

CONTENTS

I	Current status of S&T in Japan and other selected countries	
i	R&D expenditures	
1.	Total R&D expenditures	2
1-1	Trends in R&D expenditures in selected countries	2
1-1-1	Trends in R&D expenditures in selected countries (IMF exchange rate conversion)	2
1-1-2	Trends in R&D expenditures in selected countries (OECD purchasing power parity conversion)	3
1-2	Trends in R&D expenditures as a percentage of GDP in selected countries	4
2.	R&D expenditures by source of funds and sector of performance	5
2-1	R&D expenditures by source of funds in selected countries	5
2-1-1	Composition of R&D expenditures by source of funds in selected countries	5
2-1-2	Trends in government-financed R&D expenditures in selected countries (IMF exchange rate conversion)	6
2-1-3	Trends in government-financed R&D expenditures in selected countries (OECD purchasing power parity conversion)	7
2-1-4	Trends in government-financed R&D expenditures in selected countries - Percentage of R&D expenditures financed by government	8
2-1-5	Trends in government-financed R&D expenditures in selected countries - Percentage of R&D expenditures financed by government exclusive of defence R&D budget	9
2-1-6	Trends in government-financed R&D expenditures as a percentage of GDP in selected countries	10
2-2	R&D expenditures by sector of performance in selected countries	11
2-2-1	Composition of R&D expenditures by sector of performance in selected countries	11
2-2-2	R&D expenditures growth (in real terms) by sector of performance in selected countries	12
2-3	R&D expense flows in selected countries	14
2-3-1	Japan	14

2-3-2	United States	15
2-3-3	Germany	16
2-3-4	France	17
2-3-5	United Kingdom	18
2-3-6	China	19
2-3-7	Rep. of Korea	20
2-3-8	Russian Federation	21
3.	R&D expenditures per researcher	22
3-1	R&D expenditures per researcher in selected countries	22
3-2	R&D expenditures per researcher in Japan	23
3-2-1	Trends in R&D expenditures per researcher by research sector in Japan	23
3-2-2	R&D expenditures per researcher by industry (top five industrial categories) in Japan	24
3-2-3	R&D expenditures per teacher at universities and colleges by kind of organization and field of science (natural sciences and engineering only) in Japan	25
4.	R&D expenditures by type of activity	26
4-1	R&D expenditures by type of activity in selected countries	26
4-1-1	Composition of R&D expenditures by type of activity in selected countries	26
4-1-2	Trends in the percentage of basic research expenditures in selected countries	27
4-2	R&D expenditures by type of activity in Japan	28
4-2-1	Composition of R&D expenditures by research sector and type of activity in Japan	28
4-2-2	Trends in the composition of R&D expenditures by research sector and type of activity in Japan	29
5.	R&D expenditures by industry	31
5-1	Composition of manufacturing industry research expenditures by industry in selected countries	31
5-2	Trends in the percentage of business enterprise expenditure on R&D performed in service industries	33
6.	R&D expenditures by research sector in Japan	34
6-1	Trends in R&D expenditures by sector of performance in Japan	34
6-2	Trends in R&D expenditures by source of funds in Japan	35
6-3	Trends in business enterprise expenditure on R&D by industry in Japan	36

6-4	Trends in non-profit institutions and public organizations expenditure on R&D by research sector in Japan	37
6-5	Trends in universities and colleges expenditure on R&D in Japan	38
6-5-1	Trends in universities and colleges expenditure on R&D by kind of organization in Japan	38
6-5-2	Trends in universities and colleges expenditure on R&D by field of science (natural sciences and engineering only) in Japan	39
7.	R&D expenditures by sector of type of cost in Japan	40
7-1	Trends in R&D expenditures by sector of type of cost in Japan	40
7-2	Composition of business enterprise expenditure on R&D by industry (major industries) and sector of type of cost in Japan	41
7-3	Composition of non-profit institutions and public organizations expenditure on R&D by sector of type of cost and research sector in Japan	42
7-4	Composition of universities and colleges expenditure on R&D by kind of organization, field of science (natural sciences and engineering only) and sector of type of cost in Japan	43
8.	Trends in S&T budget in selected countries	44
ii	R&D personnel	
9.	Researchers	46
9-1	Trends in the number of researchers in selected countries	46
9-2	Trends in the number of researchers per 10,000 people and per 10,000 labour force in selected countries	47
9-2-1	Trends in the number of researchers per 10,000 people in selected countries	47
9-2-2	Trends in the number of researchers per 10,000 labour force in selected countries	48
9-3	Composition of the number of researchers by research sector in selected countries	49
9-4	Trends in the number of researchers by research sector in Japan	50
9-5	Trends in the number of female researchers and female researchers as a percentage of total researchers in Japan (head-counts)	51

9-6	Trends in the number of doctoral researchers by kind of organization and doctoral researchers as a percentage of total researchers in Japan (head-counts)	52
9-7	Business enterprise researchers in Japan	53
9-7-1	Composition of the number of business enterprises researchers by industry in Japan	53
9-7-2	Composition of the number of business enterprises researchers by field of science and specialty in Japan	54
9-7-3	Number of business enterprises researchers per 10,000 employees by industry (top five industrial categories) in Japan	55
9-8	Non-profit institutions and public organizations researchers in Japan	56
9-8-1	Trends in the number of non-profit institutions and public organizations researchers by kind of organization in Japan	56
9-8-2	Composition of the number of non-profit institutions and public organizations researchers by kind of organization and field of science in Japan (head-counts)	57
9-9	Universities and colleges researchers in Japan	58
9-9-1	Trends in the numbers of universities and colleges researchers by kind of organization	58
9-9-2	Trends in the number of regular researchers at universities and colleges by field of science	59
9-9-3	Trends in the number of regular researchers at universities and colleges by field of specialty (Natural sciences and engineering only)	60
9-9-4	Composition of regular researchers at universities and colleges by kind of organization and kind of occupation in Japan	61
9-9-5	Composition of regular researchers in natural sciences and engineering at universities and colleges by kind of occupation and field of specialty in Japan	62
10.	Persons employed in R&D	63
10-1	Number of research assistants per researcher in selected countries	63
10-2	Trends in the number of Persons employed in R&D by kind of occupation in Japan	64

10-3 Trends in the number of research assistants per researcher by research sector in Japan	65
10-4 Composition of the number of Persons employed in R&D by research sector, kind of organization and kind of occupation in Japan	66
11. Production and employment of R&D personnel	67
11-1 Production of R&D personnel	67
11-1-1 Graduate students as a percentage of total students in selected countries	67
11-1-2 Number of awarded degrees by field of science in selected countries (Natural sciences and engineering) (Master's and doctoral degrees)	68
11-1-3 Number of awarded degrees by field of science in selected countries (Natural sciences and engineering) (Doctoral degrees)	69
11-1-4 Trends in the number of awarded degrees by field of science in Japan (Natural sciences and engineering) (Master's degrees)	70
11-1-5 Trends in the number of awarded degrees by field of science in Japan (Natural sciences and engineering) (Doctoral degrees)	71
11-2 Employment of R&D personnel	72
11-2-1 Composition of the number of graduates by field of study and career choice in Japan (Upon completion of bachelor's degree)	72
11-2-2 Composition of the number of graduates by field of study and career choice in Japan (Upon completion of master's degree)	73
11-2-3 Composition of the number of graduates by field of study and career choice in Japan (Upon completion of doctoral degree)	74
11-2-4 Employment situation in major industries by field of science in Japan	75
11-2-5 Employment situation in major industries by academic degree in Japan	76
iii R&D performance	
12. Scientific papers	78

12-1 Trends in production share and citation share in selected countries	78
12-1-1 Trends in production share and citation share in selected countries (1 year period)	78
12-1-2 Trends in production share and citation share in selected countries (5 year overlapping period)	79
12-2 Relative citation impact for scientific papers	80
12-2-1 Trends in the relative citation impact for scientific papers in selected countries	80
12-2-2 Relative citation impact by research field in Japan	81
12-3 Number of scientific papers by research field	82
12-3-1 Composition of the number of scientific papers by research field in selected countries	82
12-3-2 Japan's share of scientific papers by research field	83
12-4 Trends in relative comparative advantage of scientific papers by research field in Japan	84
13. Patents	85
13-1 Patent applications and grants by country of origin	85
13-1-1 Trends in number of patent applications by country of origin	85
13-1-2 Trends in number of patent grants by country of origin	86
13-2 Number of Japanese-oriented overseas patent applications and grants	87
13-2-1 Trends in number of Japanese-oriented overseas patent applications	87
13-2-2 Trends in number of Japanese-oriented overseas patent grants	88
13-3 Patent applications and grants at the Japan Patent Office	89
13-3-1 Trends in number of patent applications at the Japan Patent Office	89
13-3-2 Trends in number of patent grants at the Japan Patent Office	90
13-4 Number of foreign-oriented patent applications and grants at the Japan Patent Office	91
13-4-1 Trends in number of foreign-oriented patent applications at the Japan Patent Office	91
13-4-2 Trends in number of foreign-oriented patent grants at the Japan Patent Office	92

14. Technology Trade	93
14-1 Trends in technology trade value in selected countries	93
14-2 Trends in technology trade balance in selected countries	94
14-3 Technology trade of Japan with selected countries/regions	95
14-3-1 Trends in Japan's Technology trade balance with selected countries	95
14-3-2 Ratio of Japan's technology trade vis-à-vis selected countries/ regions	96
14-3-3 Japan's technology trade value flows by geographic area	97
14-4 Technology trade by industry sector in Japan	98
14-4-1 Technology trade value in Japan's major industrial sectors	98
14-4-2 Trends in technology trade balance in Japan's major industrial sectors	99
15. High-Tech industries	100
15-1 Export market shares for high-tech products in selected countries	100
15-1-1 Export market shares for high-tech products by country in selected countries	100
15-1-2 Share of high-tech products by country manufactured in selected countries	101
15-2 Trends in imports and exports, by value, for Japan's general manufacturing industry, and the high-tech industry	102
15-3 Trends in high-tech balance of payment ratios for selected countries	103
15-4 Balance of payments for Japan's high-tech trade by industry	104
II Indicators of S&T in Japan	
16. Summary	106
16-1 R&D expenditures and the number of researchers	106
16-2 Number of R&D performing institutions by research sector and kind of organization	108
16-3 R&D expenditures by research sector and kind of organization ..	110
16-4 R&D expenditures by source of funds	112
16-5 R&D expenditures by type of activity (Natural sciences and engineering only)	114
16-6 R&D expenditures by sector of type of cost	116

16-7 R&D expenditures by selected objective	118
16-8 Number of R&D personnel by kind of occupation	120
16-9 Number of researchers by research sector and kind of organization	122
16-10 Number of researchers by research sector, field of science and specialty (head-counts)	124
16-11 R&D expenditures per researcher by research sector	125
16-12 Number of degrees granted	126
16-13 Number of students enrolled and graduates	127
16-13-1 Number of students enrolled and graduates of universities and colleges	127
16-13-2 Number of students enrolled and graduates of graduate schools	127
16-14 Destination of graduates	128
16-14-1 Number of graduates of universities and colleges by field of study and industry	128
16-14-2 Number of graduates of graduate schools by field of study and industry	129
16-15 Professional engineer	130
16-15-1 Number of passed registered professional engineer	130
16-15-2 Number of passed registered of associate professional engineer	131
17. Business enterprises	132
17-1 R&D expenditures by size of capital and industry	132
17-2 R&D expenditures by type of activity, size of capital and industry	134
17-3 R&D expenditures by sector of type of cost, size of capital and industry	136
17-4 Ratio of R&D expenditures to net sales by industry	138
17-5 Number of R&D personnel by kind of occupation, size of capital and industry	139
17-6 Number of researchers by size of capital and industry	140
17-7 Number of researchers by field of science and industry (head-counts)	141
18. Non-profit institutions and public organizations	143

18-1 R&D expenditures by kind of organization and field of science ..	143
18-2 R&D expenditures by sector of type of cost, kind of organization and field of science	144
18-3 Number of R&D personnel by kind of occupation, kind of organization and field of science	146
18-4 Number of researchers by kind of organization and field of science	147
18-5 Number of researchers by kind of organization and field of science (head-counts)	148
19. Universities and colleges	151
19-1 R&D expenditures by kind of organization and field of science ..	151
19-2 R&D expenditures by sector of type of cost, kind of organization and field of science	152
19-3 Number of R&D personnel by kind of occupation, kind of organization and field of science	154
19-4 Number of regular researchers by kind of organization and field of science	155
19-5 Number of regular researchers by kind of occupation, kind of organization and field of science	156
19-6 Number of regular researchers by field of science and kind of Organization (head-counts)	157
20. Technology trade	158
20-1 Technology trade value	158
20-2 Technology trade value by industry	160
20-2-1 Technology receipts by industry	160
20-2-2 Technology payments by industry	162
20-3 Technology trade value by country and geographic area	164
20-3-1 Technology receipts by country and geographic area	164
20-3-2 Technology payments by country and geographic area	166
20-4 Technology trade value by geographic area and industry	168
20-5 Technology trade balance in Japan's major industrial sectors by country and region	170
21. Patents	172
21-1 Number of patent applications and grants by Japanese and foreign nationals	172
21-1-1 Patent applications	172
21-1-2 Patent grants	173

21-2 Number of patents by field	174
21-2-1 Patent applications	174
21-2-2 Patent grants	174
21-3 Number of patents in Japan by applicants' nationality	176
21-3-1 Patent applications	176
21-3-2 Patent grants	176
21-4 Number of Japanese-oriented overseas patents	178
21-4-1 Patent applications	178
21-4-2 Patent grants	179
21-5 Number of overseas and Japanese patents by Japanese applicants	180
21-5-1 Patent applications	180
21-5-2 Patent grants	180
22. Industry-academy cooperation	181
22-1 Trend in the number of joint research projects between national universities and the private sector	181
23. International researchers exchange	182
23-1 Number of Japanese researchers dispatched abroad by geographic area	182
23-2 Number of foreign researchers invited to Japan by geographic area	182
23-3 Number of Japanese researchers dispatched abroad by top 10 countries	183
23-4 Number of foreign researchers invited to Japan by top 10 countries	183
23-5 Progress of researchers exchange	184
24. S&T budget	185
24-1 Budget appropriations for S&T	185
24-1-1 Budget appropriations for S&T by item	185
24-1-2 Budget appropriations for S&T by ministry and agency	186
24-1-3 Budget appropriations for S&T by kind of organization	187
24-2 Budget appropriations for government research institutes	188
24-3 Budget appropriations for space development by ministry/ agency	190
24-4 Budget appropriations for nuclear development by ministry/ agency	191
24-5 Budget appropriations for ocean development by ministry/ agency	192

24-6 Budget appropriations for earthquake research by ministry/ agency	193
24-7 Competitive funding by ministry/agency	194
25. S&T administrative organization charts	196

III Indicators of S&T in selected countries

26. Outline of R&D activities in selected countries	202
26-1 United States	202
26-1-1 United States summary	202
26-1-2 R&D expenditures by performance sector in the US	204
26-1-3 R&D expenditures by source of funds in the US	205
26-1-4 R&D expenditures by type of activity in the US	206
26-1-5 Number of researchers by research sector in the US	207
26-1-6 S&T administrative organizational charts in the US	208
26-2 European Union	214
26-2-1 EU-15 summary	214
26-2-2 EU-28 summary	216
26-2-3 R&D expenditures by performance sector in EU	218
26-2-4 R&D expenditures by source of funds in EU	219
26-2-5 Number of researchers by research sector in EU	220
26-2-6 S&T administrative organizational charts in EU	222
26-3 Germany	224
26-3-1 Germany summary	224
26-3-2 R&D expenditures by performance sector in Germany	226
26-3-3 R&D expenditures by source of funds in Germany	227
26-3-4 R&D expenditures by type of activity in Germany	228
26-3-5 Number of researchers by research sector in Germany	229
26-3-6 S&T administrative organizational charts in Germany	230
26-4 France	232
26-4-1 France summary	232
26-4-2 R&D expenditures by performance sector in France	234
26-4-3 R&D expenditures by source of funds in France	235
26-4-4 R&D expenditures by type of activity in France	236
26-4-5 Number of researchers by research sector in France	237
26-4-6 S&T administrative organizational charts in France	238
26-5 United Kingdom	240
26-5-1 United Kingdom summary	240
26-5-2 R&D expenditures by performance sector in the UK	242

26-5-3 R&D expenditures by source of funds in the UK	243
26-5-4 R&D expenditures by type of activity in the UK	244
26-5-5 Number of researchers by research sector in the UK	245
26-5-6 S&T administrative organizational charts in the UK	246
26-6 China	248
26-6-1 China summary	248
26-6-2 R&D expenditures by performance sector in China	250
26-6-3 R&D expenditures by source of funds in China	251
26-6-4 R&D expenditures by type of activity in China	252
26-6-5 Number of researchers by research sector in China	253
26-6-6 S&T administrative organizational charts in China	254
26-7 Rep. of Korea	256
26-7-1 Republic of Korea summary	256
26-7-2 R&D expenditures by performance sector in Republic of Korea	258
26-7-3 R&D expenditures by source of funds in Republic of Korea ·	259
26-7-4 R&D expenditures by type of activity in Republic of Korea ·	260
26-7-5 Number of researchers by research sector in Republic of Korea	261
26-7-6 S&T administrative organizational charts in Republic of Korea	262
26-8 Russian Federation	264
26-8-1 Russian Federation summary	264
26-8-2 R&D expenditures by performance sector in Russian Federation	266
26-8-3 R&D expenditures by source of funds in Russian Federation	267
26-8-4 R&D expenditures by type of activity in Russian Federation	268
26-8-5 Number of researchers by research sector in Russian Federation	269
26-8-6 S&T administrative organizational charts in Russian Federation	270
26-9 Canada	271
26-9-1 R&D expenditures by performance sector in Canada	271
26-9-2 R&D expenditures by source of funds in Canada	272
26-9-3 Number of researchers by research sector in Canada	273
26-9-4 S&T administrative organizational charts in Canada	274

26-10 Other countries/regions	276
27. S&T budget	282
28. R&D expenditures	284
28-1 R&D expenditures by research sector	284
28-2 R&D expenditures by research sector and type of activity	286
29. R&D personnel	288
29-1 Number of researchers by research sector	288
29-2 Number of R&D personnel by kind of occupation	290
29-3 Number of degrees granted by field of science	291
30. Number of Nobel Prize and Fields Prize winners by country	292
31. Technology trade value	294
32. Patents	296
32-1 Number of patents by country	296
32-1-1 Patent applications	296
32-1-2 Patent grants	297
32-2 Number of patents by applicant's nationality	298
32-2-1 Patent applications	298
32-2-2 Patent grants	299

Appendix

33. Central government finance in Japan	302
33-1 Budget by type of account in Japan	302
33-2 General accounts in Japan	302
34. R&D deflators in Japan	304
35. GDP deflators in selected countries	306
36. Exchange rates for selected countries	307
36-1 IMF exchange rates to Yen for selected countries	307
36-2 Purchasing power parities to Yen for selected countries	308