Japanese Innovation Systems, Facts and Problems:

Implications for Eastern European Countries

8th International Conference

on Technology Policy and Innovation

July 7, 2005

University of Lodz

Risaburo Nezu

Fujitsu Research Institute

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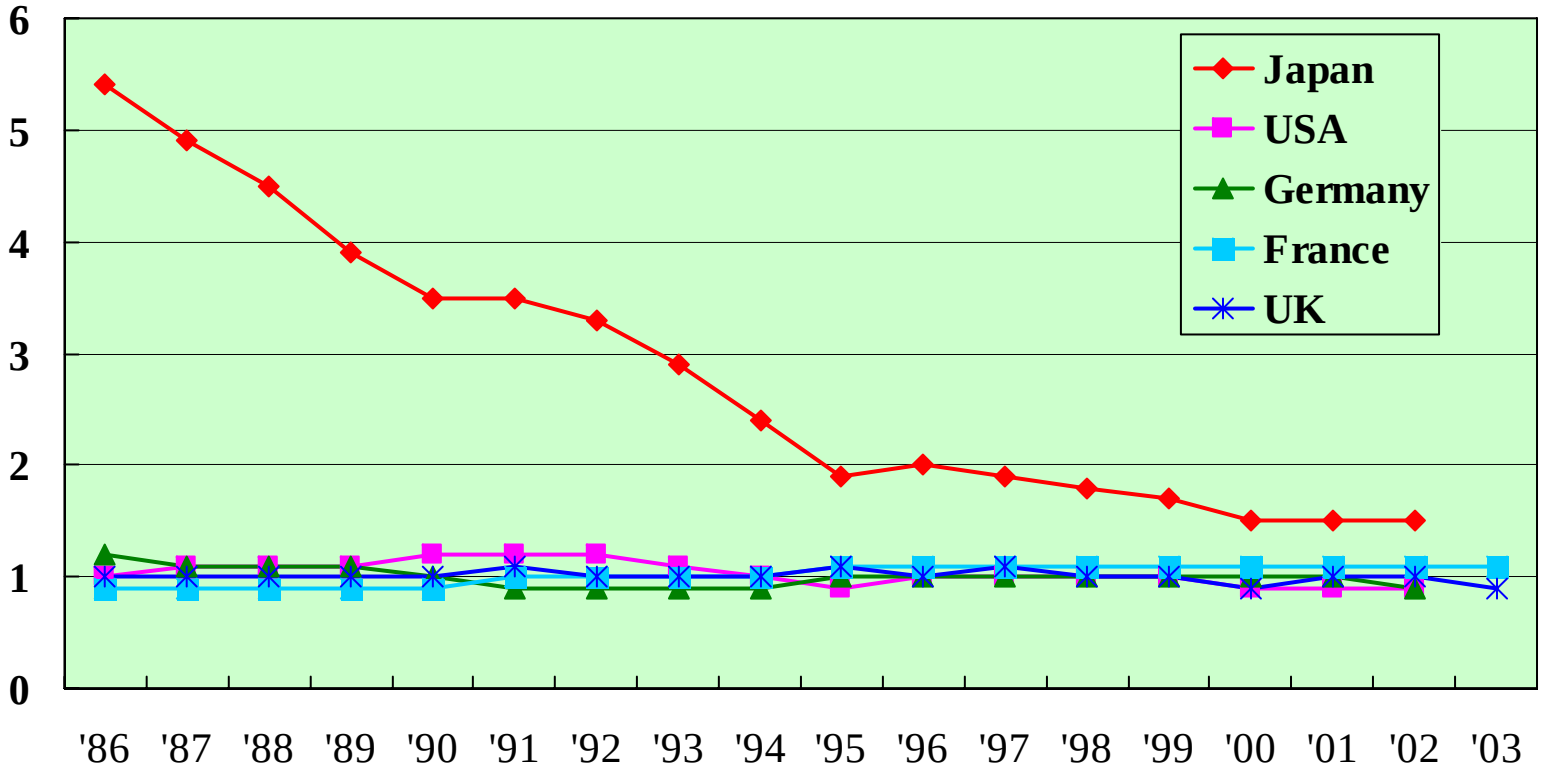
How is Japan ranked by the IMD?

- Overall performance 21-23-27-25-23-21
- GDP 2
- Patents granted 1
- Total R&D personnel 3
- Securing patents abroad 3
- Total R&D expenditure ($) 2
  - ratio of GDP 6
- Number of scientific articles 2

Source: World Competitiveness Yearbook 2005

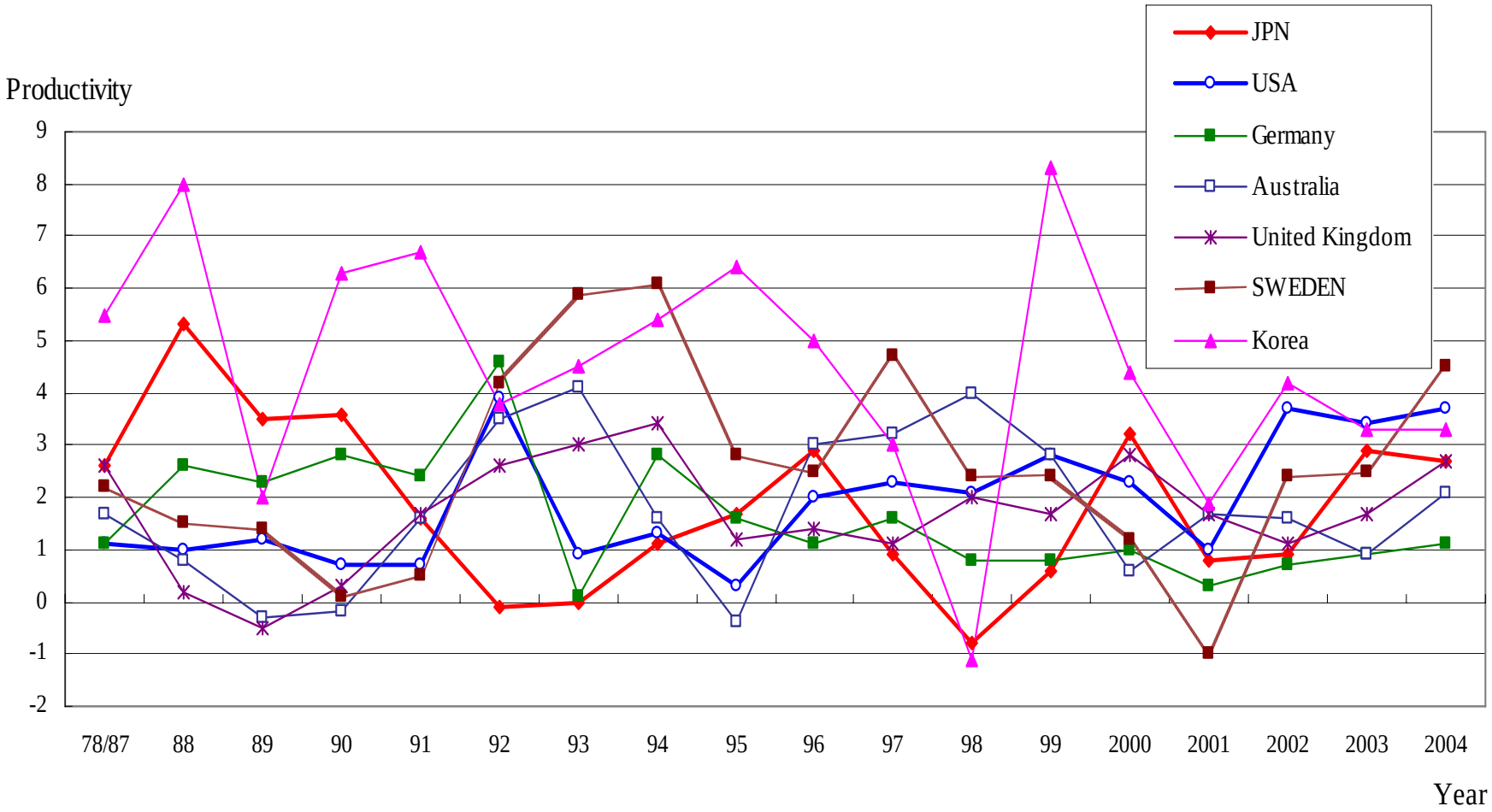
High Tech Trade Balance (export/import)



Note: High tech goods are medical products, medical equipment, office equipment, computers, electronics, precision instruments, and aircraft and space technology.

Source: NISTEP

Productivity in Major Countries



Source: OECD Economic Outlook

Number of Patents Granted in the US (2004)

Rank	Company	No	Rank	Company	No
1	IBM (US)	3,277	11	Fujitsu (JPN)	1,320
2	Matsushita(JPN)	1,965	12	Phillips (Holland)	1,224
3	Canon(JPN)	1,813	13	Fuji Photo Film (JPN)	1,030
4	Hewlett-Packard (US)	1,780	14	GE (US)	978
5	Micron Technology (US)	1,761	15	Renesas Technology (JPN)	917
6	Samsung (Korea)	1,605	16	TI (US)	915
7	Intel (US)	1,604	17	Bosch (Germany)	907
8	Hitachi (JPN)	1,534	18	Seiko Epson (JPN)	859
9	Sony (JPN)	1,348	19	NEC (JPN)	826
10	Toshiba (JPN)	1,342	20	AMD(US)	803

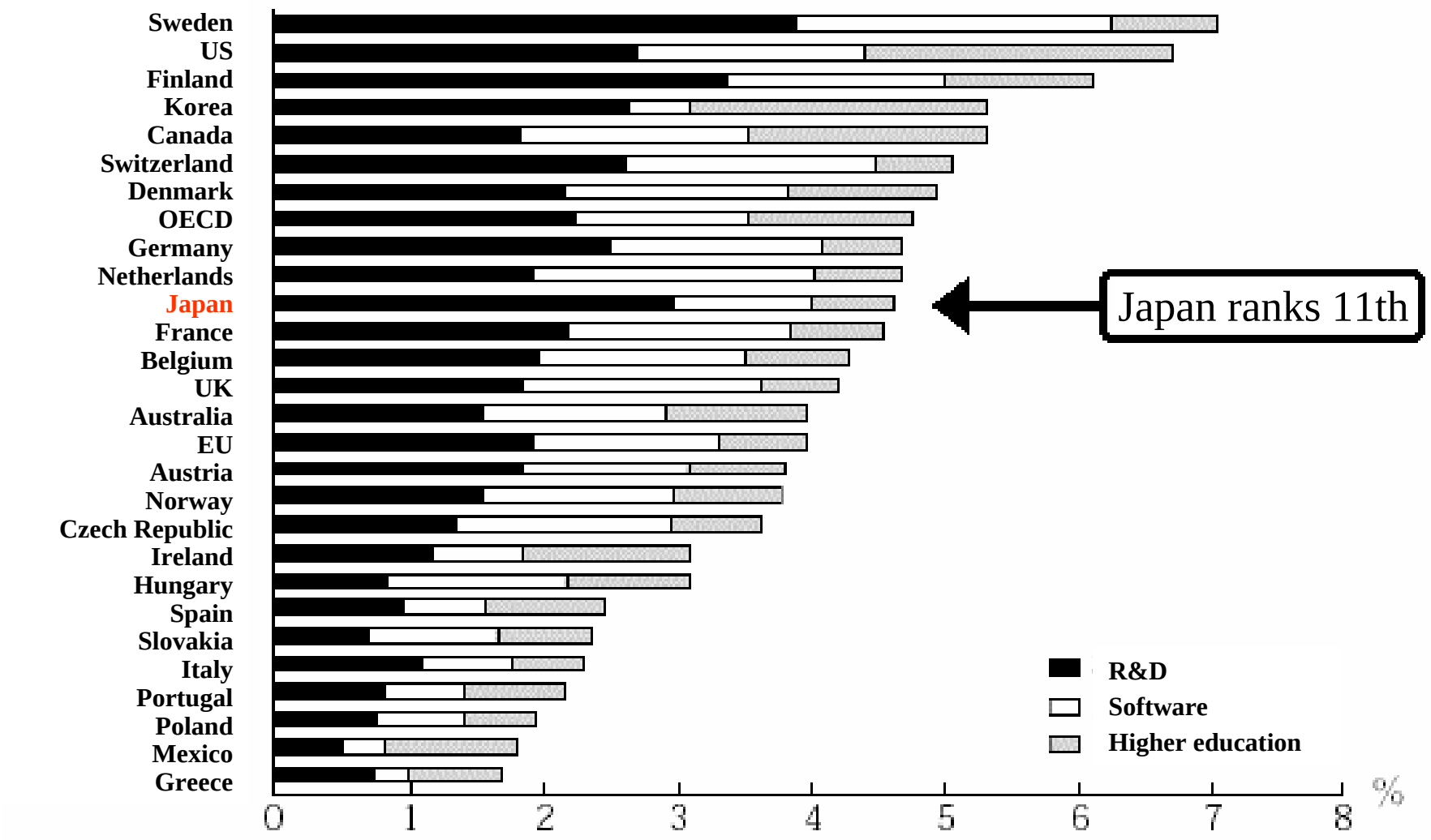
Source: Dempa Shimbun June 28, 2005

International Comparison of R&D Spending

	Japan	US	Germany	France	Poland
GDP (billion $)	4295	11004	2403	1760	210
Population (million $)	127.7	294	82.5	60.1	38.6
Total R&D (billion $)	124.19	284.6	60.3	32.6	1.1
Ratio of GDP	(3.1%)	(2.6%)	(2.5%)	(2.3%)	(0.59%)
Government	20.2%	28.6%	31.5%	42.1%	
Total research personnel (000)	675	1261	264	186	

Source: IMD World Competitiveness Yearbook

Investment in Knowledge



Source: OECD

Japanese Problems

Though Japan invests a lot in R&D, the investments do not produce results. Why ?

--Sharp decline of competitiveness

--Results of basic research do not lead to new products (weak science link)

--While businesses aggressively invest in R&D, government spends less than other countries

--Insufficient infrastructure for intellectual knowledge

Three Policy Challenges

1. How to improve competitiveness in the global market

   Industrializing Asian countries,

   Increasing speed and shortening life cycles

2. How to meet society's new demands

   Aging population, Environment, Safety

3. How to reinvigorate ailing local economies

   Dislocation of local economies,

   Decreasing public works

Key Policy Measures

1. Introduce more competitive mechanisms into the national innovation system
2. Reform national universities
3. Foster collaborations between universities, public laboratories, and industry
4. Strengthen the protection of intellectual property
5. Open innovation
6. Increase the mobility of researchers
7. Ensure public funds and prioritization through competitive funding
8. Strengthen technology management (MOT)

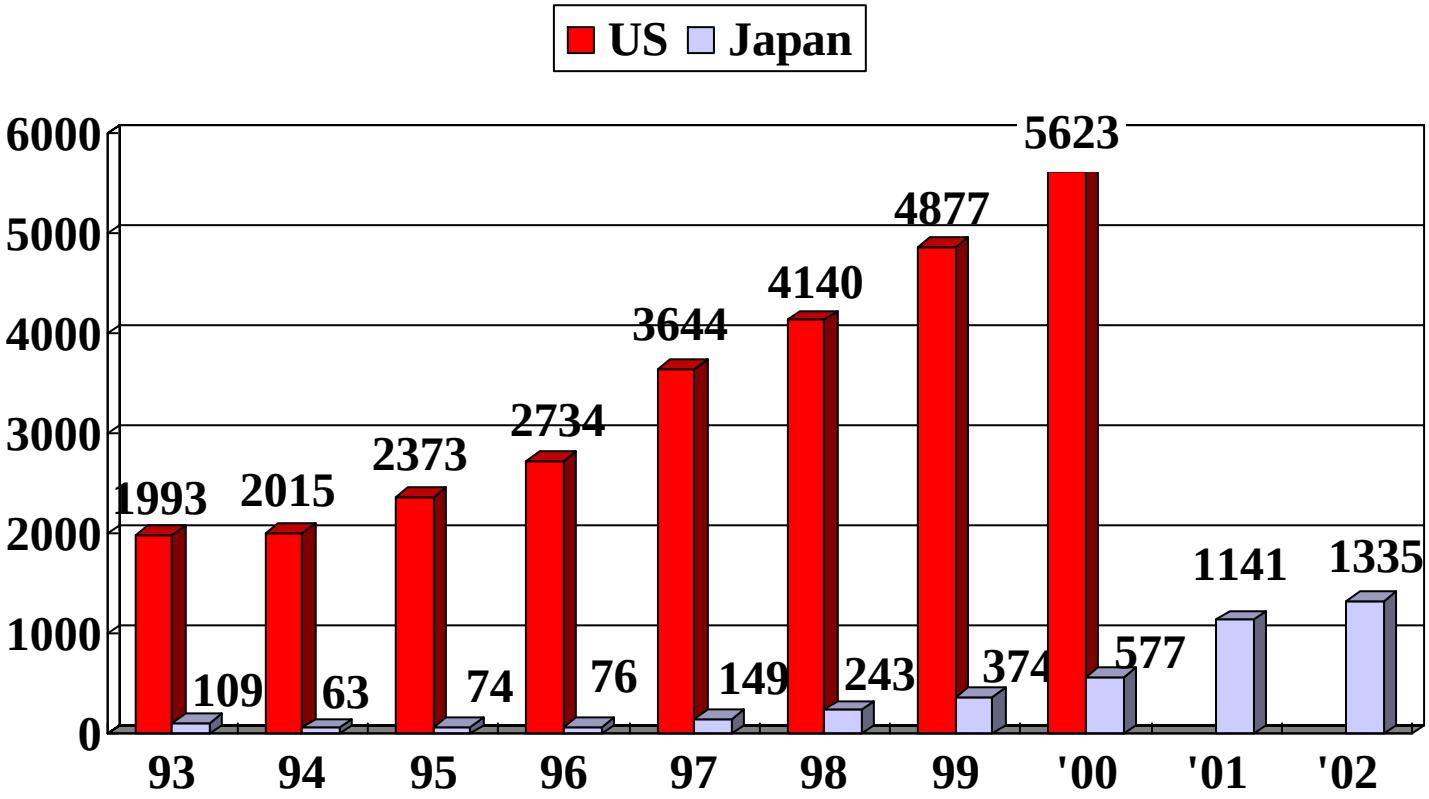
The Four Principles of Japan's IP Strategy

1. Creation of IP
   - University
   - Company
2. Protection of IP
   - Efficient and effective examination of patent applications by JPO
   - Creation of a patent court
   - Stringent measures against fakes and counterfeits
   - International harmonization of IP rules
   - Protection of trade/business secrets
3. Active use of IP
   - Technology transfers from universities and national labs
   - Technology Licensing/Transfer Office (TLO/TTO)
   - Evaluation of IP and encouragement of its utilization
4. Strengthening of the human resource base
   - Education of experts
   - Consciousness of the general public about IP

Reform of National Universities

1. Less government control and more freedom to develop their own curriculum and research plans
2. Introduction of a management structure similar to that of private businesses
3. Rigorous assessment of performance by independent outsiders
4. Greater emphasis on professional education at the post graduate level
5. More competition amongst universities
6. Greater freedom to work with business

Number of Patents Applications by Universities



Source: Patent Office (Japan :calendar year)

AUTM (US: Fiscal year)

University-Industry Collaborations

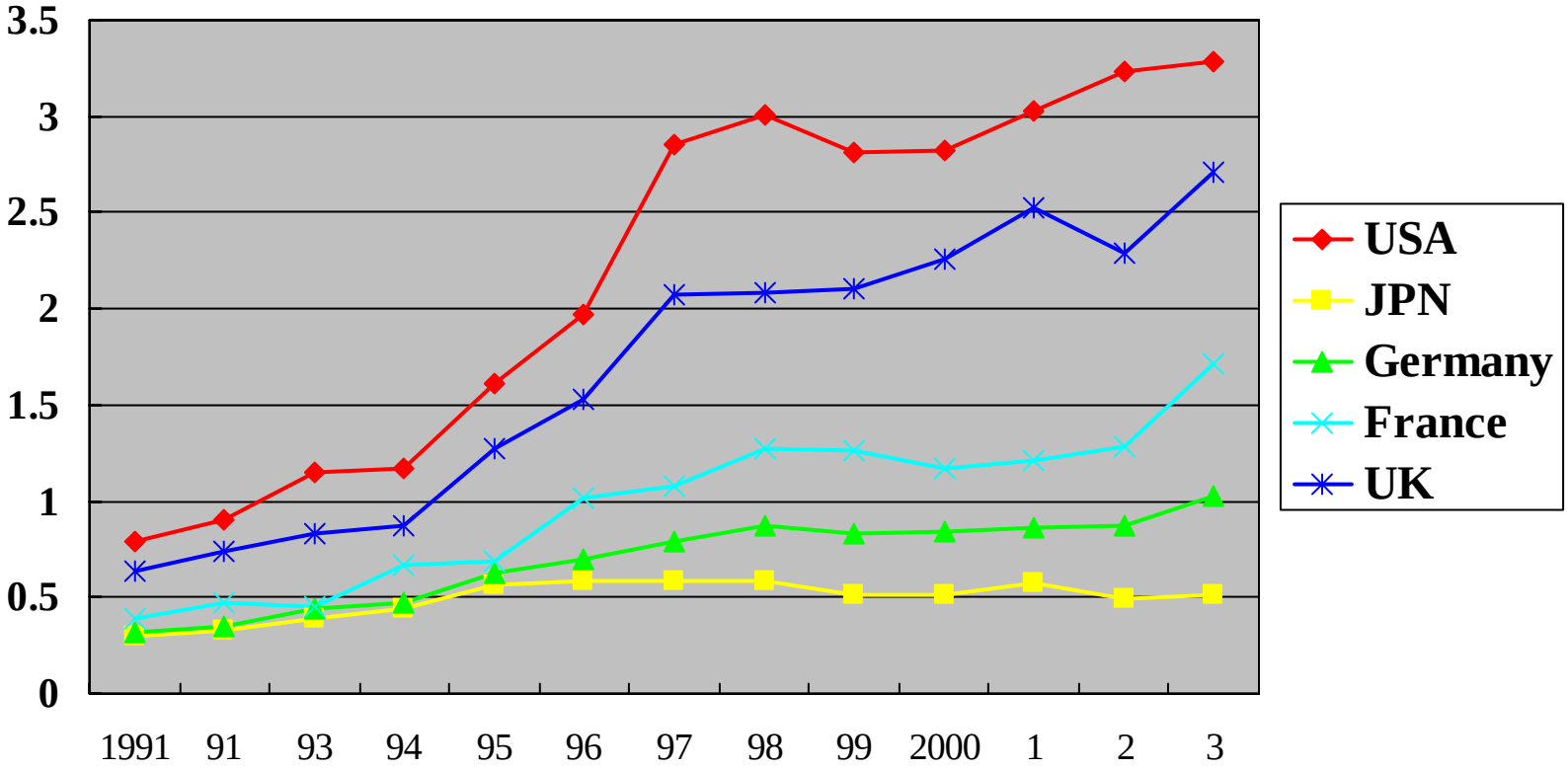
1997- Easing of restrictions on national university researchers who work off campus.

1998- Law on technology transfers from the university (TLO).

1999- Japanese Dayh-Dole Law
(Universities can hold the IPR's of government funded research.)

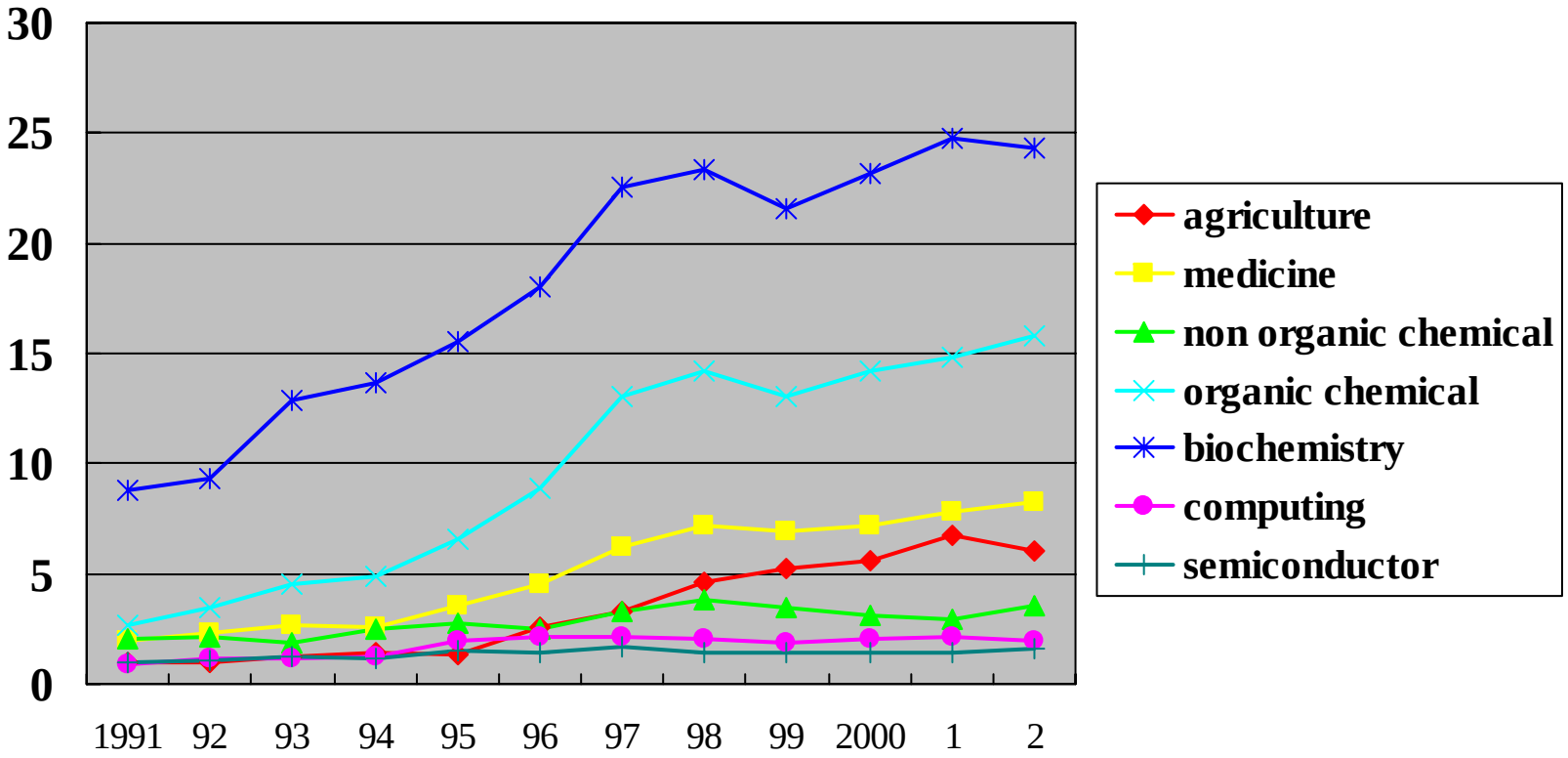
2000- Further easing of restriction on faculty who work in the private sector

Science Linkage by Country



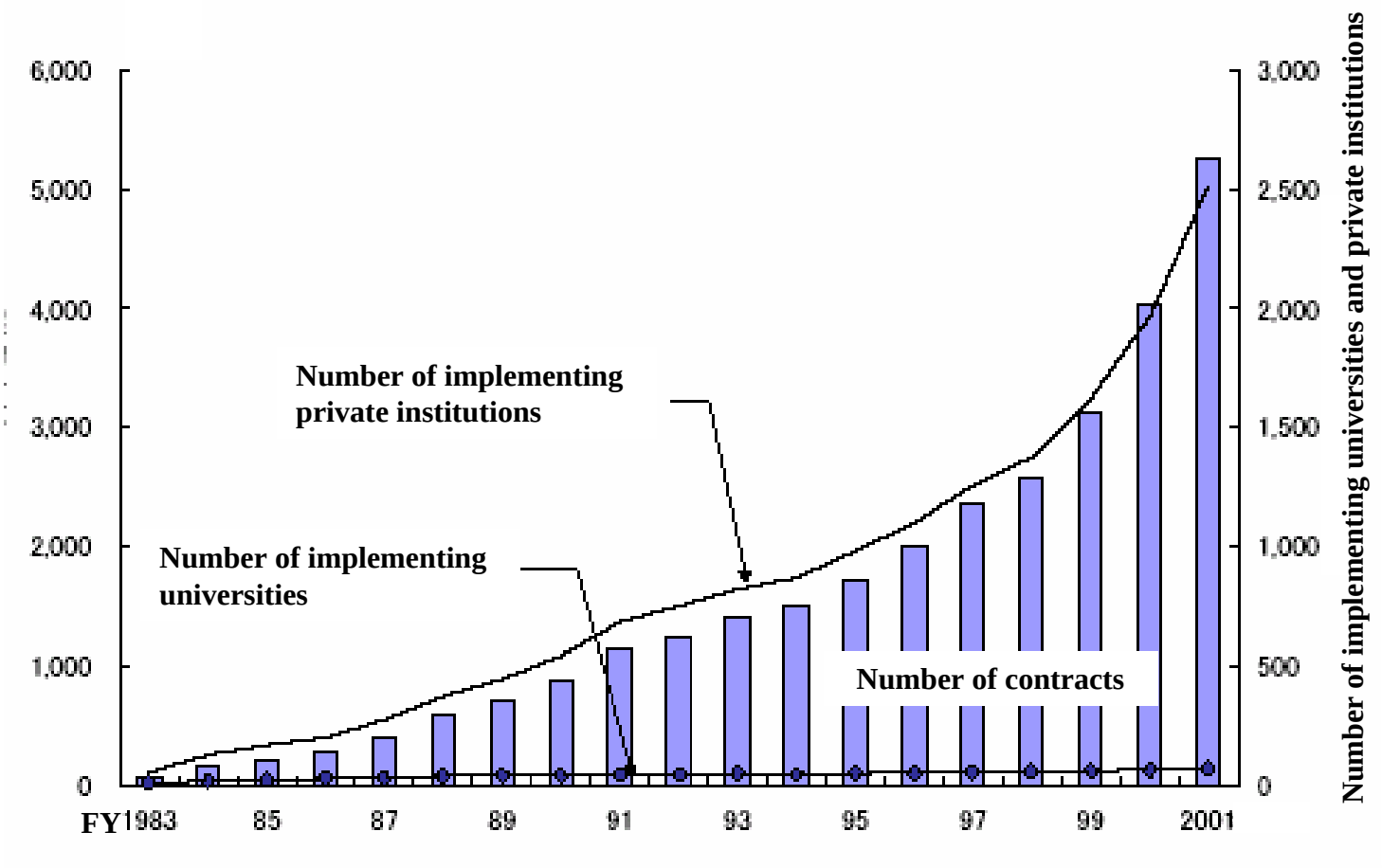
Source: NISTEP

Science Linkage by Sector in the US



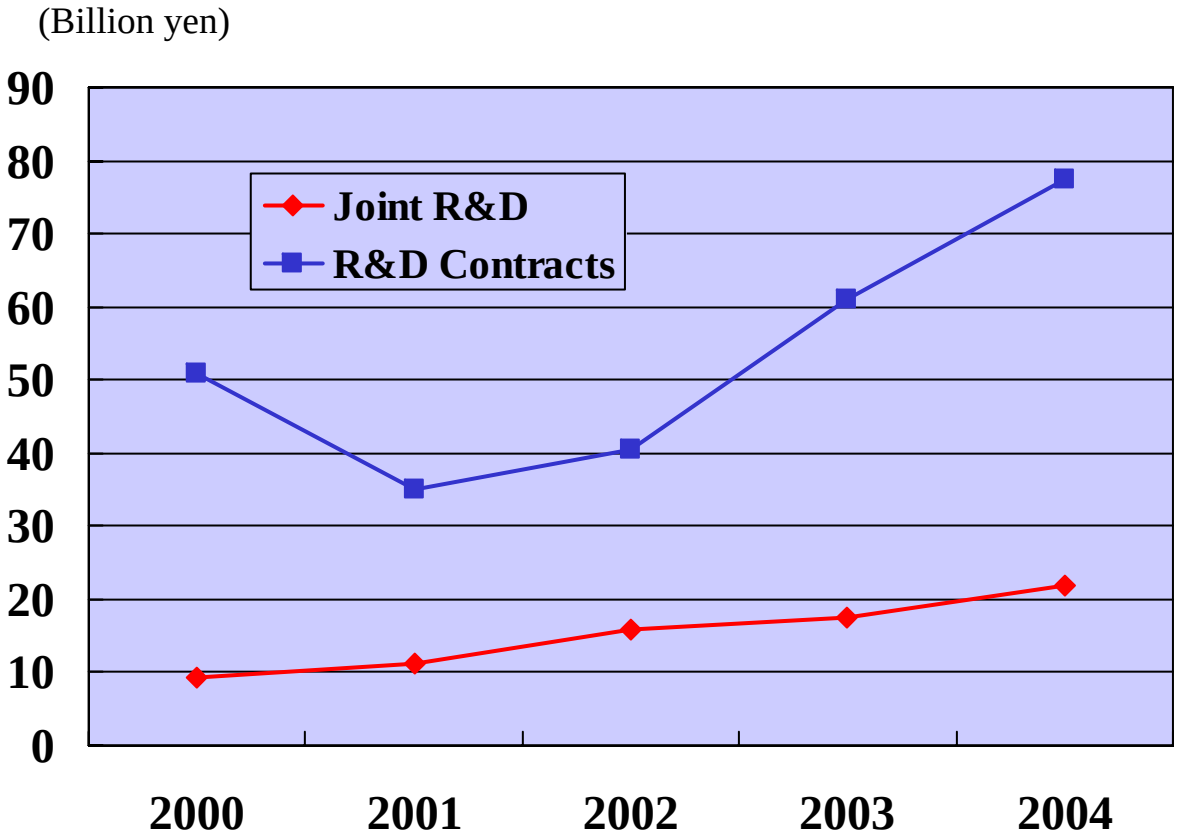
Source: NISTEP

Number of Collaborations Between National Universities and Companies in Japan



Source: NISTEP

Partnerships by the Japanese national universities



Source: MEXT

From Closed Innovation to Open Innovation: A paradigm shift (1)

1. Large Japanese companies have long believed that they could establish and maintain technology leadership by controlling the whole innovation process. (Not Invented Here (NIH) Syndrome)
2. Throughout the 1990s, a new method of innovation became dominant in information technology and bio-technology. Companies began to concentrate their resources on their strongest technology and rely on external resources for the rest. This development was supported by the advent of specialized venture businesses.
3. The Bayh-Dole Act of 1980 allowed private companies to use research conducted by universities and national laboratories for commercial purposes, and thereby helped to revive the industrial competitiveness of the US. This became the model for other countries, who have begun strengthening university-industry collaboration.

From Closed Innovation to Open Innovation: A paradigm shift (2)

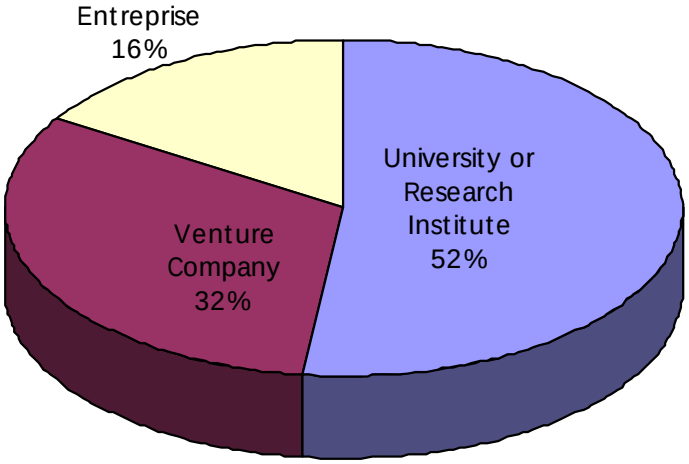
4. In the past few years, this movement has hit Japan and other Asian countries. The large central research departments of private companies have become outmoded. Many large companies have reduced their spending on R&D and have began using external knowledge.
5. The following changes are required for U-I collaborations to succeed:

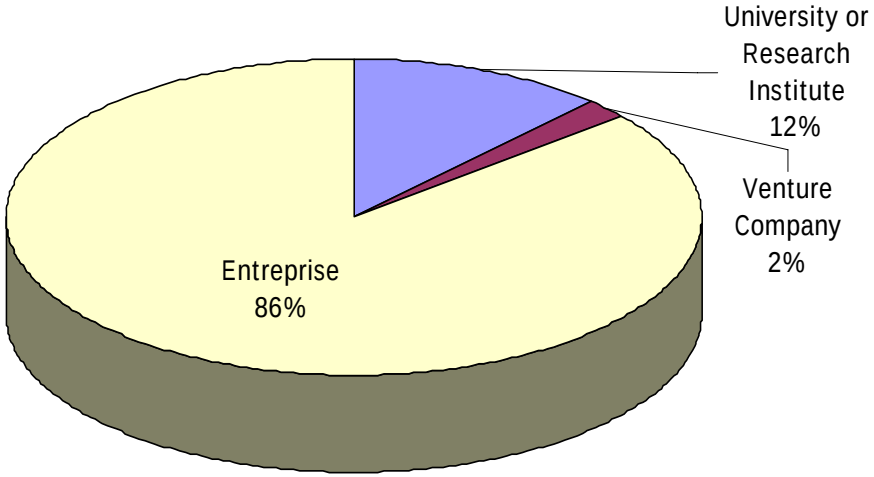
   - an open and free flow of information about technologies and research activities,
   - high mobility of scientists and engineers,
   - adequate protection of IP,
   - and a risk-taking capital market.

Many developing countries lack such an environment.

Genetic Engineering Patents Filed: The US & Japan

Universities and venture companies account for more than 80 % of the patents filed in the US; in Japan, their roles are much smaller





(Note1) 1971 – 1998 (grant year)
U.S. applicants' patent granted by USPTO

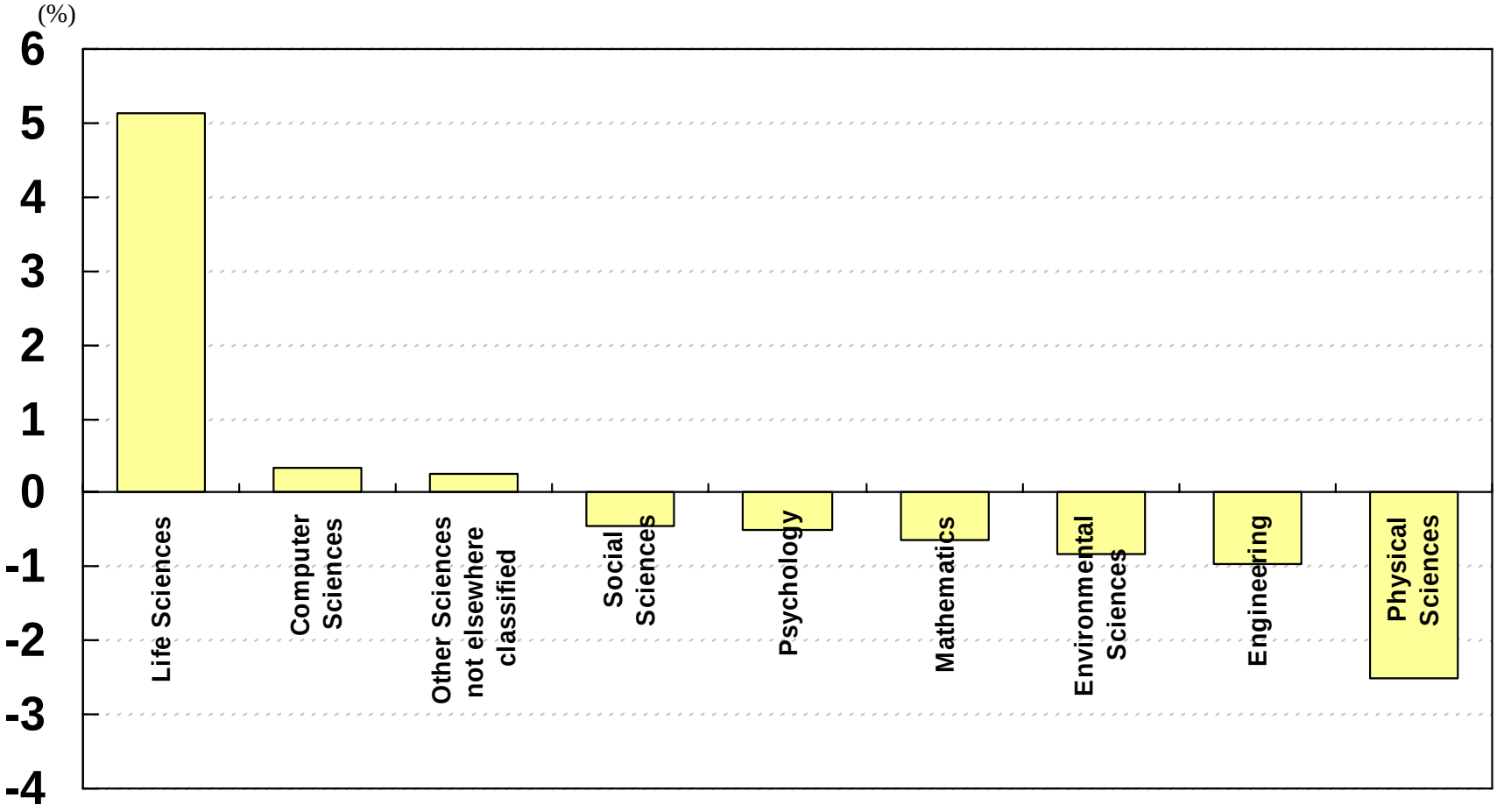
(Note2) 1971 – August, 1998 (publication year)
Japanese applicants' patent published by JPO

The number of companies and employees in the biotechnology field

	U.S.	Europe	Japan
Large Enterprises	800	540	260
Venture Companies	1,300	700	60
Employees	150,000	28,000	30,000

Source: Japanese Patent Office

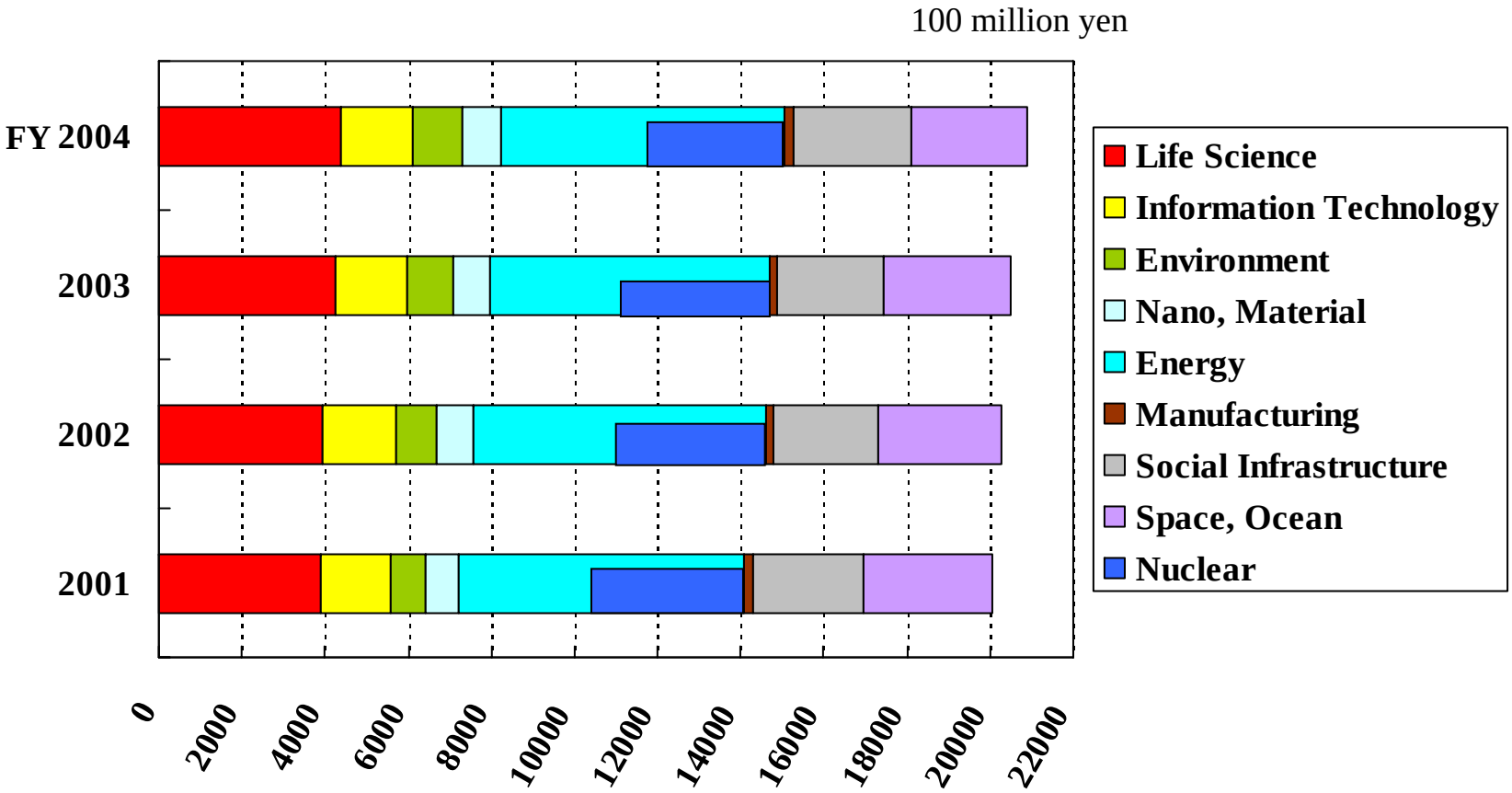
Allocation Changes in the Research Budget of the US government (1990-99)



Source : NSF, SRS, Survey of Federal Funds for Research and Development

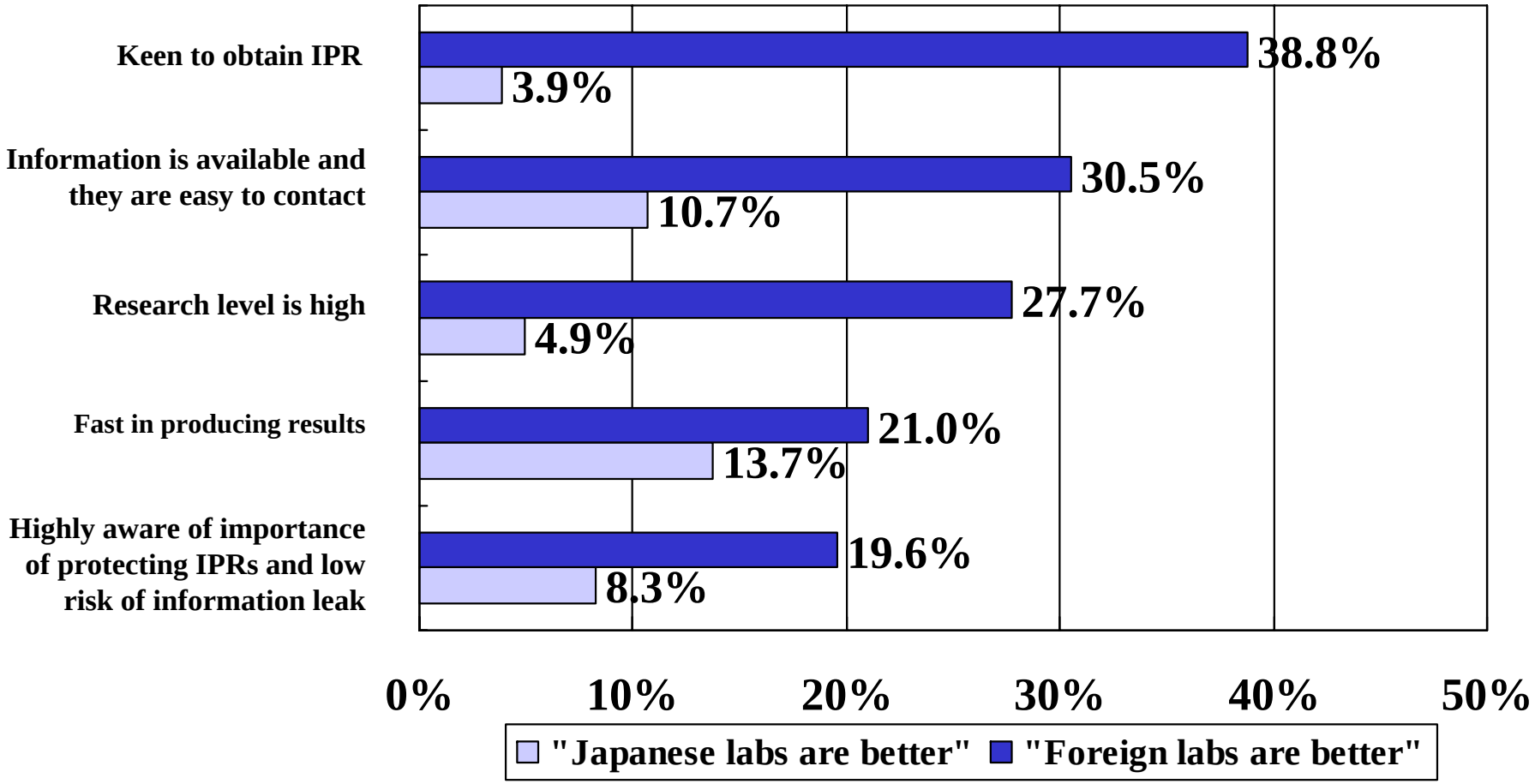
Science & Engineering Indicators, 2002

R&D Allocation in the Japanese Government Budget



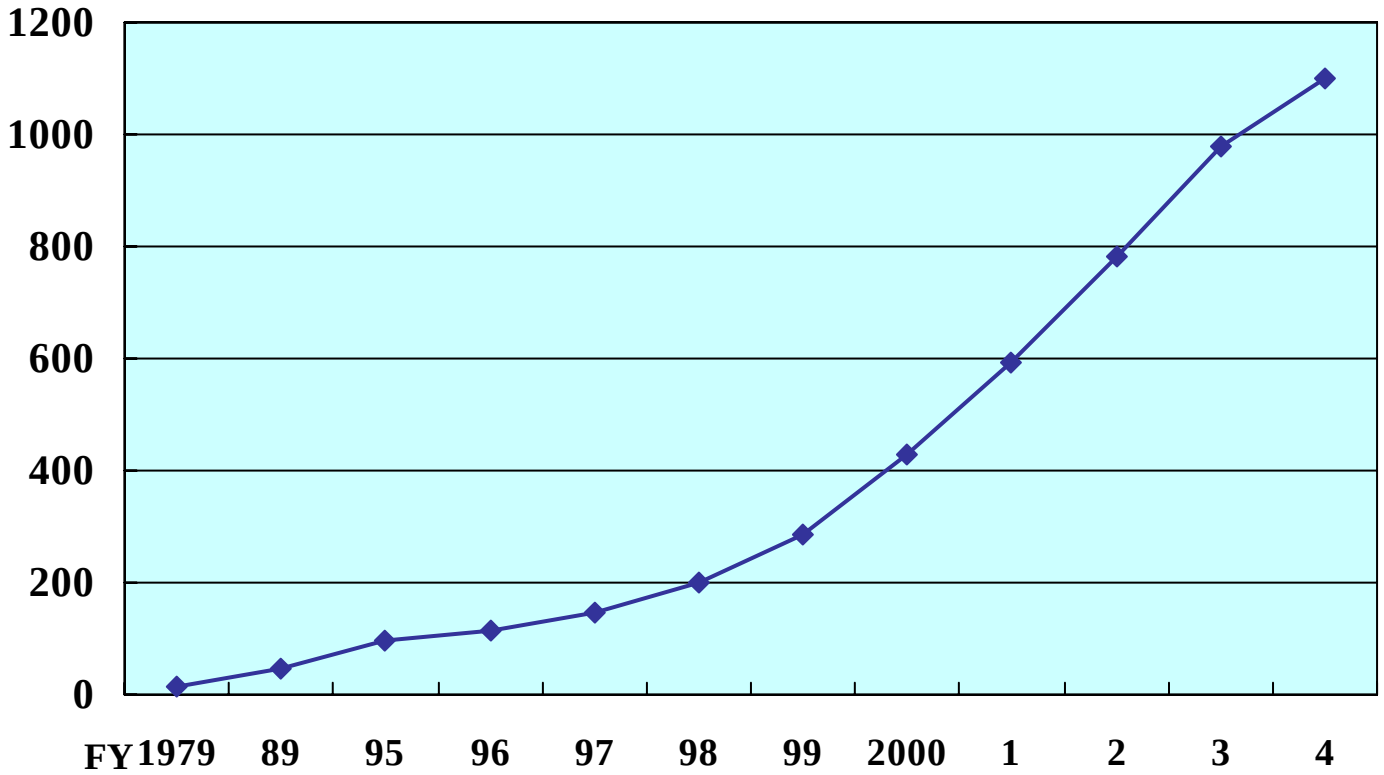
Source: METI, "An Innovation Oriented Science and Technology Policy." February, 2005

Corporate Attitudes Toward Japanese Universities and National Laboratories



Source: MEXT

Number of University Spawned Ventures in Japan



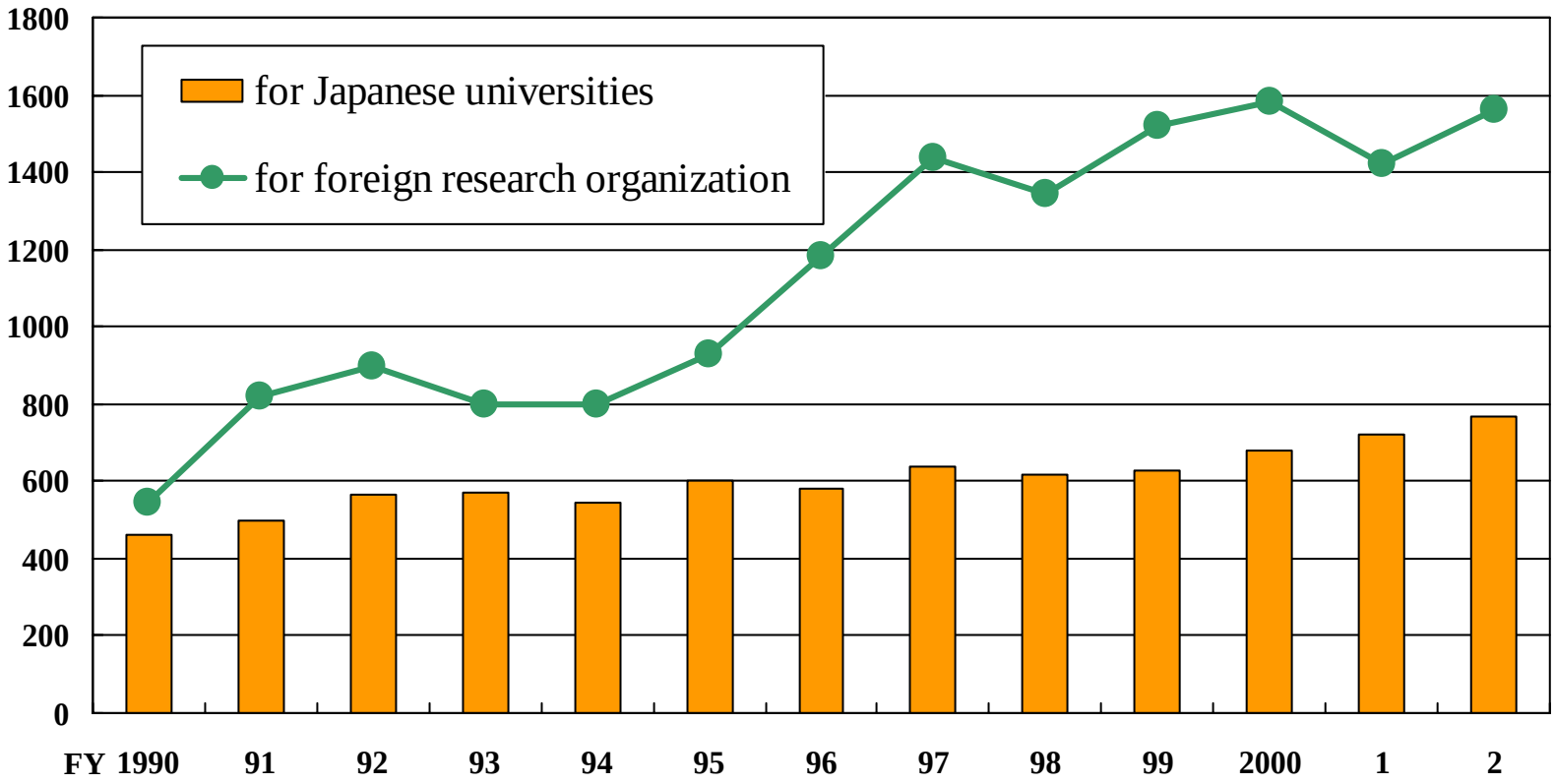
Source: METI

Problems Faced by University Spawned Ventures in Japan

1. Securing and nurturing skilled experts
2. Finding clients and marketable products
3. Securing adequate financing
4. Developing the necessary technology
5. Finding space for office and laboratories
6. Handling relations with universities

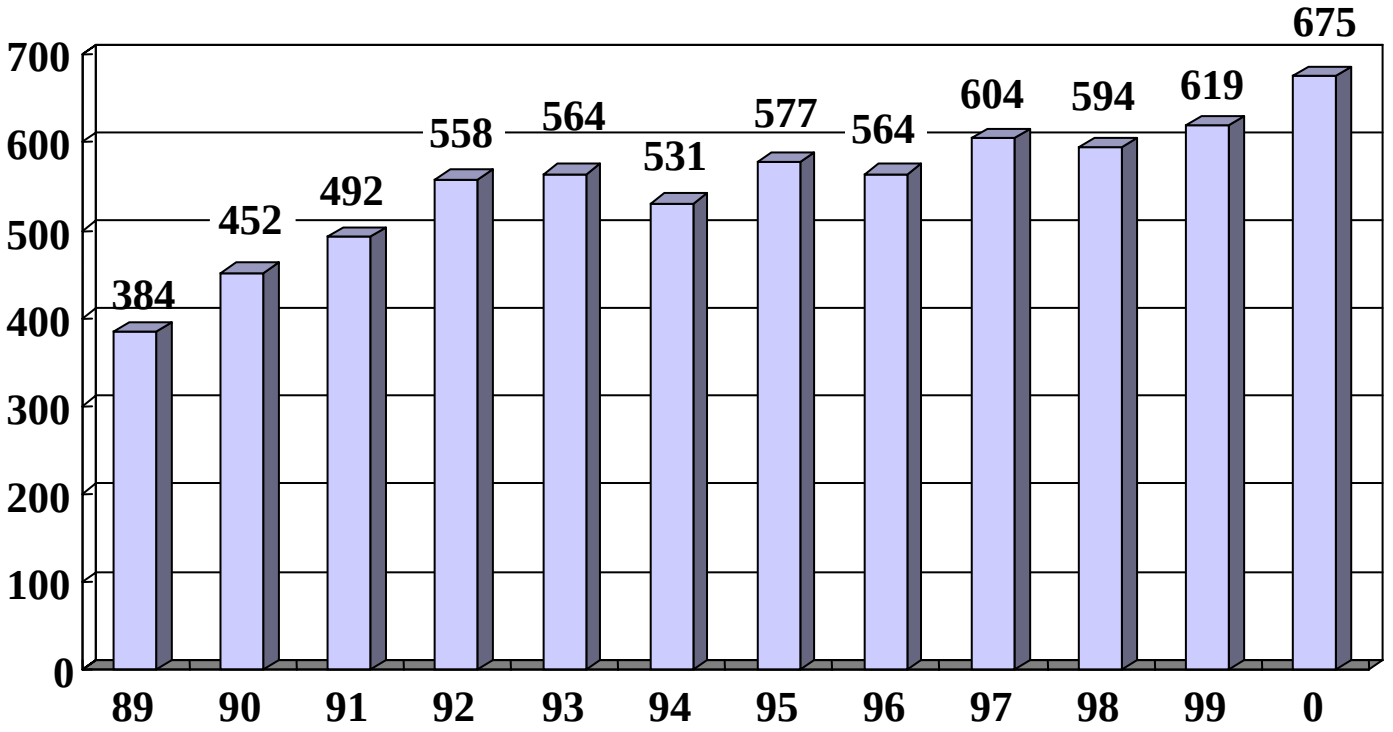
Japanese Company Support for University Research

100 million yen



Source: Ministry of Internal Affairs and Communications

Japanese Company Support for Japanese University Research

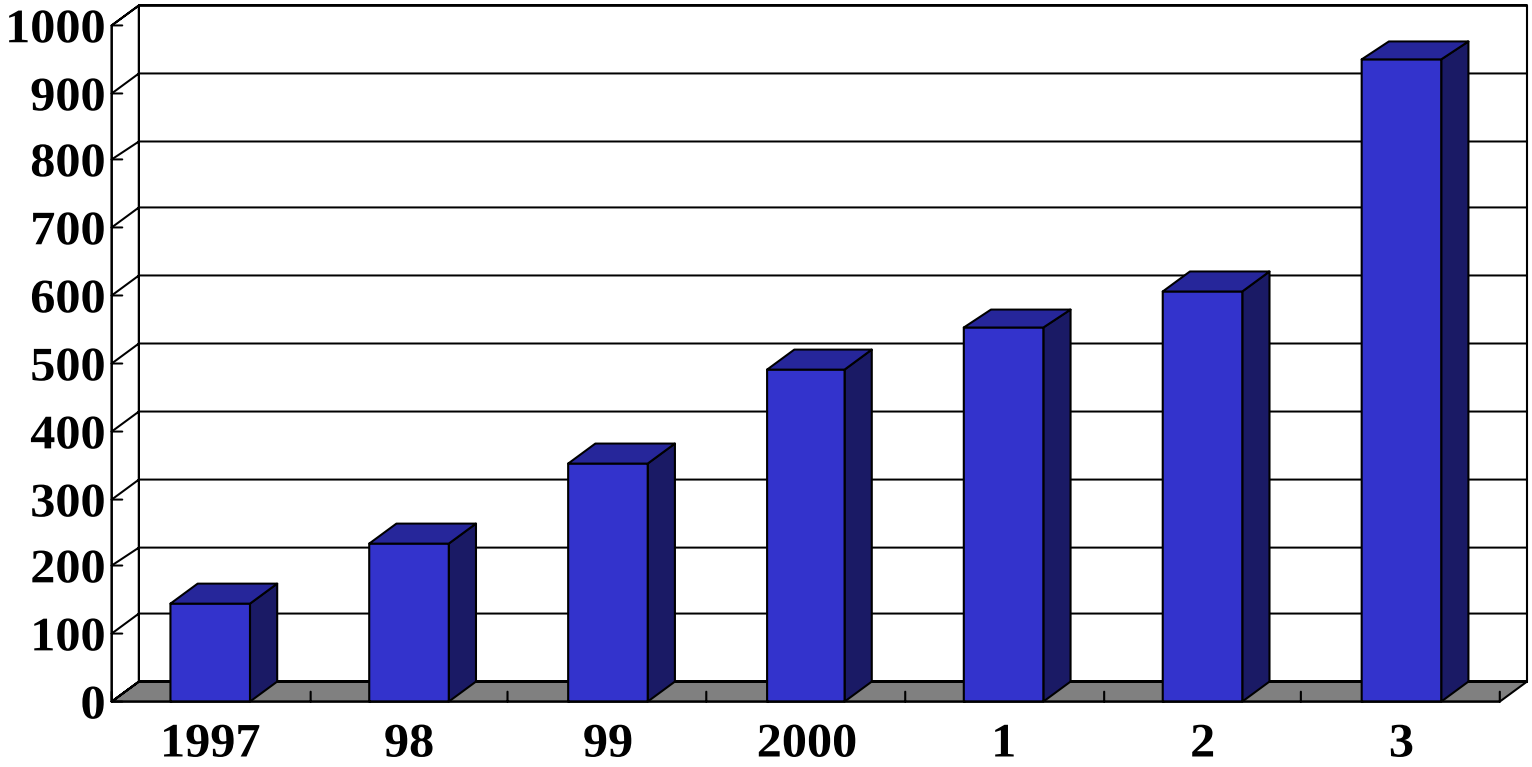


Ratio of business funding to total university research funds:

JPN 2.4% US 7.6% Germany 11.3%

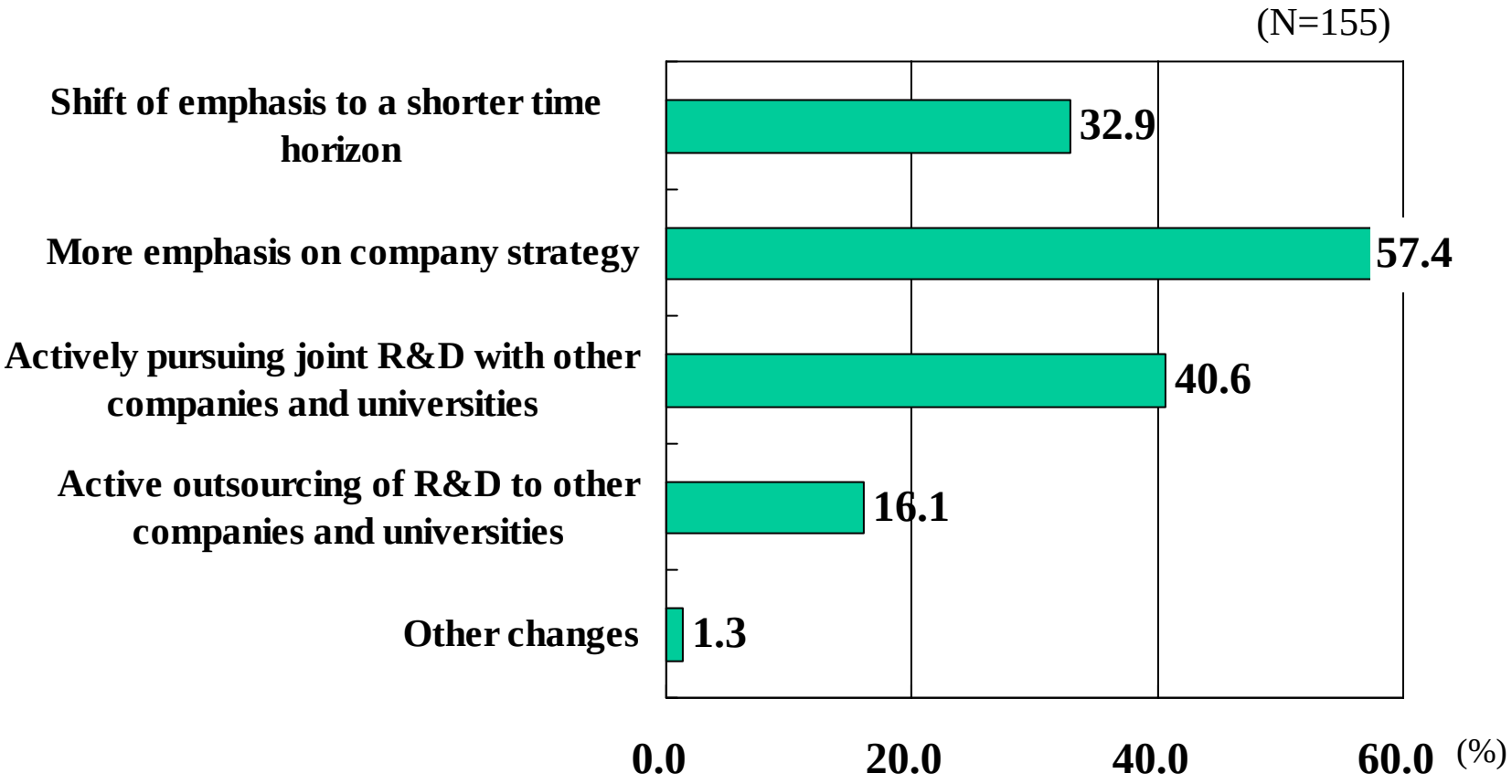
Source: Ministry of Internal Affairs and Communications , MEXT

Patent Applications by Japanese Universities



Source: NISTEP

Major Trends in the R&D of Japanese Companies



Source: METI

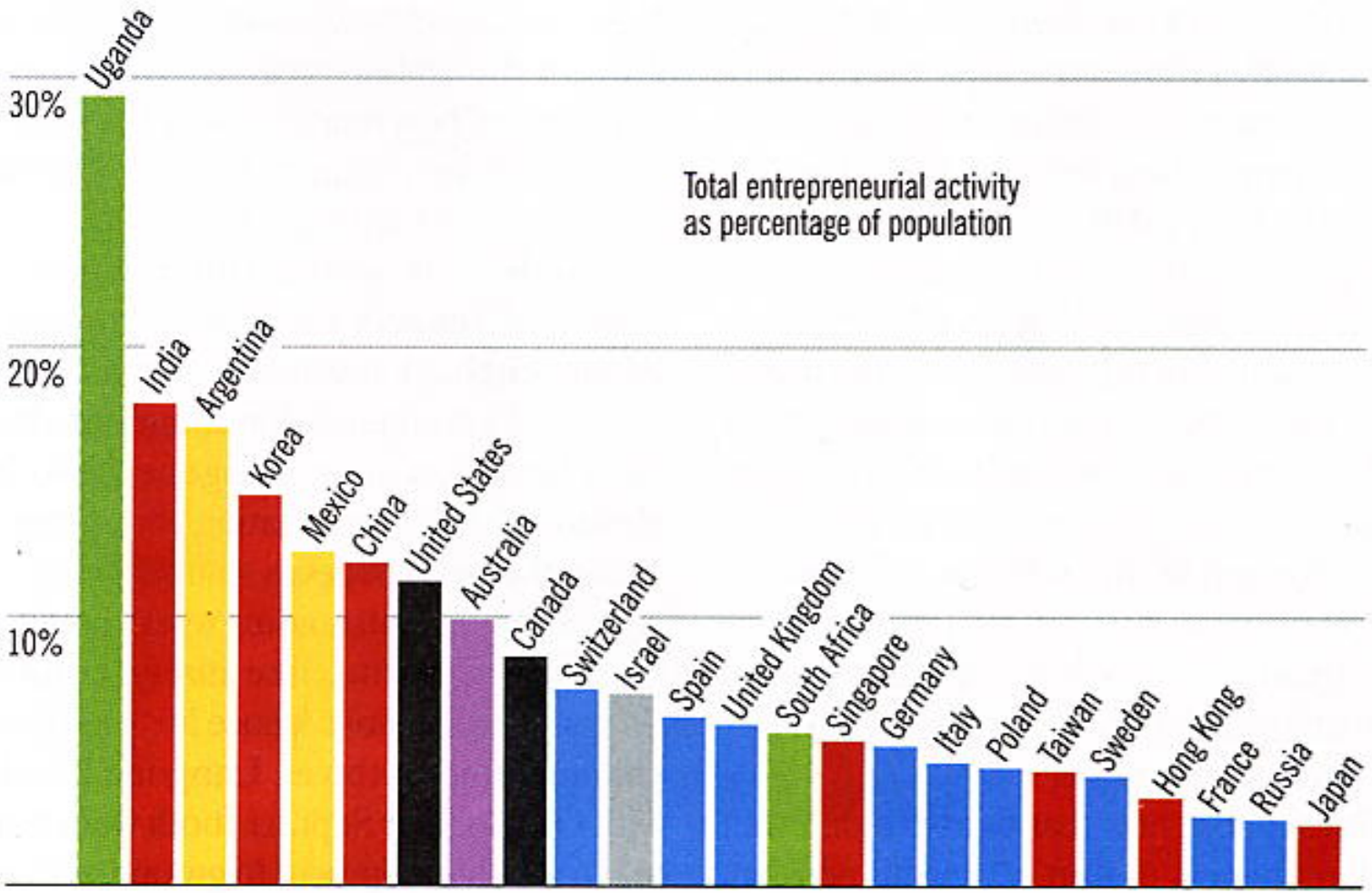
Competitive R&D Funding

- Government R&D funding should not be tied to any project; it should be distributed based upon the merits of individual proposals through an open and competitive process. There should be no sanctuary.
- In 2004, about 10 % of the government R&D funding was distributed through a competitive process. This percentage is expected rise.

Management of Technology (MOT)

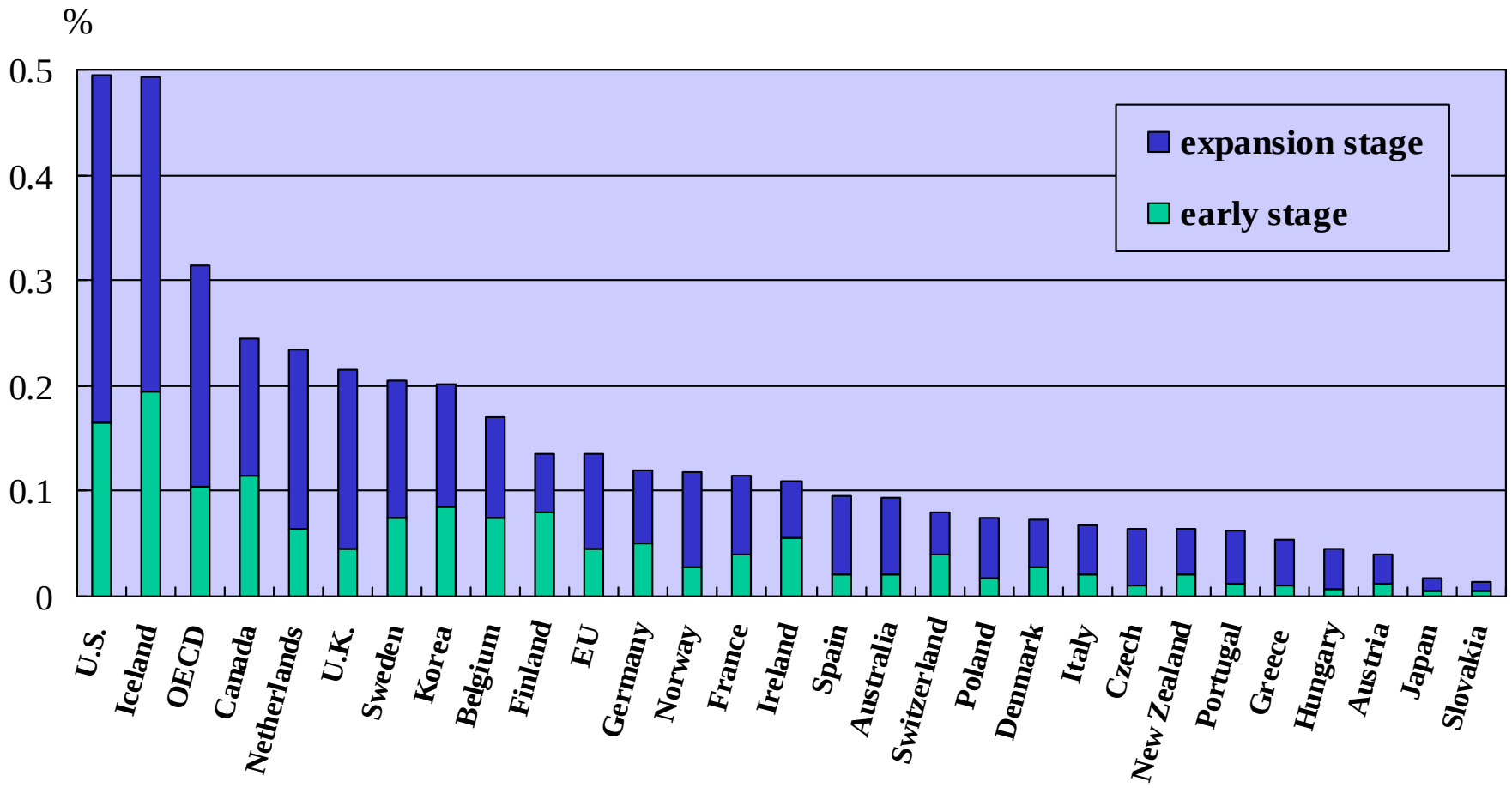
1. Japan devotes a large amount of resources, both financial and human, to R&D and produces a growing number of patents that are filed throughout the world.
2. But, such R&D is not leading to the better performance of Japanese companies or the Japanese economy in general.
3. “Death Valley” is preventing basic knowledge from developing into commercial technology.
4. This is due to weak management of technology (MOT)
5. In the US, MOT is already taught at 160 universities and twelve thousand students graduate with this major every year. In addition, all MBA programs include courses on MOT.
6. In 2003, 16 Japanese universities ran degree programs (most of them at the post-graduate level) on MOT with a total of 670 students enrolled. While the number of programs is on the rise, their quality needs to be improved.

Entrepreneurial Spirit



Source: Fortune, February 9, 2004

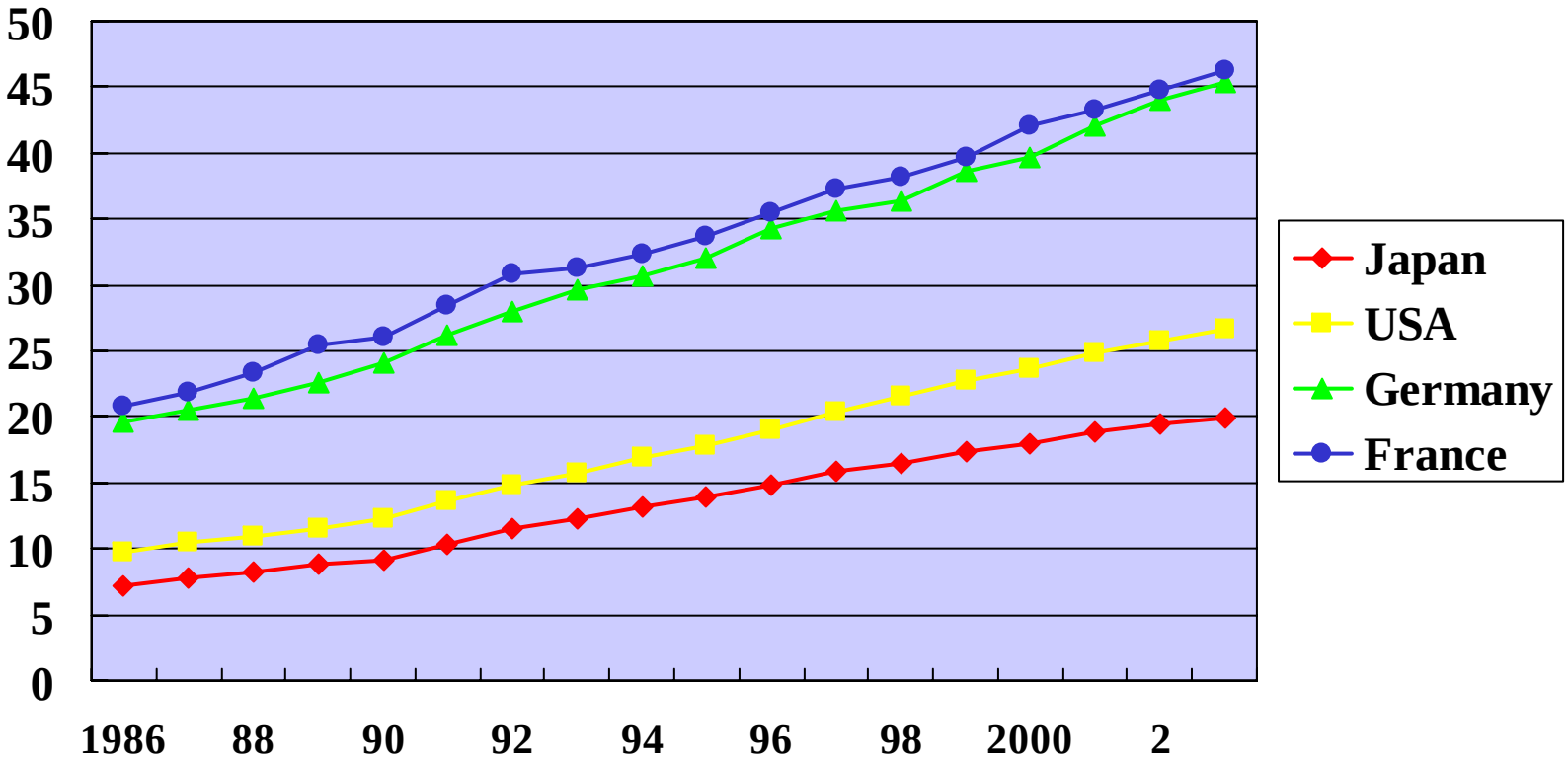
Venture Capitals Investment Relative to GDP



Note: average for period between 1998 and 2001

Source: Development Bank of Japan, *Chosa No.67, August 2004*

Percentage of International Scientific Papers



Source: NISTEP

Ratio of R&D Devoted to the Manufacturing Sector

	1990	2000
Japan	93.5%	86.3%
USA	81.1	64.9
Germany	96.1	91.3
France	92.3	85.7
UK	81.0	79.2

Total Primary Energy Supply Per Unit of GDP

Tons of oil (or equivalent) needed to produce one thousand 1995 US dollars. GDP calculated using PPP.

	1997	1998	1999	2000	2001	2002	2003
Czech Republic	0.33	0.32	0.30	0.31	0.30	0.30	0.31
Germany	0.20	0.19	0.18	0.18	0.18	0.18	0.18
Hungary	0.26	0.25	0.23	0.22	0.22	0.21	0.21
Japan	0.17	0.17	0.18	0.17	0.17	0.17	0.16
Poland	0.32	0.29	0.27	0.25	0.25	0.24	0.24
Slovak Republic	0.37	0.34	0.34	0.34	0.34	0.33	0.31
United States	0.27	0.26	0.26	0.26	0.25	0.25	0.24

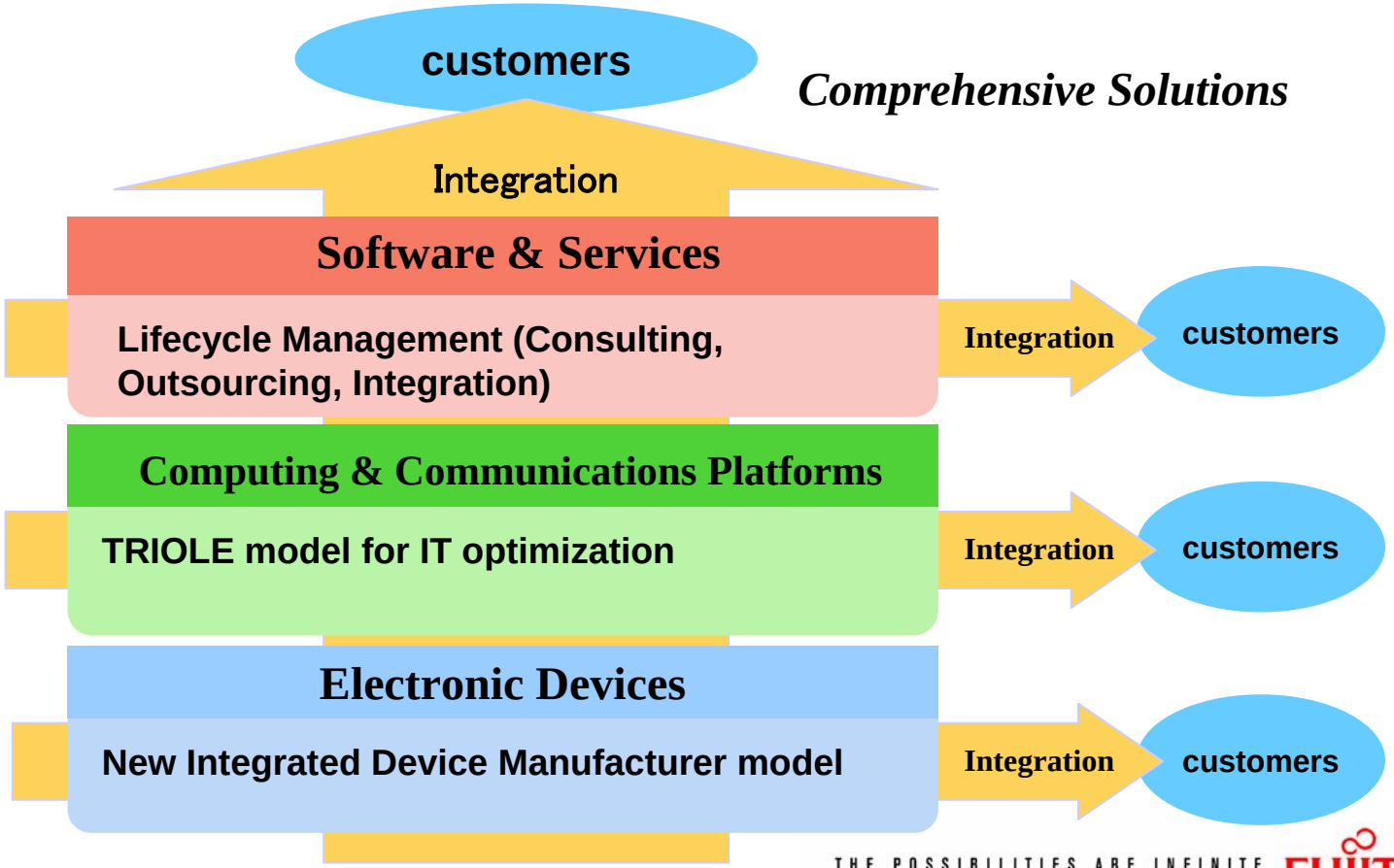
Source: OECD Factbook 2005

Lessons From the Japanese Experience

1. Spending money on R&D does not always lead to good results. Sound management of national innovation systems needs to be in place.
2. The ivory tower mentality should be erased. Barriers separating university, industry, and national laboratories must be removed. The flow of ideas, people, and money should not be inhibited.
3. Open innovation systems must be in place. External knowledge should be fully exploited.
4. Allocation of research fund should be flexible and subject to periodic reviews. It should be distributed based on the merit of proposals and performance.
5. . Effective protection of IPR is key.
6. Universities should have clear policies in pursuing collaboration with businesses in order to avoid conflict of interest.
7. Where appropriate, let the market force to decide the direction of R&D.

FUJITSU Value Chain

Our highly integrated business model overcomes the limitations of horizontally segmented models, enabling us to help customers manage increasing IT complexity and change.



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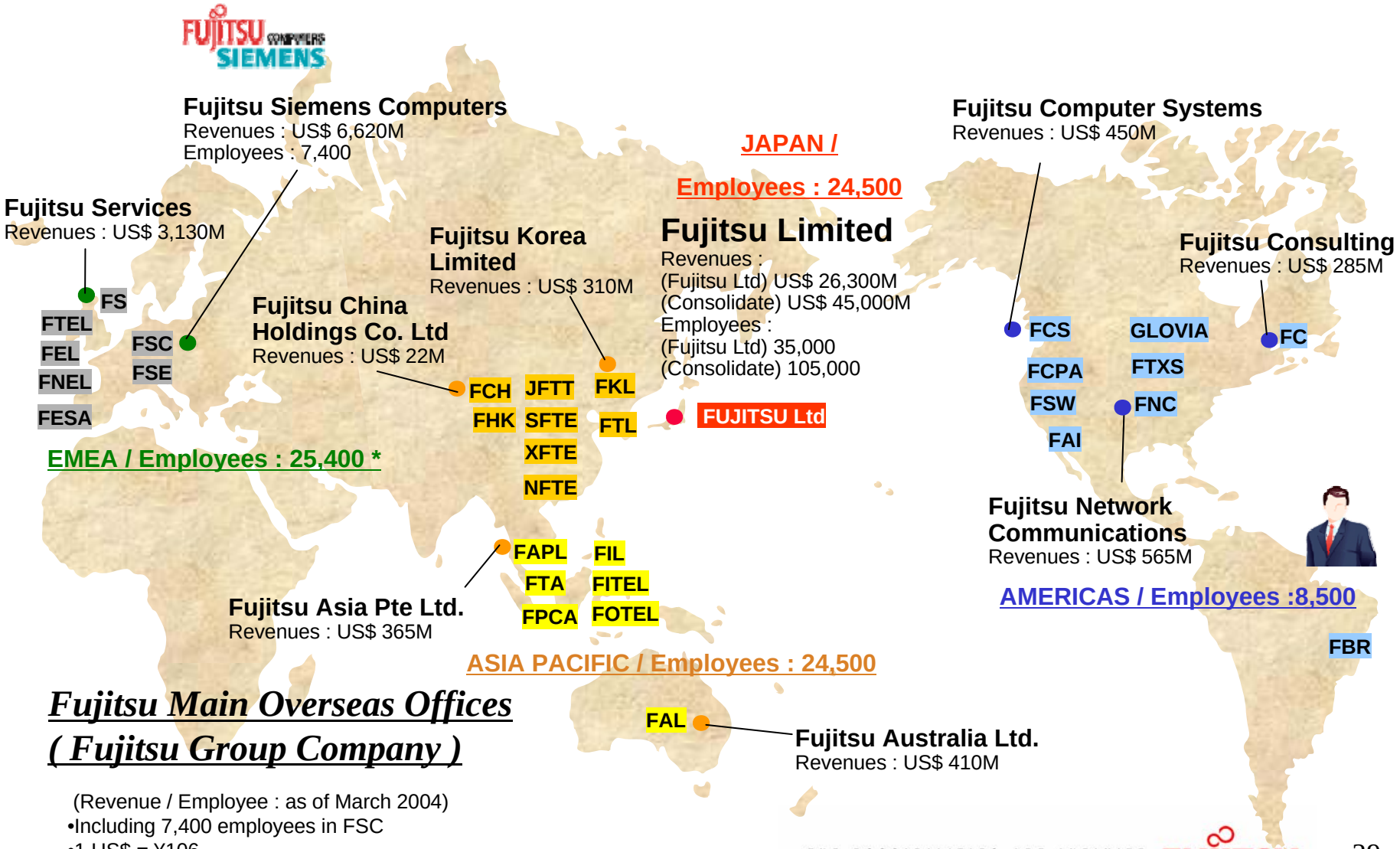
Fujitsu Worldwide Business Network



Fujitsu Main Overseas Offices
(Fujitsu Group Company)

(Revenue / Employee : as of March 2004)
- Including 7,400 employees in FSC
- 1 US$ = ¥106

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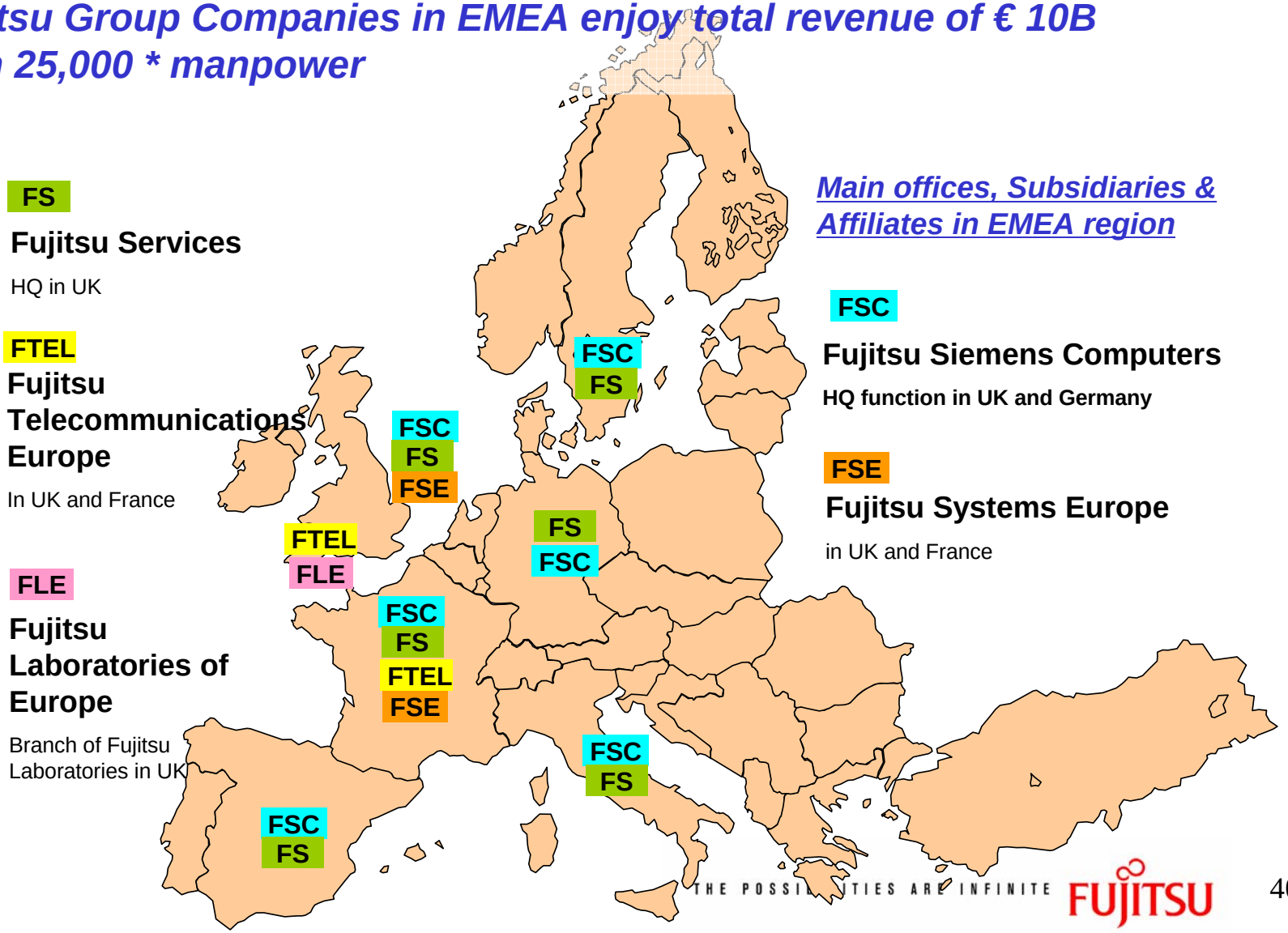
FJ Group Company in EMEA

Fujitsu Group Companies in EMEA enjoy total revenue of € 10B with 25,000 * manpower



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