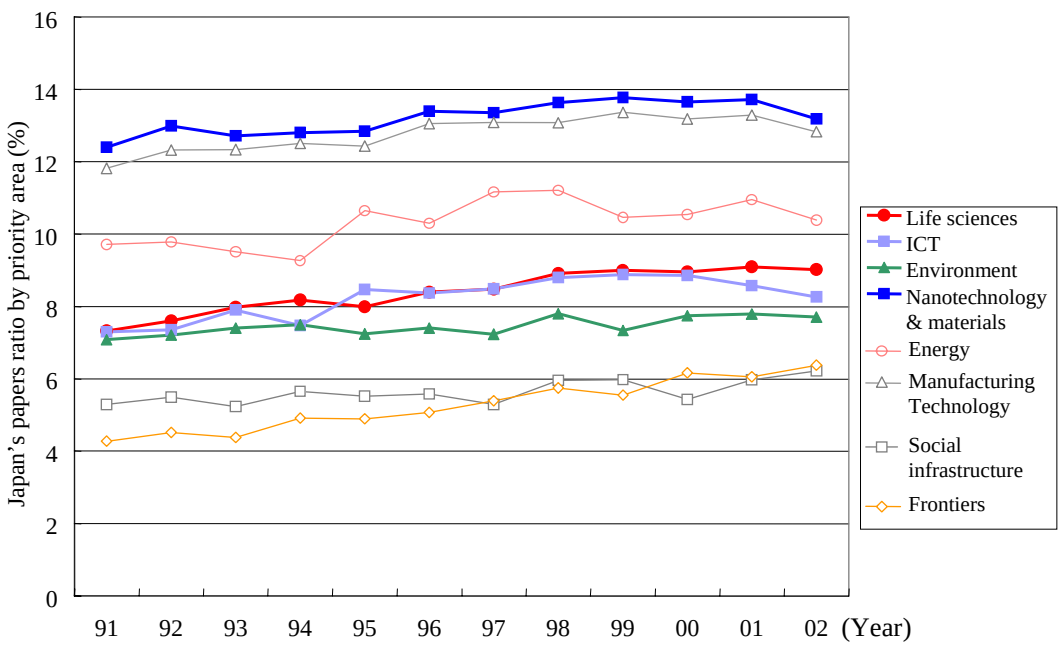
Magnified Japan's performance



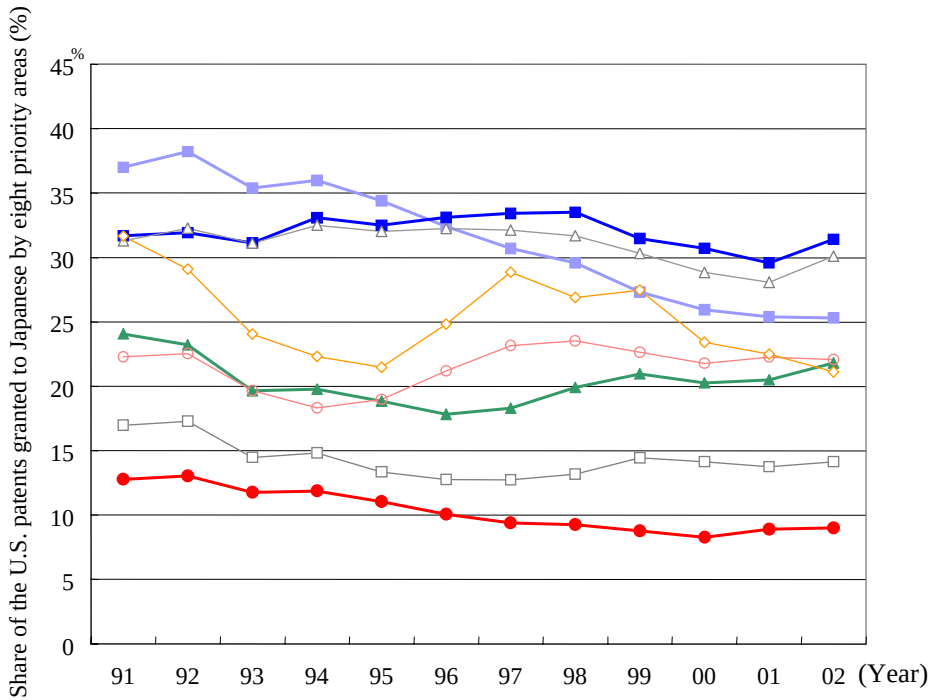
Data: CHI Research Inc. "International Technology Indicators 1980-2002"

Research Papers and Patents by Priority Areas

Shares of Japan's research papers



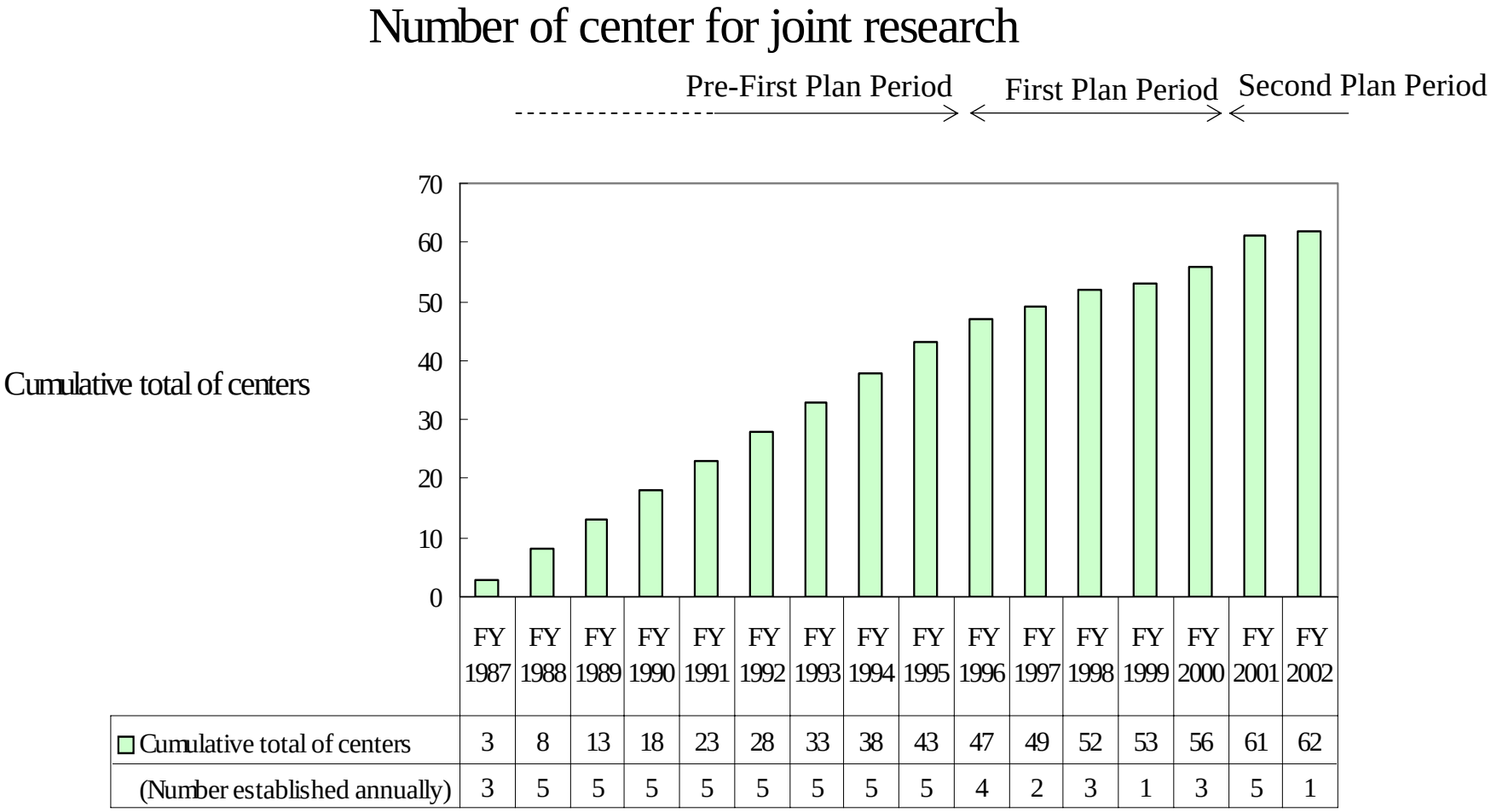
Shares of Japan's U.S. patents



Data:(Paper)ISI, "National Science Indicators 1981-2002"

(U.S. patents) CHI Research Inc., "International Technology Indicators 1980-2002"

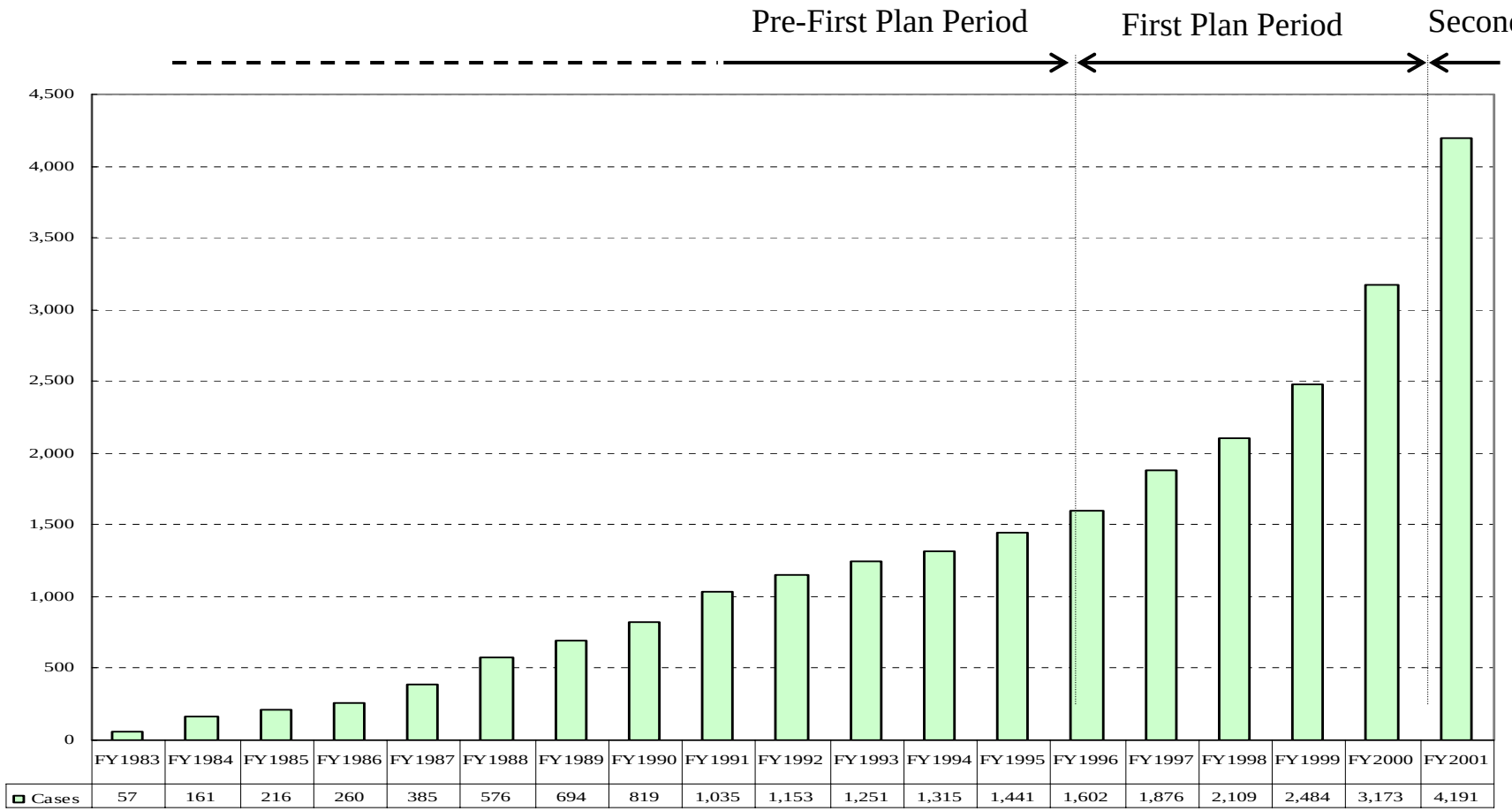
Number of Joint Research Centers at National Universities



	FY 1987	FY 1988	FY 1989	FY 1990	FY 1991	FY 1992	FY 1993	FY 1994	FY 1995	FY 1996	FY 1997	FY 1998	FY 1999	FY 2000	FY 2001	FY 2002
Cumulative total of centers	3	8	13	18	23	28	33	38	43	47	49	52	53	56	61	62
(Number established annually)	3	5	5	5	5	5	5	5	5	4	2	3	1	3	5	1

Source: MEXT Website

Number of Joint Research between National Universities and Industry

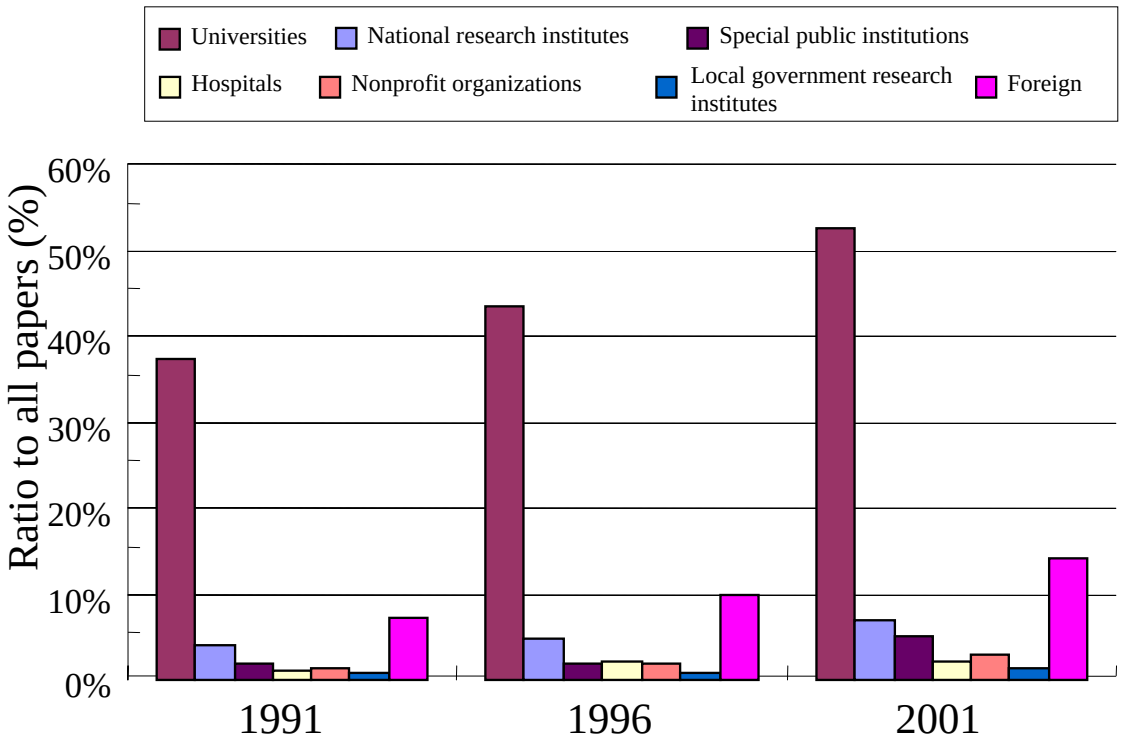


	FY1983	FY1984	FY1985	FY1986	FY1987	FY1988	FY1989	FY1990	FY1991	FY1992	FY1993	FY1994	FY1995	FY1996	FY1997	FY1998	FY1999	FY2000	FY2001
Cases	57	161	216	260	385	576	694	819	1,035	1,153	1,251	1,315	1,441	1,602	1,876	2,109	2,484	3,173	4,191

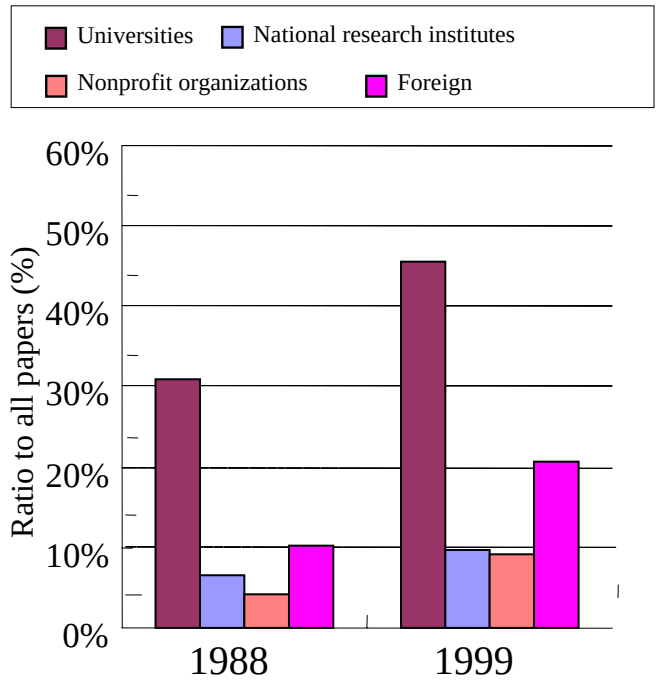
Source: MEXT, “Industry-Academic Collaboration 1983-2001” March 2003

Ratios of coauthored papers between company researchers and researchers in other sectors

Japan



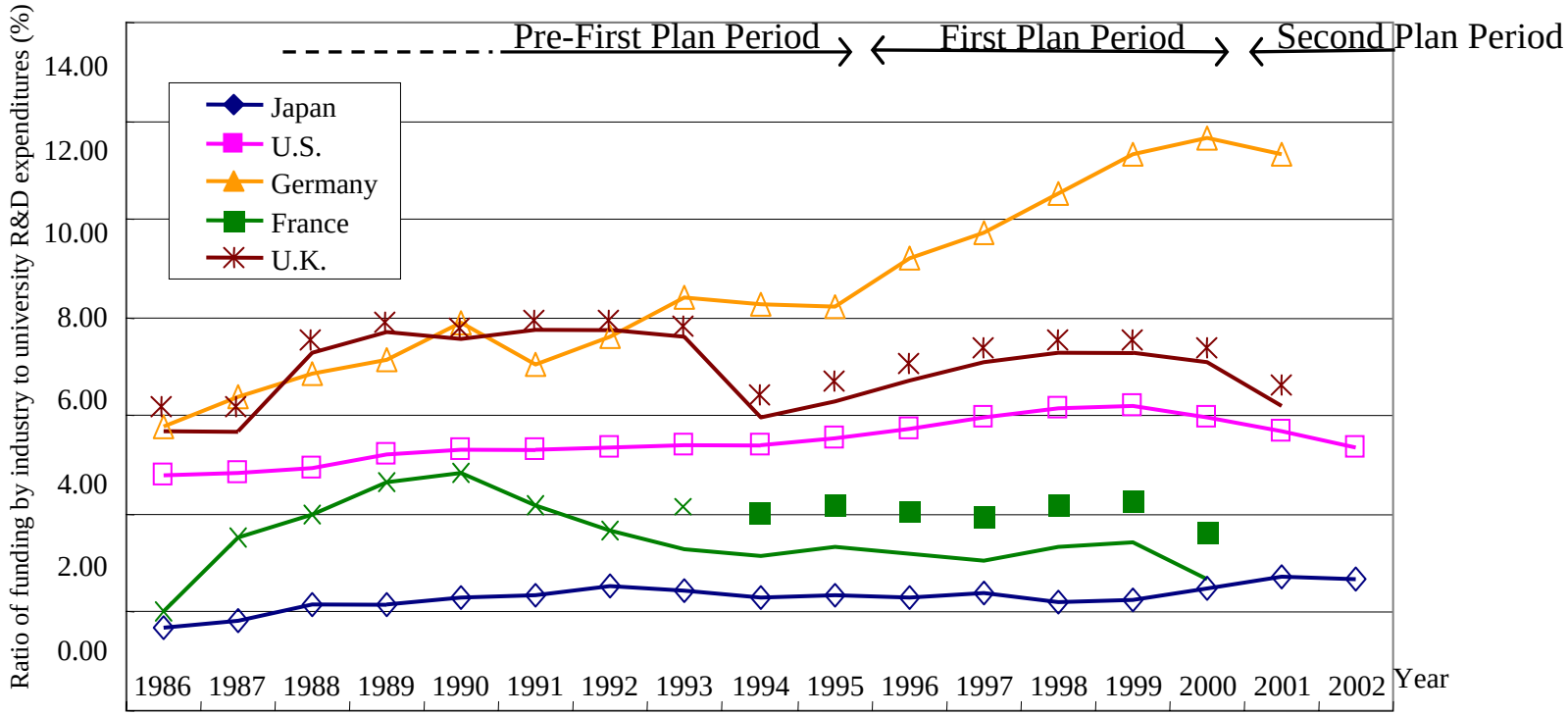
United States



Data: (Japan)Prepared by NISTEP using the CD-ROM version of SCI

(U.S.)NSF, “Science & Engineering Indicators: 2002”

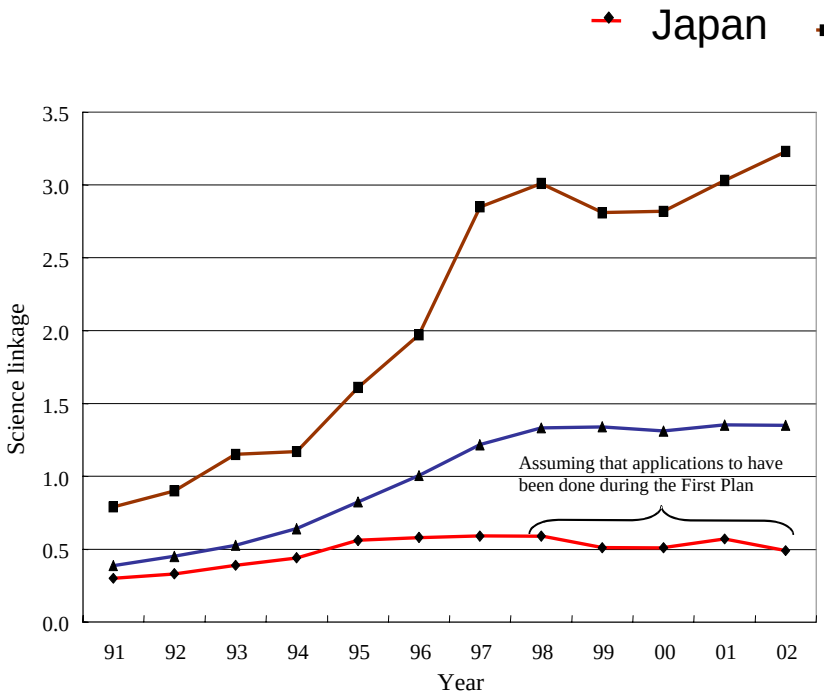
Ratios of Industry-Funded University R&D over All University R&D



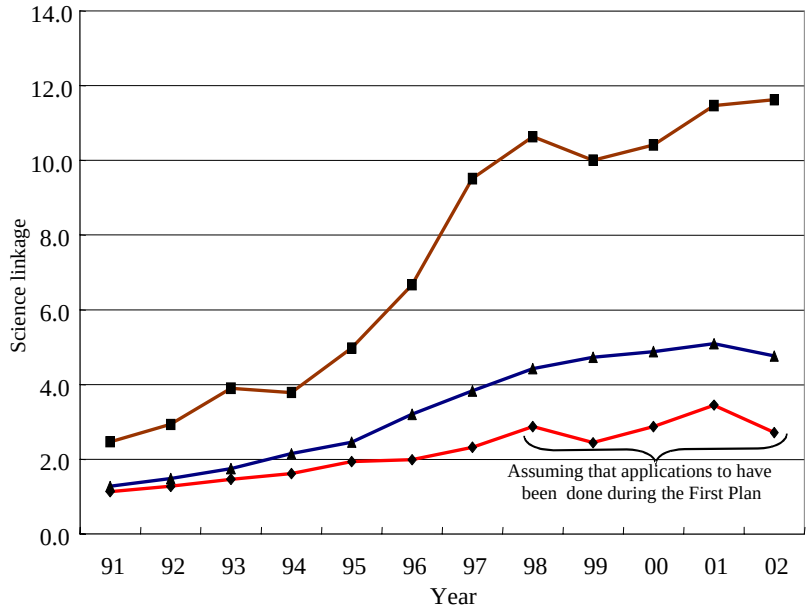
Source: <Japan> MPHPT, "Report on the Survey of Research and Development"
<U.S.> NSF, "National Patterns of R&D Resources: 2002 Data Update"
<Germany, France> OECD, "Basic Science and Technology Statistics 2002/2"
<U.K.> OECD, "Basic Science and Technology Statistics 2002/2," ONS, "Gross domestic expenditure on research and development 2002" for the data after 2001

Science Linkage in U.S. Patents

All Areas



Life Sciences

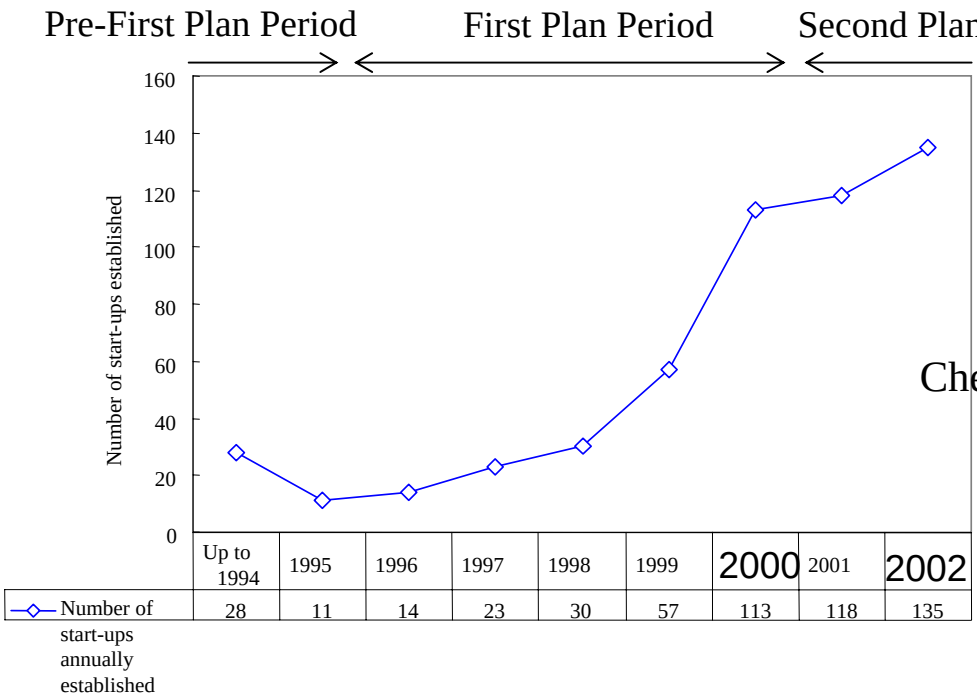


*: "Science linkage" is the number of cited scientific papers in the U.S. patent examination reports per registered patent. It indicates a frequency of the use of scientific knowledge among patents.

Data: CHI Research Inc. "International Technology Indicators 1980-2002"

University Spin-Offs

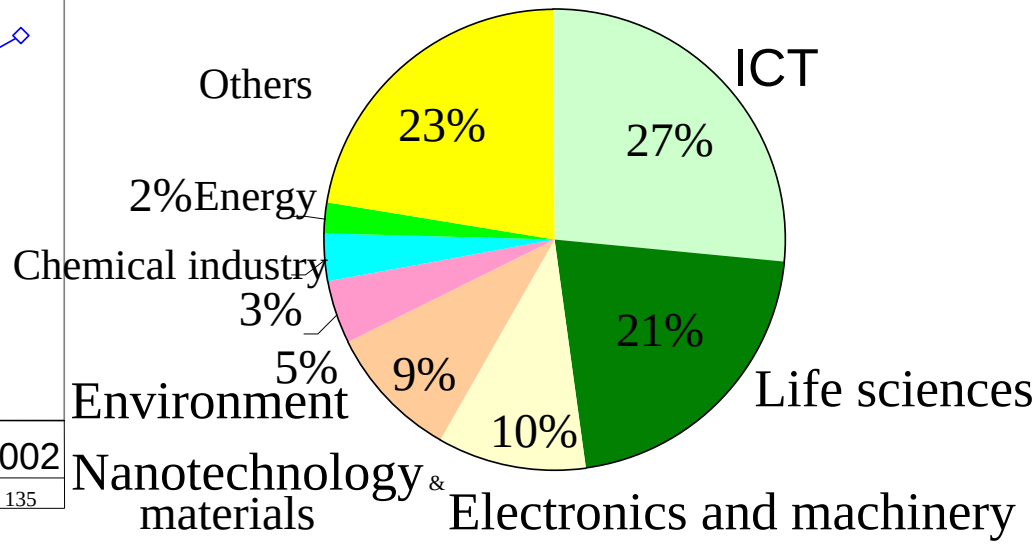
Numbers of University Spin-Offs



*The accumulated number of spin-offs is 614 as of August of 2003.

University Spin-Offs by Industry

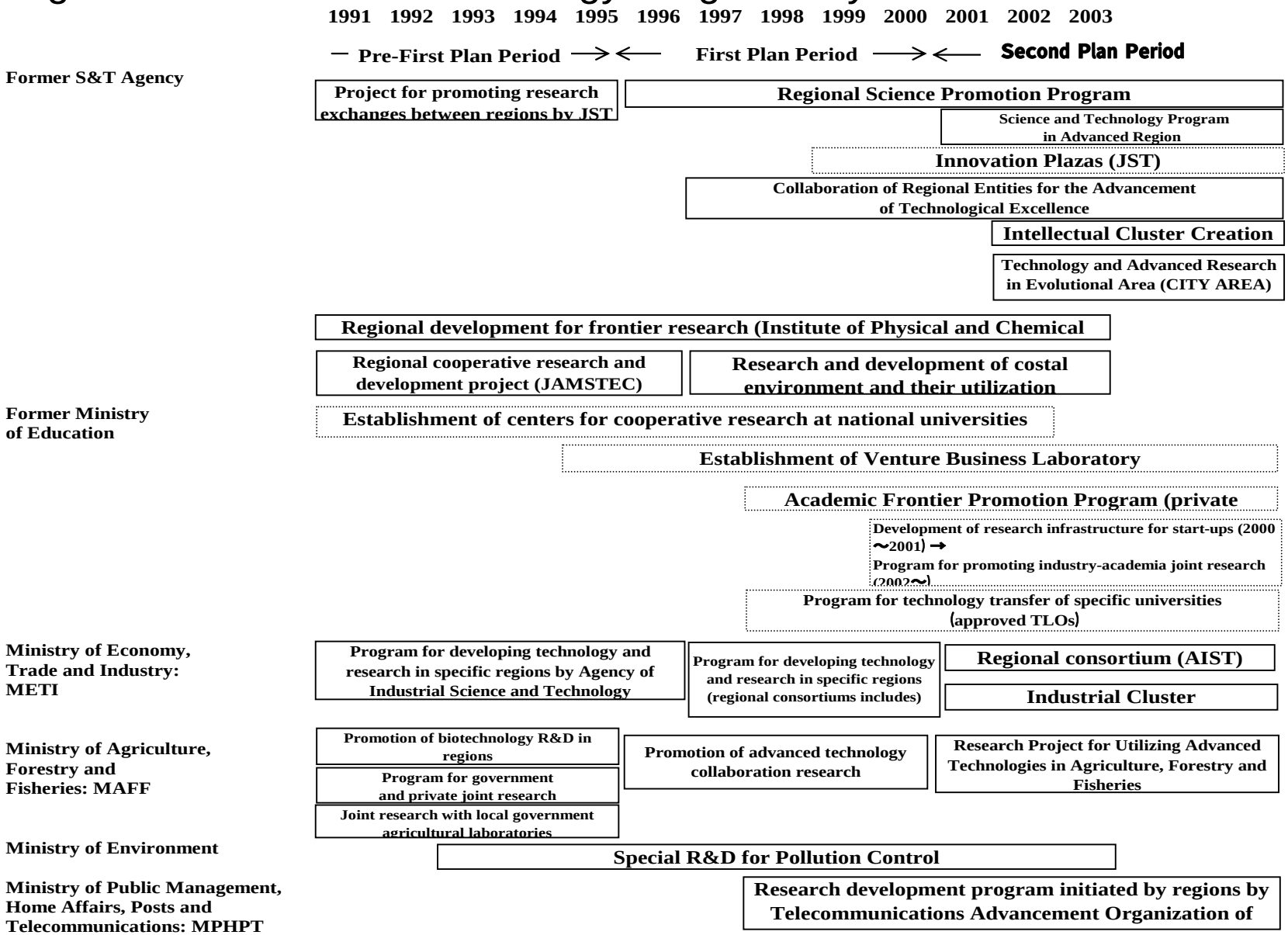
Start-ups have been concentrating particularly in ICT and life sciences among the four priority areas



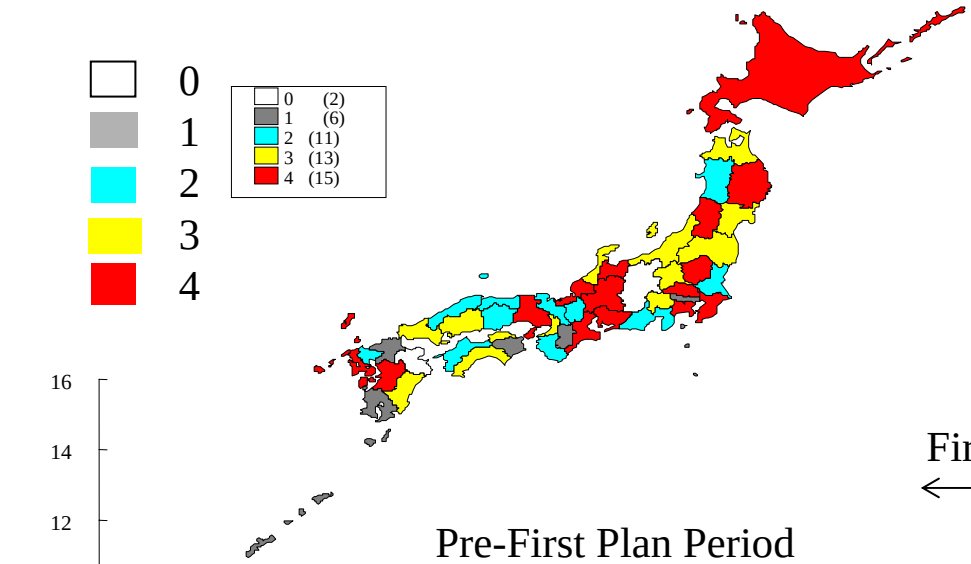
*: Breakdown of 614 companies as of August, 2003

Source: Calculated by NISTEP based on "Research Results of University-Initiated Start-Ups", FY2003 (Press release by University of Tsukuba in January of 2004)

Regional Science and Technology Programs by Central Government

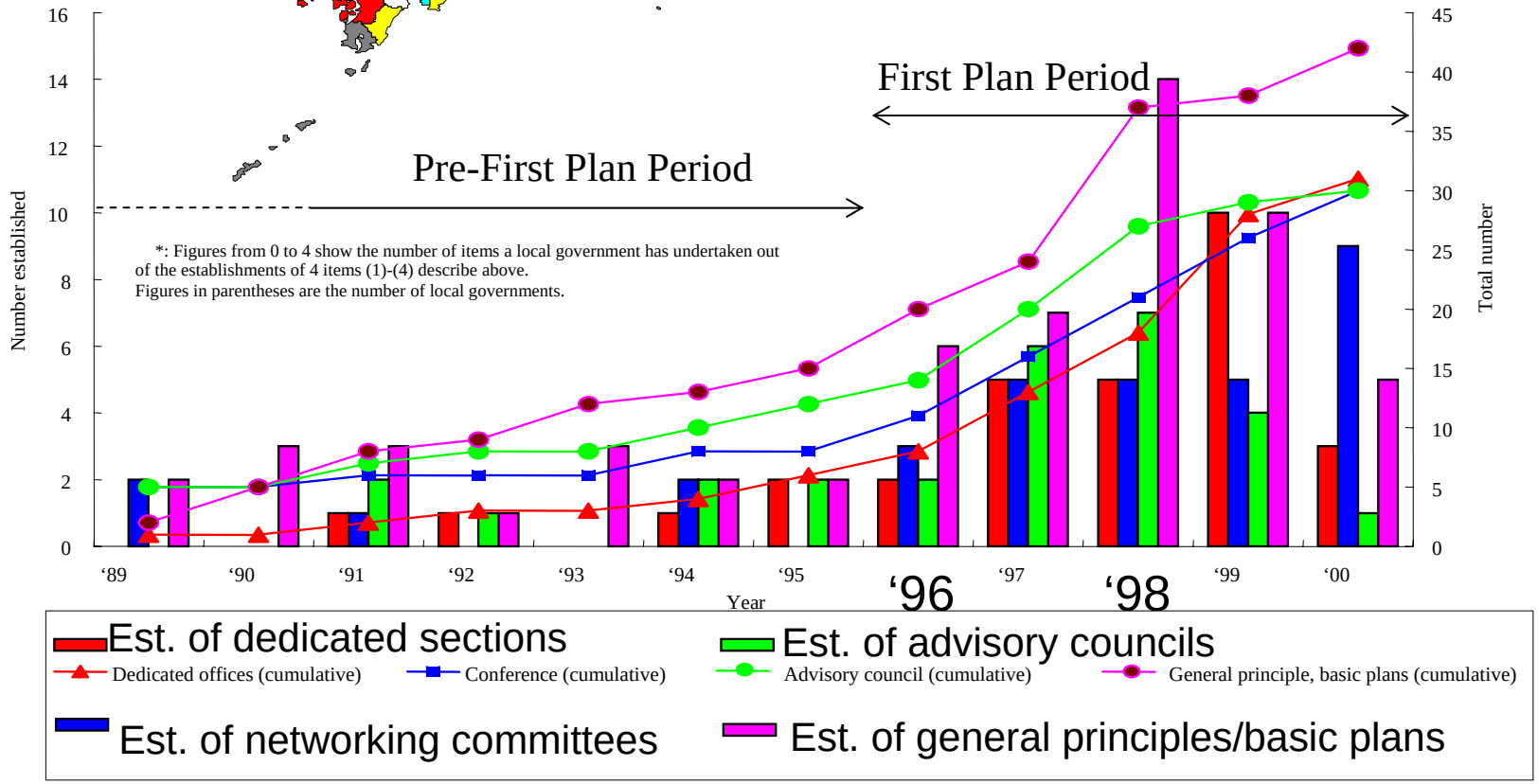


Science and Technology Programs by Local Governments



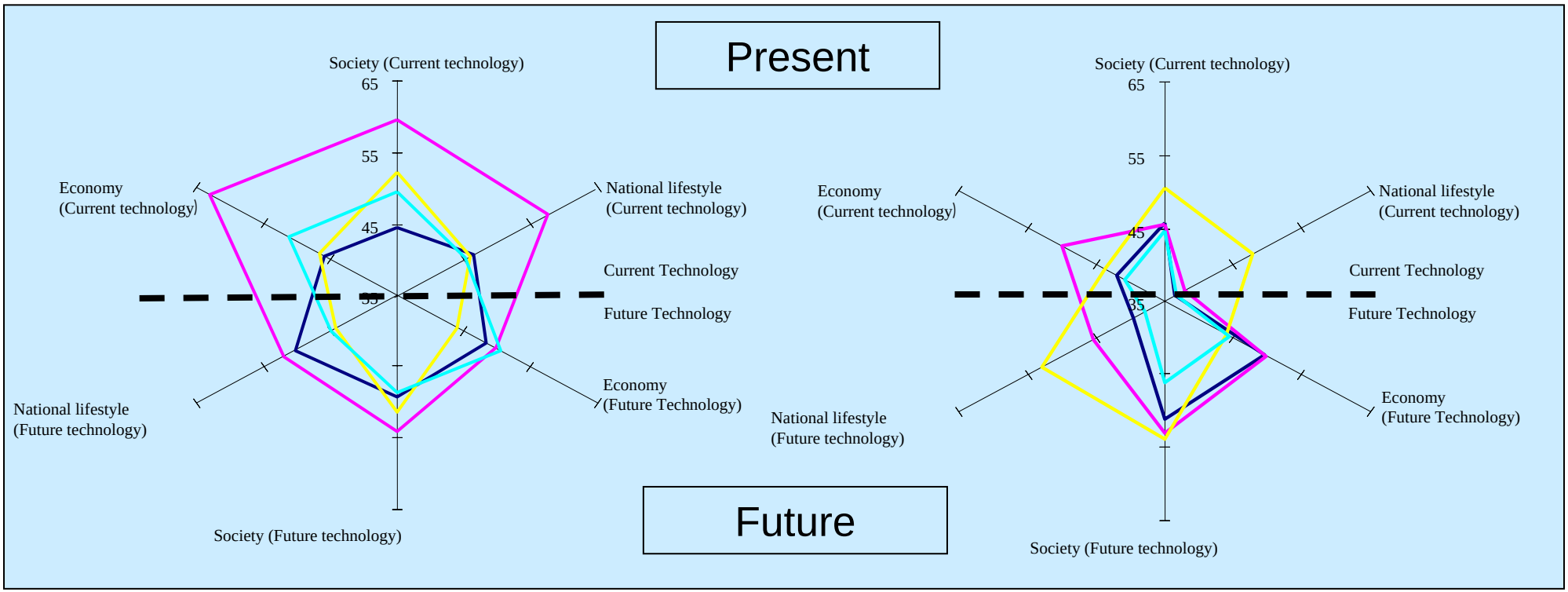
Source: NISTEP, “Study on Regional Science and Technology Promotion Policies (5th Survey) ” (2001)

*Nagano and Oita, two prefectures with no promotion activities on the figure, have already developed promotion guidelines afterwards.



Scales of S&T Impacts

- ICT
- Life sciences
- Environment
- Nanotechnology & Materials
- Energy
- Manufacturing Technology
- Social Infrastructure
- Frontiers



Case Studies for FY2003

	Technology	Areas
Current Technology	Early detection of cancer by CT scanner and diagnosis technology	Life sciences
	Parallel computers with high arithmetic processing speed	ICT
	Manufacturing and utilizing technology of Freon and Halon substitutes, which don't cause ozone layer destruction and global warming	Environment
	Technology to increase energy density of lithium batteries	Nanotechnology & materials
Future Technology	Technology to utilize cultivated self-tissues, originated from stem cells, for the use of artificial organs and tissues	Life sciences
	Safe waste disposal and recycle technology: gasification melting furnaces and ash melting furnaces	Environment